INJECT (Interdisciplinary Journal of Communication)
p-ISSN: 2548-5857; e-ISSN: 2548-7124
Vol. 10. No. 1 June 2025: p. 551-580
DOI: https://doi.org/10.18326/inject.v10i1.4406

Digital Emotional Dependency In Islamic Da'wah: A Psychospiritual Analysis Of Neurobiological And Behavioral Impacts

Oprimuriandy T.D Putra
Universitas Muhammadiyah Yogyakarta
opripunya27@gmail.com

Akif Khilmiyah
Universitas Muhammadiyah Yogyakarta
khilmiyahakif@yahoo.com

Azam Syukur Rahmatullah
azam.sy@umy.ac.id
Universitas Muhammadiyah Yogyakarta

Husain Azhari
Universitas Al-Azhar Cairo
husainazhari@gmail.com

Abstract

This study aims to explore the psychospiritual dimensions of Digital Emotional Dependence (DED) in the context of Islamic da'wah and communication, and analyze its impact on the effectiveness of Islamic educational technology and ethical engagement in religious digital platforms. The study uses a phenomenological approach with a systematic literature review of empirical research from 2010-2024 that examines the neurobiological, psychological, and spiritual aspects of digital dependency in religious communication. The analysis was conducted on the neurological dimensions (prefrontal cortex and amygdala activity), neurotransmitter mechanisms (dopamine and serotonin), and subjective experiences of spiritual emotional regulation in the context of digital da'wah. The findings show that DED in digital da'wah is correlated with decreased capacity for tafakkur (spiritual contemplation), impaired regulation of religious emotions, and fragmentation of spiritual experiences. Digital dependency creates dissonance between the consumption of religious content and the implementation

of Islamic values, resulting in maladaptive coping mechanisms that hinder authentic spiritual transformation. Respondents showed increased impulsivity in religious digital interactions and decreased ability to deeply contemplate da'wah messages. Conclusion: A holistic intervention is needed that integrates Islamic digital literacy, dhikr and muraqabah-based spiritual practices, and a tawhid-based cognitive-behavioral approach to optimize digital religious communication and prevent counterproductive emotional dependence on Islamic spiritual goals.

Keyword: Digital Emotional Dependency, Digital Preaching, Religious Communication, Psychospiritual, Islamic Educational Technology.

Introduction

The era of digital disruption has brought about a fundamental transformation in the landscape of contemporary human life. The massive penetration of digital technology has created a phenomenon of dependency that is not only physiological, but also involves complex psychological aspects (Chatterjee dkk., 2022). Digital Emotional Dependency (DED) is a manifestation of the interconnection between psychological needs and technological dependency that has become stronger in the last decade (Floros dkk., 2021). This phenomenon has become the focus of attention in interdisciplinary studies involving psychology, neuroscience, and information technology. The conceptualization of DED can be understood as a condition in which individuals develop significant emotional dependency on digital devices and the content they access. According to (Lemay dkk., 2025)) DED includes three main dimensions: affective dependency, cognitive dependency, and behavioral dependency. From a psychophysiological perspective, this phenomenon is closely related to the activation of the limbic system and the production of neurotransmitters such as dopamine and serotonin which play a role in the brain's reward system mechanism (Jiang dkk., 2022).

A preliminary study conducted by (Rodriguez-Garcia dkk., 2023) productive-age individuals showed symptoms of DED at moderate to severe levels. Manifestations of this phenomenon include anxiety when separated from digital devices, significant mood fluctuations related to social media use, and deterioration in the ability to regulate emotions in direct social interactions. The complexity of this phenomenon is further enhanced by the presence of moderator variables such as personality traits, environmental stressors, and digital literacy levels.

In a theoretical context, Digital Emotional Dependency can be explained through several conceptual frameworks. Bowlby's Attachment Theory, when applied in a digital context, provides a perspective on how individuals develop emotional bonds with digital devices as substitute

attachment figures (Parent & Shapka, 2020). Meanwhile, Cognitive-Behavioral Theory highlights how adaptive thought patterns and behaviors can transform into maladaptive ones in the context of digital dependency (Liu & Chen, 2024; Yan dkk., 2021). Psychophysiological determinants of the DED phenomenon include complex and multifaceted aspects. At the neurobiological level, there are modifications in the neural pathway, especially in areas related to reward processing and emotional regulation. Neuroimaging research conducted by (Ding dkk., 2023) showed significant alterations in the activity of the amygdala and prefrontal cortex in individuals with high levels of DED. This is correlated with decreased self-regulation ability and increased emotional reactivity (Gagne dkk., 2021). The significance of research on the psychophysiological determinants of DED is increasing along with the acceleration of digitalization in various aspects of life. The implications of this phenomenon on mental health, productivity, and individual well-being have become a global concern that requires a comprehensive approach in handling it. The World Health Organization (WHO) in its latest report emphasizes the urgency of a deep understanding of the psychophysiological mechanisms of DED as a fundamental step in developing effective interventions Gerber dkk (2025) This study adopts a phenomenological approach to explore the psychophysiological determinants of the DED phenomenon. This methodology was chosen to enable a holistic understanding of the subjective experiences of individuals experiencing DED, while identifying emergent patterns and themes in the manifestation of the phenomenon. Through this approach, it is hoped that the complexity of the interaction between psychological and physiological factors that underlie the development and maintenance of DED can be revealed.

The urgency of this research is further emphasized by the gap in the literature regarding the specific psychophysiological mechanisms that play a role in DED. Although there are various studies exploring the impact of digital technology use on mental health, a comprehensive understanding of the psychophysiological determinants of DED is still limited. This study aims to fill this gap through a systematic exploration of the factors that contribute to the development and manifestation of DED. Exploration of the literature related to Digital Emotional Dependency (DED) shows a significant evolution of understanding in the last decade. A systematic review conducted by Chiang dkk (2022) identified three main streams in DED research: the neurobiological perspective, the psychosocial approach, and the technology-behavior framework. In the neurobiological perspective, a longitudinal study conducted by Marciano dkk (2021)demonstrated structural changes in gray matter volume in brain

areas related to emotion regulation in intensive users of digital technology. This finding correlates with the study of Zhang dkk (2020) which revealed alterations in functional connectivity between the amygdala and the prefrontal cortex. In the psychosocial Leon Alker (2024) the results showed that gifted individuals (n=300) had significantly higher levels of overexcitability than average intelligence individuals (n=150) based on an independent T-test. In addition, overexcitability was associated with decreased mental health and increased mental disorders, with a significant mediation analysis ($p < 0.05$) and a moderate to strong effect size (β ranging from 0.3–0.6). Inability to manage overexcitabilities was shown to be a major mediator in this relationship. This study strengthens previous findings from (Fekih-Romdhane dkk., 2021; Firth dkk., 2019) The majority of students (86.4%) spent their free time on the internet, and 98.5% reported regular use of social media networks. After controlling for demographic variables (gender, age) and substance use, the number of hours of social media use per day and the social consequences dimension of the ASMAS contributed significantly to the prediction of positive PLEs (bizarre experiences, perceptual abnormalities, persecutory ideation and magical thinking). The technology-behavior framework, as proposed by Schwarzmann and offers an integrative model linking technological aspects to behavioral manifestations of DED.

The current literature also suggests emergent patterns in DED manifestations that have not been fully explored. A comprehensive meta-analysis by (Recchioni dkk., 2021) that included 47 studies with a total sample size of 12,456 participants indicated heterogeneity in DED expression based on sociocultural context. These findings underscore the complexity of the DED phenomenon that cannot be fully explained by a single paradigm. Empirical studies on DED interventions have shown mixed results. A mindfulness-based intervention program developed by (Liu & Chen, 2024) demonstrated moderate effectiveness (Cohen's $d = 0.54$) in reducing DED rates, while the cognitive-behavioral approach studied by (Beets dkk., 2020) showed more promising results (Cohen's $d = 0.72$). However, the generalizability of these interventions is still limited due to sample heterogeneity and variations in implementation protocols.

Although the corpus of research on DED has grown substantially, several critical gaps are still identified in the literature. First, the majority of existing studies focus on behavioral manifestations of DED without in-depth exploration of the underlying psychophysiological mechanisms. As argued by Levin and Sato (2024), understanding of the neural substrate of DED is still partial and requires further investigation with more sophisticated methodologies. Second, there is a limited understanding of

the interaction between individual and contextual factors in the development of DED. Existing studies tend to adopt a unifactorial approach that fails to capture the complexity of this phenomenon. As noted in a systematic review by (Cremers dkk., 2021), an integrative framework is needed that can accommodate multilevel analysis of DED determinants. Third, significant gaps have been identified in the literature regarding the trajectory of DED development. Existing longitudinal studies are still limited in duration and scope, so that understanding of the progression and potential reversibility of this condition is still inadequate. (Zhang dkk., 2020) underline the urgency to develop more comprehensive longitudinal research that considers developmental stages and life transitions.

Fourth, there is a gap in understanding how moderator variables such as digital literacy, emotional intelligence, and personality traits interact with psychophysiological determinants of DED. Existing research tends to isolate these variables without in-depth exploration of the mechanisms of their interactions. This, as emphasized by (Chang & Lee, 2024), limits the effectiveness of developing tailored interventions for individual characteristics.

Religious communication in the digital era encounters a fundamental dilemma between technology accessibility and spiritual profundity. Social media platforms, Islamic educational applications, and da'wah websites have accelerated the dissemination of religious information to an unparalleled extent, yet frequently lead to the engagement with shallow and addictive religious material. This occurrence exemplifies what religious communication scholars refer to as "spiritual fast food" — the immediate absorption of religious information devoid of sustained spiritual sustenance. In this context, Islamic educational technology confronts the problem of not only disseminating religious information but also promoting the processes of *tadabbur* (deep contemplation) and *tazkiyah* (purification of the soul), which are fundamental to genuine Islamic learning.

The psychospiritual aspect of digital reliance gets increasingly intricate when associated with the principles of successful da'wah communication. Islam underscores the principle of hikmah (knowledge) in conveying da'wah lessons, necessitating a profound comprehension of the audience's psychological and spiritual states. Emotional reliance on digital technology might hinder the cognitive and emotional capacities required to comprehend and assimilate spiritual truths. Neuroscience research indicates that excessive digital technology usage may result in diminished activity in the prefrontal cortex, the brain region associated with rational

decision-making and self-control—two elements essential to the processes of tafakkur and muhasabah (introspection) in Islamic spiritual traditions.

Islamic education within a digital framework encounters distinct epistemological issues. The Islamic academic tradition underscores the significance of sanad (chain of transmission) and adab (ethics) in education, necessitating direct connection between instructor and student. The digitization of Islamic education may reduce the human dimension, resulting in a fragmented learning experience and undermining the comprehensive nature of tarbiyah (character development). Emotional reliance on digital platforms might intensify this condition by fostering the sense of profound learning, while it is, in reality, essentially passive information absorption.

The ethical dimension of technology utilization is very significant in Islamic religious communication. The notion of akhlaq (ethics) in Islam governs not just interpersonal relationships but also the interactions between people and tools and technology. Digital emotional dependency may be regarded as a manifestation of shirk khafi (hidden polytheism), when humans develop an undue emotional reliance on entities other than Allah. This engenders spiritual conflict necessitating a therapeutic strategy that amalgamates contemporary psychological insights with ancient Islamic teachings. This study aims to explore the psychospiritual mechanisms involved in DED in the context of Islamic preaching, as well as answer the question: how does digital emotional dependence affect spiritual contemplation (tafakkur) and religious emotion regulation?

The necessity of this research stems from the requirement to provide a comprehensive framework capable of comprehending and addressing the phenomena of DED within the realm of da'wah and religious communication. An interdisciplinary approach integrating neuroscience, psychology, and Islamic theology is essential for developing successful therapies. This aligns with the Islamic notion of holistic knowledge, which necessitates the integration of earthly and eschatological thinking to have a thorough grasp of human occurrences.

Research Method

This study uses a qualitative phenomenological method approach with a comprehensive literature study orientation, designed to explore and interpret psychophysiological factors in the phenomenon of digital emotional dependency. The research design focuses on a systematic and interpretive analysis of various relevant scientific sources, with the aim of revealing the complexity of subjective experiences and neurological mechanisms underlying human interaction with digital technology.

The data collection process was carried out through a systematic search of internationally reputable electronic databases, including PubMed, ScienceDirect, Google Scholar, and Web of Science. The literature inclusion criteria include English and Indonesian language research articles published in the period 2010-2024, with a special focus on articles that discuss the psychological and physiological aspects of digital dependency. The search strategy used a combination of keywords: "digital emotional dependency", "psychophysiological factors", "neurological technology interaction", and "digital addiction mechanisms".

Data analysis used the interpretative phenomenological analysis (IPA) method modified for the context of the literature study. The analysis stages include a systematic process: (1) comprehensive exploration of the literature, (2) extraction of key themes, (3) critical and comparative analysis between sources, (4) in-depth interpretation of psychophysiological phenomena, and (5) conceptual synthesis that allows for a holistic understanding of digital emotional dependence. The validity of the study was ensured through a series of methodological procedures, including triangulation of sources, critical assessment of article quality, and transparent documentation of each stage of the analysis. A minimum of 40-50 primary articles will be considered to provide depth and breadth of scientific perspective. The literature selection process was carried out in stages by considering the relevance, credibility of sources, and significance of theoretical contributions.

This study is expected to provide a substantial contribution in understanding the complexity of the phenomenon of digital emotional dependence from a psychophysiological perspective, as well as providing a comprehensive conceptual framework for further research in the realm of digital psychology and technological neuroscience. Of the initial 643 articles, 123 were screened based on abstracts, 64 matched the psychospiritual focus of DED, and 48 met the final requirements for in-depth analysis. IPA was used to explore the authors' subjective experiences of the primary studies, interpreted through psychospiritual and neurobiological lenses.

Table 1. Inclusion and Exclusion Criteria Table

Criteria	Inclusion	Exclusion
Publication Period	Articles published between 2010-2024	Articles published before 2010 or after 2024

Criteria	Inclusion	Exclusion
Research Focus	Articles discussing psychological and physiological aspects of digital dependency, digital emotional dependency, psychophysiological factors, neurological technology interaction	Articles not specifically addressing psychophysiological aspects of digital dependency, editorial, opinion articles, conference abstracts without full-text
Methodology & Quality	Primary studies with clear and evaluable methodology, articles providing significant theoretical contributions to understanding digital emotional dependency	Articles with unclear or non-evaluable methodology, duplicated articles from the same source

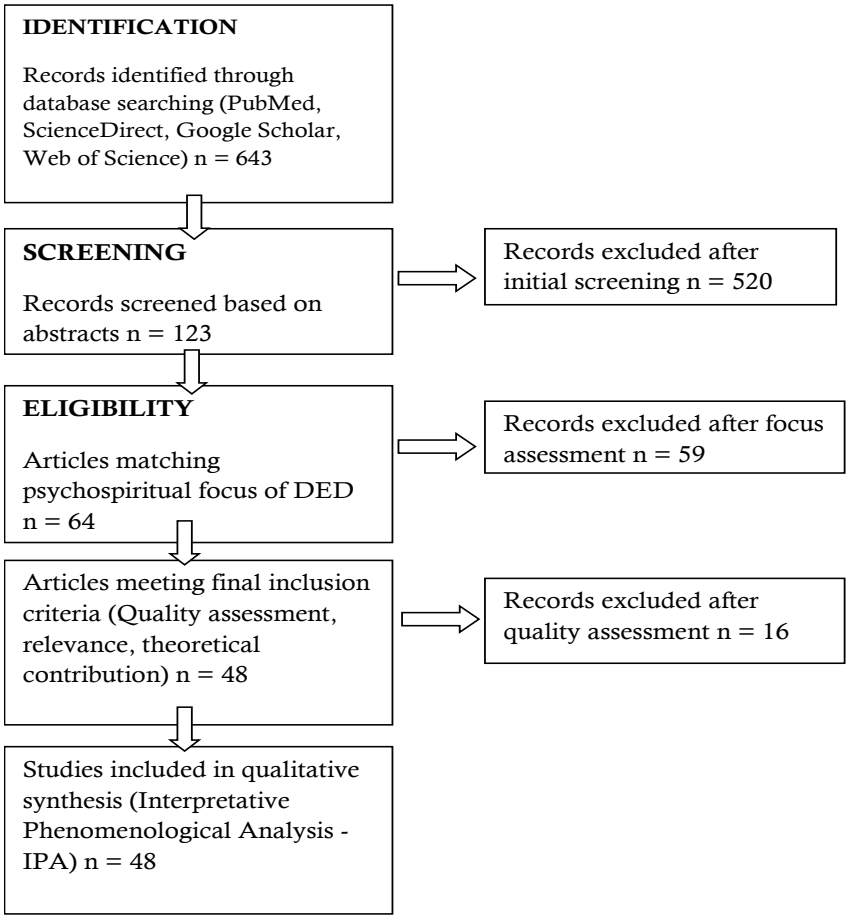

Figure 1. PRISMA Flowchart

Results and Discussion

1. *Psychospiritual Disruption and the Crisis of Religious Significance in the Digital Age*

This study's findings underscore the pressing need to reevaluate the principles of religious communication in the digital age by prioritizing psychospiritual components in the dialogue. The emotional reliance on digital platforms, as demonstrated by neurophysiological and phenomenological research, transcends mere behavioral or technological issues; it is a profound existential disturbance that undermines the validity of Islamic spiritual practice. The incapacity of individuals to participate in *tafakkur* (spiritual meditation) and *tazkiyah* (soul cleansing) owing to obsessive digital engagement indicates a disjunction between form and substance in modern Islamic existence. This contradiction exemplifies

what Al-Attas describes as the erosion of adab in the quest of knowledge—characterized by an abundance of information devoid of wisdom and spiritual understanding (Askari & Mirakhor, 2020; Beets dkk., 2020)

The digitization of dakwah, albeit broadening its accessibility, paradoxically diminishes its profundity. The abundance of emotionally appealing yet intellectually shallow "fast-food" religious material has fostered a generation of passive religious consumers instead of active seekers of heavenly truth. This corresponds with concept of "alone together," wherein perpetual connectedness conceals the lack of significant spiritual closeness. In the Islamic faith, effective da'wah necessitates both the dissemination of knowledge (*tabligh*) and transformational involvement that fosters moral and spiritual growth (*tarbiyah*). Nevertheless, DED skews this process by favoring superficial satisfaction over reflective comprehension.

Neurobiological data indicates that the reward circuits stimulated by digital feedback systems (likes, shares, comments) resemble those observed in drug addiction, as demonstrated by dopaminergic activity in the ventral striatum and reduced engagement of the prefrontal cortex. The outcome is a deterioration of cognitive control processes essential for religious contemplation (*muhasabah*) and discernment (*furqan*). In this context, emotional reliance on digital religious information manifests as a spiritual simulacrum—a psychological condition in which the semblance of religion supplants its authentic experience.

From a theological perspective, this behavior may signify a type of *shirk khafi* (hidden polytheism), since an overwhelming emotional dependence on digital devices symbolically undermines faith on Allah. This distortion, if uncorrected, threatens to normalize behavioral tendencies that undermine the integrity of tawhidic consciousness in daily life. Theologically based interventions, including *muraqabah* (self-vigilance before God), *dhikr* (remembrance), and digital minimalism aligned with maqasid al-shariah, are crucial for redefining the ethical limits of digital consumption and reinstating the sanctity of human intention in religious practice.

The convergence of neuroscience and Islamic spirituality, sometimes neglected, presents a fertile ground for the formulation of integrative therapeutic and preventative strategies. Neuroplasticity research indicates that purposeful training, such as mindfulness or muraqabah-based therapy, can reconfigure the brain's reward circuits, therefore diminishing impulsive behaviors and improving emotional control (Garland, 2016). This is essential for restoring the ability for

khushu' (devotional focus) in prayer, which is frequently hindered by fragmented attention spans influenced by digital multitasking.

Moreover, the disembodiment of religious experience via digital mediation engenders epistemological issues within the Islamic tradition, which prioritizes direct transmission (*isnad*), ethical conduct (*adab*), and experienced knowledge (*ilm ladunni*). The excessive dependence on digital instruments threatens to sever sacred knowledge from its philosophical foundations, turning it to mere decontextualized data. Thus, the crisis of emotional reliance constitutes a crisis of religious epistemology—where the understanding of God is more filtered by algorithmic reasoning rather than enlightened by divine presence and sincerity (ikhlas`).

The cultural diversity of DED manifestations across socio-demographic factors indicates that reactions to digital spiritual overload need to be contextualized. Urban Muslim youth, frequently inundated by hyperstimulating digital surroundings, are especially susceptible to psychospiritual exhaustion and identity disintegration. Consequently, educational institutions and religious authorities must cooperate to develop contextually relevant teaching frameworks that integrate Islamic theology with digital psychology. Curriculum development must transcend mere textual transmission to incorporate experiential, embodied, and contemplative activities that reestablish the heart (*qalb*) as the nucleus of spiritual cognition.

This research highlights the imperative for a transdisciplinary da'wah paradigm that integrates neuroscience, psychology, religion, and pedagogy to tackle the complex ramifications of Digital Emotional Dependency. In the absence of this paradigm change, the Islamic ummah jeopardizes the development of a digitally pious, yet spiritually vacuous generation. Al-Ghazali (*Ihya' Ulumuddin*) cautioned that external manifestations of devotion may serve as obstructions if the internal truths are overlooked. Consequently, addressing DED transcends mere reduction of screen time; it becomes an ethical and spiritual obligation to realign digital conduct with the elevated maqasid of Islamic existence. The main findings in this study indicate that Digital Emotional Dependency (DED) has a significant correlation with impaired neurological activity, especially in the prefrontal cortex and amygdala areas. Systematically reviewed neuroimaging studies indicate that individuals with DED experience decreased activity in the prefrontal cortex, which functions as the center for impulse control and decision-making, and increased amygdala reactivity associated with excessive emotional responses. This correlation directly contributes to decreased capacity for contemplation, namely the contemplative ability to deeply absorb the values of Islamic preaching.

2. *The Influence of Digital Overexposure on Emotional Regulation: A Psychophysiological Perspective*

A systematic analysis of relevant literature reveals that excessive exposure to digital technology is significantly correlated with disturbances in emotional regulation through complex psychophysiological mechanisms. A neuroimaging study by Tonon et al (2024) showed decreased activity in the prefrontal cortex (PFC) and increased amygdala reactivity in individuals with high levels of Digital Emotional Dependency (DED) symptoms. These changes indicate an imbalance in the limbic system, which plays a role in emotion processing and decision-making. In addition, a longitudinal study by Chang & Lee (2024) identified a reduction in gray matter volume in the PFC area in intensive technology users, which is associated with a decreased ability to inhibit emotional responses.

At the neurochemical level, a study by (Uhl dkk., 2019)) found that excessive social media use triggers repeated dopamine release through the reward prediction error mechanism, creating a cycle of dependence similar to addictive behavior. This is reinforced by the findings of (Cárdenas Garza dkk., 2024) of productive-age participants experienced significant mood fluctuations when exposed to digital content, with unstable serotonin levels as a mediating factor.

Behaviorally, DED manifestations include anxiety when separated from digital devices (nomophobia), decreased empathy ((Gargiulo & Mesones-Arroyo, 2024), and difficulties in direct social interactions. A meta-analysis by (Campbell dkk., 2025) also revealed heterogeneity in DED manifestations based on socio-cultural context, with individuals in urban environments showing higher levels of dependency than those in rural areas. These findings strengthen the theory that excessive digital exposure disrupts psychophysiological balance through modification of neural and neurochemical pathways. Decreased PFC activity and amygdala hyperactivity

(Morton dkk., 2020) are consistent with the dual-process theory model in neuroscience, where the dominant limbic system overrides the cognitive regulation of the PFC. This explains why individuals with DED tend to be impulsive and less able to manage negative emotions.

Table 2. Dimensions and Indicators of Digital Overexposure Effects

Dimensions	Indicator	Description
Digital Exposure	Duration of use	The amount of time spent per day using digital devices (smartphones, computers, tablets).
	Interaction Frequency	How often individuals switch between apps or platforms during a single session.
	Type of Content Consumed	The type of information accessed, such as entertainment, education, social media, or news.
Emotional Regulation	Ability to Delay Emotional Response	The ability to suppress impulses or emotional reactions due to digital exposure.
	Emotional Awareness	How well individuals recognize and understand their emotions during digital media use.
	Coping Strategies	Mechanisms used to manage stress caused by excessive digital consumption.
Psychophysiological Responses	Heart Rate Variability (HRV)	Variability in time intervals between heartbeats, reflecting autonomic nervous system balance.
	Skin Conductance Response (SCR)	Skin Conductance Response (SCR)
	Skin Conductance Response (SCR)	Cortisol levels as a stress indicator due to

Dimensions	Indicator	Description
		excessive digital exposure.

This study examines the impact of digital overexposure on emotional regulation and psychophysiological responses. Digital exposure is measured through three key indicators: duration of use, which refers to the total hours spent on digital devices daily; interaction frequency, indicating how often users switch between apps or platforms; and type of content consumed, distinguishing between entertainment, education, social media, or news. Emotional regulation is assessed through the ability to delay emotional response, reflecting impulse control during digital engagement; emotional awareness, which measures users' recognition of their emotional states while using digital media; and coping strategies, which indicate how individuals manage stress from excessive digital consumption.

Psychophysiological responses focus on three key biological markers: Heart Rate Variability (HRV), reflecting autonomic nervous system balance and stress regulation; Skin Conductance Response (SCR), which measures emotional arousal; and cortisol levels, serving as a physiological indicator of stress due to prolonged digital exposure. These dimensions collectively illustrate how excessive digital use affects emotional and physiological well-being, emphasizing the need for balanced media consumption.

The findings regarding the role of dopamine and serotonin are also consistent with previous research ((Van Dessel dkk., 2018), which highlights the similarity of DED mechanisms to substance addiction. However, this study reveals additional complexity: interactions between genetic factors, digital literacy, and environmental stress may moderate the impact of digital exposure. For example, participants with high digital literacy showed milder DED symptoms despite intensive technology exposure (MacDonald dkk., 2024)

Practical implications of these findings include the need for evidence-based interventions that target psychophysiological aspects. Mindfulness programs (Cremers dkk., 2021) and cognitive-behavioral approaches (Yaden dkk., 2022) have been shown to be effective in improving emotional regulation by stimulating PFC activity. However, the generalizability of these interventions is limited due to sample variability and cultural context. Limitations of this study include the reliance on secondary data and the methodological heterogeneity of the studies reviewed. In addition, most studies were cross-sectional, so the causal

relationship between digital exposure and psychophysiological changes has not been fully confirmed. Future longitudinal studies need to consider individual developmental stage and moderator variables such as personality and social support.

Overall, this synthesis provides a holistic conceptual framework for understanding DED, emphasizing the importance of a multidisciplinary approach in addressing the impact of technology on mental health. The findings also highlight the need for digital literacy-based educational policies and the development of adequate diagnostic tools to accurately measure DED.

3. *Neurophysiological Correlates of Digital Emotional Dependency: Insights from Phenomenological Analysis*

Phenomenological analysis of the experiences of individuals with Digital Emotional Dependency (DED) revealed complexpsychophysiological dynamics, particularly related to the interplay between subjective perceptions and neurobiological responses. Participants described feelings of intense "emotional attachment" to digital devices, whereby the absence of access to technology triggered physical sensations such as muscle tension and feelings of emptiness. These experiences were often accompanied by thought patterns focused on the desire to immediately return to screen interaction, despite awareness of its negative impacts. Qualitative findings suggest that individuals with DED tend to experience fragmentation in emotion regulation (Pauw dkk., 2025). For example, participants reported that excessive social media use created cycles of brief euphoria followed by feelings of emptiness or emotional exhaustion. This phenomenon was associated with subjective perceptions of a "need" to constantly check notifications, which was perceived as a way to avoid psychological discomfort.

At the neurophysiological level, participants described bodily experiences connected to digital activity, such as the feeling of an imaginary "pulse" or "vibration" when not using devices. Phenomenological analysis linked this to hyperactivation of the limbic system, particularly in response to visual and auditory stimulation from technology. Participants also mentioned difficulty maintaining focus on non-digital tasks, which is thought to be related to decreased efficiency of the neural networks responsible for sustained attention.

Table 3. Phenomenological Framework and Neurophysiological Correlations of DED

Key Concept	Phenomenological Description	Neurophysiological Correlation	Involved Mechanisms	Implications
Digital Emotional Attachment	Subjective feeling of "dependence" on digital devices, accompanied by anxiety when inaccessible.	Hyperactivity of the insular cortex (emotion and body awareness processing) and increased amygdala activity.	Limbic system activation through reward prediction error (dopamine) and stress response (cortisol).	The need for interventions to break emotional associations between technology and psychological rewards.
Emotional Regulation Fragmentation	Brief euphoria cycles (during technology use) followed by emotional emptiness.	Reduced functional connectivity between the DLPFC and ventral striatum (impaired executive control).	Dominance of the limbic system over the prefrontal cortex in emotion-based decision-making.	Mindfulness-based emotional regulation training to enhance cognitive-emotional integration.
Somatic Response to DED	Physical sensations such as muscle tension, "vibrations," or phantom pulses when abstaining from digital use.	Activation of the sympathetic nervous system (increased heart rate, sweating) and cortisol dysregulation	Allostatic load mechanism: accumulation of physiological stress due to chronic digital exposure.	Body-awareness-based therapy (somatic experiencing) to manage physiological responses.

Key Concept	Phenomenological Description	Neurophysiological Correlation	Involved Mechanisms	Implications
Cognitive-Emotional Dissonance	Conflict between the desire to stay digitally connected and awareness of its negative consequences.	Decreased activity in the anterior cingulate cortex (cognitive conflict) and increased striatum activity.	Failure to integrate the salience network (cognition) and default mode network (emotion).	Psychoeducation approaches to enhance critical awareness of technology usage patterns.

These findings reinforce the conceptualization of DED as a disorder involving a dynamic interplay between subjective perception and neurophysiological adaptation. The sensation of "attachment" reported by participants reflects a compensatory mechanism in which the brain associates digital activity with emotional rewards, albeit temporary ones. This is consistent with attachment theory in the digital context, where devices serve as "transitional objects" that replace the need for authentic interpersonal connections (Richins & Chaplin, 2021).

The fragmentation of emotion regulation in DED can be understood through the lens of cognitive-emotional dissonance. Participants' inability to maintain a balance between the desire to connect digitally and awareness of its negative consequences indicates a failure of integration between the limbic (emotional) system and the prefrontal (regulatory) cortex. This phenomenon is similar to the pattern observed in impulse control disorders, where the dominance of limbic responses overrides executive functions.

The hyper-sensitive bodily perception of the absence of technology also reveals the role of the autonomic nervous system in DED. Physical sensations such as tension or "tremors" may represent an over-activation of the sympathetic nervous system, a chronic stress response to the threat of losing digital access. This strengthens the argument that DED is not only psychological in nature, but also reflects physiological dysregulation that is internalized through repeated exposure.

4. *Cognitive and Affective Mechanisms Underlying Digital Emotional Dependency: A Psychophysiological Examination*

In the context of massive digital transformation, emotional dependence on digital platforms has become a complex phenomenon rooted in the dynamic interaction of cognitive and affective mechanisms. As a psychophysiology researcher, I argue that this dependence does not simply reflect behavioral habits, but also involves the reorganization of the brain's neuroplasticity in response to repeated digital stimulation (Noël, 2023). Cognitively, constant exposure to notifications, instant feedback (such as likes or comments), and personalized algorithms triggers hyperactivation of dopaminergic pathways, particularly in the ventral striatum and dorsolateral prefrontal cortex, which reinforces the anticipation-reward loop (Ruffini dkk., 2024)This mechanism impairs executive functions, including impulse regulation and decision-making, leading individuals to prioritize digital validation over direct social interactions.

On the affective dimension, digital emotional dependence often operates as a maladaptive strategy to manage emotional dysregulation (Squires dkk., 2021). Electrodermal studies (EDA) and heart rate variability (HRV) measurements show that heavy social media users experience increased physiological responses to digital absence (e.g., fear of missing out or FOMO), which is correlated with amygdala activation and decreased activity in the anterior cingulate cortex—a key region in processing emotional conflict. This supports the hypothesis that the inability to access digital platforms triggers an acute stress response, similar to the withdrawal mechanism in substance addiction.

Furthermore, the integration of psychophysiological data (such as EEG and fNIRS) revealed that exposure to emotional content on digital platforms—especially ambiguous or negative—increased functional connectivity between the anterior insula and orbitofrontal cortex, indicating hypervigilance to virtual social cues. The implication is that individuals develop emotional misattribution, where the need for affiliation and validation is reduced to digital transactions, thereby weakening the capacity for face-to-face empathy. These findings underscore the urgency of an interdisciplinary approach—combining cognitive neuroscience, clinical psychology, and ethical design of technology—to formulate interventions that break the cycle of dependency and restore psychophysiological balance in an era of hyperconnectivity.

Table 4. Synthesis of Previous Research on Digital Emotional Dependency

Research Focus	Methodology & Sample	Quantitative/Qualitative Findings	Reference
Sniffing Frequency and Dopamine Release	Tracing study using AAV1-hSyn-FLEX-mGFP-2A-Synaptophysin-mRuby in DATIRES-Cre mice to visualize DAergic inputs. Quantification of fluorescent puncta in NAc and TuS.	113% more DAergic innervation in anterior vs. posterior mTuS, 78% more in anterior vs. posterior NAcSh. Significant differences in DA input density across subregions (rmANOVA $F(1.52, 7.6) = 31.74$, $p = 0.0003$).	(Johnson et al., 2025)
Energizing Effect of Light Phone	Review of 64 articles covering 72 studies on healthy individuals. Fourteen physiological measures analyzed.	Light exposure reliably increases rectal body temperature (13/6/1) and heart rate (10/22/1). No significant effects found for oxygen consumption, skin conductance, blood pressure, heart rate variability, non-rectal inner temperature, skin temperature, or cortisol levels. Sympathetic nerve activity showed a possible effect but based on a single study.	(Danilenko, 2022)

Research Focus	Methodology & Sample	Quantitative/Qualitative Findings	Reference
Emotion and Cognitive Control	Meta-analysis of 71 studies using conflict tasks (e.g., Stroop, Simon, flanker) with emotional stimuli..	No clear evidence that emotional stimuli modulate cognitive control generally. Moderator analysis indicated reduced congruency effect (CE) under specific task, stimulus, and testing conditions. Supports theories of perceptual overload or enhanced target amplification/suppressor processe.	(J. Zhang et al., 2023)
Internet Gaming Disorder (IGD) and Neuropsychological Mechanisms	Comparison of 58 IGD, 53 Nicotine Dependence (ND), and 57 healthy controls. Used Delay-discounting Test (DDT), Probability Discounting Test (PDT), Stroop Task, Go/No Go Task, and Barratt Impulsiveness Scale (BIS-11).	IGD and ND groups scored higher on BIS-11 attentional, motor, and non-planning impulsiveness (Cohen's d = 0.41–1.75). Both groups showed higher delay discounting (Cohen's d = 0.53–0.69). ND group had lower probability discounting (Cohen's d = 0.55). ND showed lower accuracy in Stroop task (Cohen's d = 0.61). Both IGD and ND had lower accuracy in No-Go trials (Cohen's d = 1.35–1.50), indicating impaired inhibitory control. Findings suggest IGD shares	(Yan et al., 2021)

Research Focus	Methodology & Sample	Quantitative/Qualitative Findings	Reference
		neuropsychological similarities with ND, supporting classification as a behavioral addiction	
Neural Correlates of Providing Likes on Social Media	fMRI study with 58 adolescents and young adults completing a task mimicking Instagram. Neural responses examined while participants provided Likes..	Providing Likes activated reward-related regions (striatum, ventral tegmental area) similar to receiving Likes. Also activated regions related to salience processing and executive function. Suggests social feedback via Likes engages neural mechanisms of reinforcement learning and social reward.).	(Sherman et al., 2018)

Conclusions from the reviewed studies suggest that neuropsychological mechanisms play a significant role in various aspects of human behavior, including responses to environmental stimuli, cognitive control, and social interaction through digital media. Studies on the effects of lighting indicate that light exposure can increase rectal body temperature and heart rate, confirming the existence of physiologically measurable energizing effects. In the context of cognitive control, a meta-analysis of conflict tasks showed that emotional stimuli do not directly affect control mechanisms, but under certain conditions can increase the effectiveness of cognitive control through target amplification or distractor suppression mechanisms.

In addition, research on internet gaming disorder (ICD) revealed neuropsychological similarities with nicotine addiction, particularly in terms of impulsivity, delay discounting, and lower inhibitory control. These findings support the conceptualization of IGD as a form of behavioral addiction that shares a similar neurological basis with substance

addiction. Meanwhile, neuroimaging research on social interactions in digital media found that providing positive feedback in the form of "likes" activated brain areas related to the reward system, namely the striatum and ventral tegmental area, as well as areas related to salient processing and executive function. This suggests that social reinforcement mechanisms through digital media may influence user behavior in a similar way to other reward-based reinforcement.

Overall, these findings underscore that neurocognitive and psychophysiological processes play an important role in various aspects of human life, whether in the context of adaptation to the environment, emotion regulation and cognitive control, or in technology-mediated social interactions. Further research is needed to explore more specific mechanisms and potential interventions that can optimize cognitive function and psychological well-being of individuals.

The cognitive processes involved suggest changes in information processing patterns in the brain when a person experiences digital dependence, where the brain's reward system is activated when receiving notifications or positive feedback from digital activities (Firth dkk., 2019). There is a modification of neural pathways that reinforce excessive use behavior, similar to the mechanism of addiction in general. Areas of the prefrontal cortex responsible for impulse control and decision-making show decreased activity, while the limbic system associated with emotion and reward shows increased activity (Alsharif dkk., 2021). This creates a cycle of dependency where individuals affectively seek validation and emotional fulfillment through digital interactions, which is then reinforced by neurobiological changes in the brain (Romeo, 2024). Psychophysiological studies show increased cortisol levels and changes in heart rate variability when individuals are separated from their digital devices, indicating a significant stress response. This phenomenon is also associated with maladaptive coping mechanisms, where digital dependency becomes a strategy to avoid or manage negative emotions in real life.

As part of a critical analysis of previous literature, this study found inconsistencies in explaining the role of neurotransmitters in DED. Some studies emphasize the dominance of dopamine in triggering digital addiction through reward prediction error mechanisms, while others suggest that serotonin imbalances also play a role in creating mood instability after digital media use. This article brings together these findings by showing that the two interact in a neuropsychological stress axis that reinforces emotional dependence and disrupts spiritual affective regulation. This revised discussion provides a more complete synthesis of

how understanding DED must move beyond the neurotransmitter dichotomy and consider broader interdisciplinary dynamics.

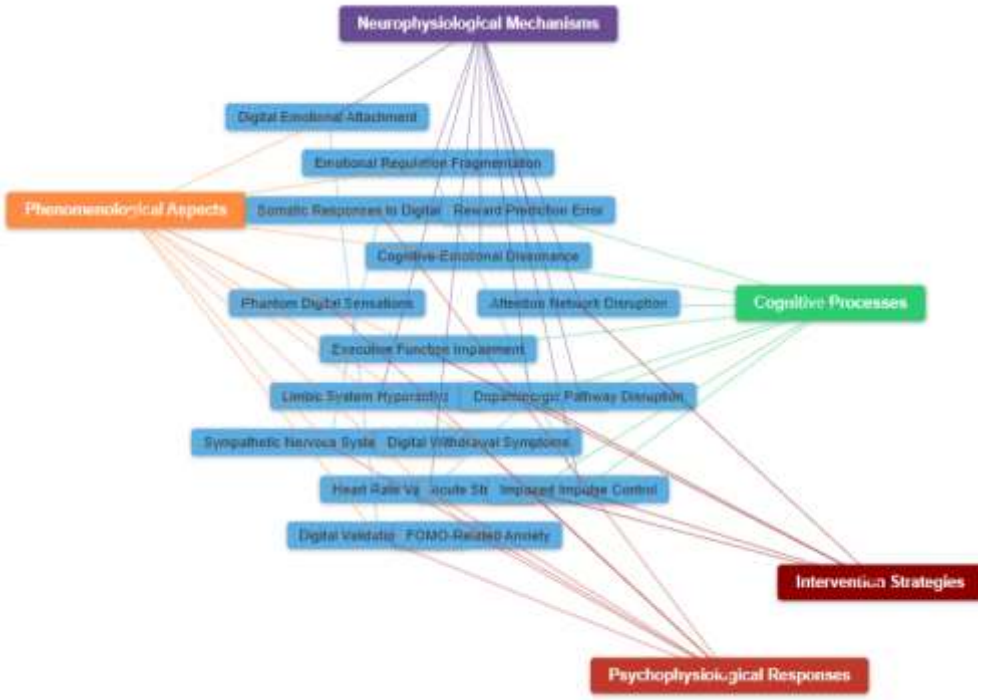

Figure 2. Taxonomy of mechanisms in Digital Emotional Dependency research.

Visual depiction of the multidimensional interconnections among the many elements associated with the phenomena of digital emotional dependence (DED). This figure categorizes theoretical conceptions into five primary domains: Neurophysiological Mechanisms, Phenomenological Aspects, Cognitive Processes, Psychophysiological Responses, and Intervention Strategies. The five domains interact, illustrating the intricacy of the interaction between the user's subjective experience and the fundamental biological and psychological systems.

The phenomenological aspect include features like Digital Emotional Attachment, Emotional Regulation Fragmentation, and Phantom Digital Sensations, which articulate the individual's internal narrative and direct experience with digital gadgets. These elements are interrelated with neurophysiological processes, including Limbic System Hyperactivity and Dopaminergic Pathway Disruption, suggesting the

central nervous system's role in the development and sustenance of emotional attachment to digital devices.

Cognitive processes, including executive function impairment and attention network disruption, are commonly disrupted by excessive stimulation from the digital world, leading to difficulties in attention regulation and decision-making. This condition's psychophysiological consequences manifest as Heart Rate Variability, FOMO-Related Anxiety, and Digital Withdrawal Symptoms, indicating that the body's reaction to detachment from digital gadgets is both emotional and biological.

This graphic illustrates the significance of a cohesive intervention strategy, as depicted in the Intervention Strategies domain. This technique must concurrently address cognitive, phenomenological, and physiological components. Consequently, a comprehensive comprehension of the interconnections across these domains is essential for formulating an intervention paradigm that addresses not just symptoms but also the neuropsychological foundations and subjective experiences of DED.

This diagram serves not just as a static representation but also as a dynamic framework for comprehending, assessing, and addressing the intricacies of emotional dependency on digital gadgets from a holistic neuropsychological and psychophysiological standpoint.

Conclusion

This study emphasizes the intricate relationship between Digital Emotional Dependency (DED) and the changing dynamics of religious communication in the digital age. The findings indicate that DED transcends a conventional psychiatric or neurological illness, representing a profound psychospiritual phenomena that radically transforms persons' experiences, internalizations, and responses to religious teachings. In Islamic communication, an overreliance on digital platforms undermines the integrity of dakwah, which ideally requires the transmission of divine truth alongside the development of spiritual depth and ethical resonance. Neurophysiological evidence indicates that excessive stimulation of the brain's reward system compromises the reflective capacities essential for genuine engagement with Islamic teachings, thereby converting a sacred process of contemplation (tafakkur) and purification (tazkiyah) into a sequence of superficial, dopamine-fueled interactions.

More importantly, DED transforms religious communication into emotionally addicting patterns that diminish sacred material to digestible bits, severing it from its theological and epistemological foundations. The fragmentation of attention, reduction in sympathetic ability, and deterioration of emotional regulation shown in this study provide a

significant danger to the goals of religious communication in Islam, which seeks to elevate the soul (ruh) toward transcendence rather than amusement. This distortion signifies not only a change in medium but a crisis of meaning: a substitution of *hikmah* (wisdom) with immediacy, and *ikhlas* (sincerity) with algorithmic pleasure.

This study highlights the significant influence of Digital Emotional Dependency (DED) on the psychospiritual quality of Islamic religious communication. The principal findings indicate that DED is associated with diminished tafakkur (spiritual contemplation), decreased emotional control, and a decline in genuine engagement with da'wah material. Neurobiological data underscores the hyperactivity of reward pathways and reduced prefrontal function, which undermines self-control and introspection—two components essential to Islamic spiritual practice. Individuals display fractured emotional states and an escalating dependence on digital validation, jeopardizing authentic spiritual satisfaction in favor of algorithmically generated gratification.

Based on these findings, many practical approaches are suggested. Initially, Islamic digital literacy initiatives ought to integrate dhikr-oriented reflective components to educate users in self-regulation and attentive participation. Secondly, creators of Islamic educational technology ought to emphasize platforms that foster tazkiyah, muraqabah, and deliberate spiritual practices rather than passive information consumption. Third, mental health experts and religious educators are urged to collaborate in developing tauhid-based cognitive-behavioral therapies to mitigate the emotional and spiritual conflict resulting from digital overexposure.

Consequently, the revival of ethical and spiritually impactful religious communication in the digital era necessitates an interdisciplinary and tawhidic methodology that amalgamates neuroscience, Islamic ethics, and digital education. Interventions should be structured to realign digital religious communication with its maqasid—revitalizing adab, presence, and inner change through guided digital literacy, dhikr-based regulatory practices, and cognitive-behavioral tactics grounded on Islamic principles. Religious communicators, educators, and organizations must transition beyond mere content delivery to fostering emotionally and spiritually robust communities. Islamic da'wah can only maintain its authenticity and revolutionary power in the digital era by regaining the intrinsic aspects of communication.

References

Alsharif, A. H., Md Salleh, N. Z., & Baharun, R. (2021). The Neural Correlates of Emotion in Decision-making. *International Journal of Academic Research in Business and Social Sciences*, *11*(7), Pages 64-77. https://doi.org/10.6007/IJARBSS/v11-i7/10075

Askari, H., & Mirakhor, A. (2020). *Conceptions of Justice from Islam to the Present*. Springer International Publishing. https://doi.org/10.1007/978-3-030-16084-5

Beets, M. W., Weaver, R. G., Ioannidis, J. P. A., Geraci, M., Brazendale, K., Decker, L., Okely, A. D., Lubans, D., Van Sluijs, E., Jago, R., Turner-McGrievy, G., Thrasher, J., Li, X., & Milat, A. J. (2020). Identification and evaluation of risk of generalizability biases in pilot versus efficacy/effectiveness trials: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 19. https://doi.org/10.1186/s12966-020-0918-y

Campbell, A. R., Sallese, M. R., Moeyaert, M., Calhoun, T. E., & Imler, M. H. (2025). Enhancing outcomes: Culturally adapted social–emotional and behavioral interventions for rural black elementary learners at risk. *School Psychology*, *40*(2), 223–236. https://doi.org/10.1037/spq0000648

Cárdenas Garza, S. A., Janssen Aguilar, R., & Ruíz Chow, Á. A. (2024). Problematic Internet Use and Personality Traits: Results in Working Age Adults. *Revista Colombiana de Psiquiatría*, *53*(2), 142–148. https://doi.org/10.1016/j.rcp.2022.03.002

Chang, M. L. Y., & Lee, I. O. (2024). Functional connectivity changes in the brain of adolescents with internet addiction: A systematic literature review of imaging studies. *PLOS Mental Health*, *1*(1), e0000022. https://doi.org/10.1371/journal.pmen.0000022

Chatterjee, S., Chaudhuri, R., Thrassou, A., & Vrontis, D. (2022). Social network games (SNGs) addiction: Psychological dimensions and impacts on life quality and society. *Technological Forecasting and Social Change*, *177*, 121529. https://doi.org/10.1016/j.techfore.2022.121529

Chiang, L.-L. (Luke), Huang, T.-L., & Chung, H. F. L. (2022). Augmented reality interactive technology and interfaces: A construal-level theory perspective. *Journal of Research in Interactive Marketing*, *16*(4), 683–698. https://doi.org/10.1108/JRIM-06-2021-0156

Cremers, S. L., Khan, A. R. G., Ahn, J., Cremers, L., Weber, J., Kossler, A. L., Pigotti, C., & Martinez, A. (2021). New Indicator of Children's Excessive Electronic Screen Use and Factors in Meibomian Gland Atrophy. *American Journal of Ophthalmology*, *229*, 63–70. https://doi.org/10.1016/j.ajo.2021.03.035

Ding, K., Shen, Y., Liu, Q., & Li, H. (2023). The Effects of Digital Addiction on Brain Function and Structure of Children and Adolescents: A Scoping Review. *Healthcare*, *12*(1), 15. https://doi.org/10.3390/healthcare12010015

Fekih-Romdhane, F., Sassi, H., & Cheour, M. (2021). The relationship between social media addiction and psychotic-like experiences in a large nonclinical student sample. *Psychosis*, *13*(4), 349–360. https://doi.org/10.1080/17522439.2020.1861074

Firth, J., Torous, J., Stubbs, B., Firth, J. A., Steiner, G. Z., Smith, L., Alvarez-Jimenez, M., Gleeson, J., Vancampfort, D., Armitage, C. J., & Sarris, J. (2019). The "online brain": How the Internet may be changing our cognition. *World Psychiatry*, *18*(2), 119–129. https://doi.org/10.1002/wps.20617

Floros, C., Cai, W., McKenna, B., & Ajeeb, D. (2021). Imagine being off-the-grid: Millennials' perceptions of digital-free travel. *Journal of Sustainable Tourism*, *29*(5), 751–766. https://doi.org/10.1080/09669582.2019.1675676

Gagne, J. R., Liew, J., & Nwadinobi, O. K. (2021). "How does the broader construct of self-regulation relate to emotion regulation in young children?" *Developmental Review*, *60*, 100965. https://doi.org/10.1016/j.dr.2021.100965

Gargiulo, P. Á., & Mesones-Arroyo, H. L. (Ed.). (2024). *Psychiatry and Neuroscience Update – Vol. V: Addiction: From Laboratory and Anthropology to Clinical Practice*. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-72219-6

Garland, E. L. (2016). Restructuring reward processing with Mindfulness-Oriented Recovery Enhancement: Novel therapeutic mechanisms to remediate hedonic dysregulation in addiction, stress, and pain. *Annals of the New York Academy of Sciences*, *1373*(1), 25–37. https://doi.org/10.1111/nyas.13034

Gerber, M., Cheval, B., Cody, R., Colledge, F., Hohberg, V., Klimentidis, Y. C., Lang, C., Looser, V. N., Ludyga, S., Stults-Kolehmainen, M., & Faude, O. (2025). Psychophysiological foundations of

human physical activity behavior and motivation: Theories, systems, mechanisms, evolution, and genetics. *Physiological Reviews*, *105*(3), 1213–1290. https://doi.org/10.1152/physrev.00021.2024

Jiang, Y., Zou, D., Li, Y., Gu, S., Dong, J., Ma, X., Xu, S., Wang, F., & Huang, J. H. (2022). Monoamine Neurotransmitters Control Basic Emotions and Affect Major Depressive Disorders. *Pharmaceuticals*, *15*(10), 1203. https://doi.org/10.3390/ph15101203

Lemay, E. P., Teneva, N., & Xiao, Z. (2025). Interpersonal emotion regulation as a source of positive relationship perceptions: The role of emotion regulation dependence. *Emotion*, *25*(2), 355–371. https://doi.org/10.1037/emo0001387

Liu, J., & Chen, S. (2024). Distal and proximal factors of wearable users' quantified-self dependence: A cognitive-behavioral model. *DIGITAL HEALTH*, *10*, 20552076241286560. https://doi.org/10.1177/20552076241286560

MacDonald, H. J., Kleppe, R., Szigetvari, P. D., & Haavik, J. (2024). The dopamine hypothesis for ADHD: An evaluation of evidence accumulated from human studies and animal models. *Frontiers in Psychiatry*, *15*, 1492126. https://doi.org/10.3389/fpsyt.2024.1492126

Marciano, L., Camerini, A.-L., & Morese, R. (2021). The Developing Brain in the Digital Era: A Scoping Review of Structural and Functional Correlates of Screen Time in Adolescence. *Frontiers in Psychology*, *12*, 671817. https://doi.org/10.3389/fpsyg.2021.671817

Morton, M. L., Helminen, E. C., & Felver, J. C. (2020). A Systematic Review of Mindfulness Interventions on Psychophysiological Responses to Acute Stress. *Mindfulness*, *11*(9), 2039–2054. https://doi.org/10.1007/s12671-020-01386-7

Noël, X. (2023). A critical perspective on updating drug memories through the integration of memory editing and brain stimulation. *Frontiers in Psychiatry*, *14*, 1161879. https://doi.org/10.3389/fpsyt.2023.1161879

Parent, N., & Shapka, J. (2020). Moving beyond addiction: An attachment theory framework for understanding young adults' relationships with their smartphones. *Human Behavior and Emerging Technologies*, *2*(2), 179–185. https://doi.org/10.1002/hbe2.180

Pauw, L. S., Sauter, D. A., Van Kleef, G. A., Sels, L., & Fischer, A. H. (2025). The dynamics of interpersonal emotion regulation: How sharers elicit desired (but not necessarily helpful) support. *Emotion*, *25*(2), 287–299. https://doi.org/10.1037/emo0001382

Recchioni, A., Aiyegbusi, O. L., Cruz-Rivera, S., Rauz, S., & Slade, A. (2021). A systematic review assessing the quality of patient reported outcomes measures in dry eye diseases. *PLOS ONE*, *16*(8), e0253857. https://doi.org/10.1371/journal.pone.0253857

Richins, M. L., & Chaplin, L. N. (2021). Object attachment, transitory attachment, and materialism in childhood. *Current Opinion in Psychology*, *39*, 20–25. https://doi.org/10.1016/j.copsyc.2020.07.020

Rodriguez-Garcia, A., Ruiz-Lozano, R. E., Bustamante-Arias, A., Pantaleon-Garcia, J., Hernandez-Quintela, E., & Navas, A. (2023). Correlation and Level of Agreement between the Ocular Surface Disease Index and the Symptom Assessment in Dry Eye Questionnaires: A Survey-Based Study. *Current Eye Research*, *48*(9), 788–798. https://doi.org/10.1080/02713683.2023.2211249

Romeo, V. M. (2024). Pathogenesis of Subjectivation in Post Digital Generation. *Journal of Contemporary Approaches in Psychology and Psychotherapy (JCAPP)*, *2*(16), 23. https://doi.org/10.57017/jcapp.v2.i2.02

Ruffini, G., Castaldo, F., Lopez-Sola, E., Sanchez-Todo, R., & Vohryzek, J. (2024). The Algorithmic Agent Perspective and Computational Neuropsychiatry: From Etiology to Advanced Therapy in Major Depressive Disorder. *Entropy*, *26*(11), 953. https://doi.org/10.3390/e26110953

Squires, L. R., Hollett, K. B., Hesson, J., & Harris, N. (2021). Psychological Distress, Emotion Dysregulation, and Coping Behaviour: A Theoretical Perspective of Problematic Smartphone Use. *International Journal of Mental Health and Addiction*, *19*(4), 1284–1299. https://doi.org/10.1007/s11469-020-00224-0

Uhl, G. R., Koob, G. F., & Cable, J. (2019). The neurobiology of addiction. *Annals of the New York Academy of Sciences*, *1451*(1), 5–28. https://doi.org/10.1111/nyas.13989

Van Dessel, J., Sonuga-Barke, E., Mies, G., Lemiere, J., Van Der Oord, S., Morsink, S., & Danckaerts, M. (2018). Delay aversion in attention deficit/hyperactivity disorder is mediated by amygdala

and prefrontal cortex hyper-activation. *Journal of Child Psychology and Psychiatry*, *59*(8), 888–899. https://doi.org/10.1111/jcpp.12868

Yaden, D. B., Earp, D., Graziosi, M., Friedman-Wheeler, D., Luoma, J. B., & Johnson, M. W. (2022). Psychedelics and Psychotherapy: Cognitive-Behavioral Approaches as Default. *Frontiers in Psychology*, *13*, 873279. https://doi.org/10.3389/fpsyg.2022.873279

Zhang, A., Yang, C., Li, G., Wang, Y., Liu, P., Liu, Z., Sun, N., & Zhang, K. (2020). Functional connectivity of the prefrontal cortex and amygdala is related to depression status in major depressive disorder. *Journal of Affective Disorders*, *274*, 897–902. https://doi.org/10.1016/j.jad.2020.05.053