

REVIEW ARTICLE



In the original version of this article the affiliation of Coralie Latrouite was incorrectly stated as 3, Department of Mechatronics, University Duisburg-Essen, Germany. The error was corrected on 21st March, 2025.

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The Digital Media-use Effects (d-MUSE) Model: A comprehensive framework for exploring/ studying functional and dysfunctional effects on adolescent wellbeing

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ABSTRACT

Background and Aims: Digital media have become a fundamental aspect of daily life for children and adolescents, influencing cognitive, emotional, and social development. The present work explores the dual nature of digital media use, identifying both positive and negative impacts on well-being and development. **Methods:** A comprehensive review of existing literature was conducted to explore the interplay between digital media use and its effects on child and adolescent well-being. The study employs the Digital Media-use Effects (d-MUSE) model to analyze psychological mechanisms and contextual factors mediating these effects. **Results:** Functional media use promotes positive mental, physical, and social outcomes, while dysfunctional use is linked to negative psychological consequences, such as increased anxiety, depression, and social isolation. The proposed d-MUSE model highlights the interplay of psychological mechanisms and contextual factors—both proximal and distal—that mediate the effects of digital media on short- and long-term well-being. **Discussion:** The present work endeavours to refine our existing comprehension of the intricate interplay of elements and mechanisms underpinning functional and dysfunctional employment of digital media. Prospective research trajectories, which spotlight factors that hitherto remained at the periphery of investigative scrutiny, find discourse in this synthesis.

KEYWORDS

digital media, adolescents, development, well-being, mental health, smartphone use, social media use

INTRODUCTION

Digital media are an essential part of everyday life of children and adolescents in industrialized states. Broadly defined, digital media refer to content created, distributed, and

consumed through digital platforms and devices. This includes a wide range of activities such as social media, video gaming, streaming services, online communication, and educational tools. Digital media encompass both interactive and passive forms of engagement and are accessed through devices like smartphones, tablets, computers, and gaming consoles. In Germany, more than 94% of young people (12–19 years) already own a smartphone and use it several times a day (Feierabend, Plankenhorn, & Rathgeb, 2020). In addition to smartphones, almost all adolescents have access to television, computer, laptop, and WLAN, and even the youngest already regularly use digital media (Hawkey, 2019). For example, children aged 8–12 years spend an average of 4–6 h a day in front of a screen, watching videos, playing games and socialising (Brailovskaia, Rohmann, Bierhoff, & Margraf, 2018; Twenge & Campbell, 2019).

The use of digital media has both advantages and disadvantages, which are particularly relevant in children and young people as their personalities, abilities, and minds are still developing (Hurrelmann & Bauer, 2018; Hurrelmann & Quenzel, 2018; Nivins, Sauce, Liebherr, Judd, & Klingberg, 2024; Sauce, Liebherr, Judd, & Klingberg, 2022). Recent research, particularly in video gaming and social media use, reveals a complex interplay of both positive and negative effects on psychological well-being, as well as cognitive, physical, and social development (Reinecke & Oliver, 2016).

In terms of cognitive development, studies highlight the potential of educational apps and online platforms to foster skills such as problem-solving, critical thinking, and creativity. For instance, Hirsh-Pasek et al. (2015) demonstrated that well-designed educational apps could significantly improve learning outcomes in young children. Additionally, digital platforms provide opportunities for mental health support through mindfulness and meditation apps, which have been shown to improve psychological well-being (Firth et al., 2017). However, digital media use has also been linked to several negative consequences for psychological well-being, particularly among children and adolescents. Prolonged screen time has been associated with increased feelings of anxiety and depression, as well as reduced self-control, emotional stability, and overall well-being (Twenge & Campbell, 2018), but discussions in this area not settled yet (also much studies are hampered by being cross-sectional) (Keles, McCrae, & Grealish, 2020). Using social media platforms, in particular, can be associated with decreases in components of subjective well-being: individuals' moment-to-moment emotional experiences and their overall life satisfaction (Kross et al., 2013). In the meanwhile it is well known though that mere length of social media use is only weakly associated with well-being (Huang, 2017) and a person-centred approach is needed to understand the digital well-being complex (Montag, Demetrovics, et al., 2024; Montag, Yang, & Elhai, 2021). This said, heavy social media use can disrupt sleep patterns, resulting in significant clinical implications for the health and well-being of young adults (Levenson, Shensa, Sidani, Colditz, & Primack, 2016).

Considering effects on physical development, there is consistent evidence of the potential of active video games to

promote physical activity in children and adolescents. For example, exergames, which require physical movement to play, can improve physical fitness, coordination, and motor skills as well as combat obesity in children (Staiano & Calvert, 2011). Additionally, location-based augmented reality games like Pokémon Go have been shown to encourage walking and outdoor activities, further contributing to physical activity and health benefits (Althoff, White, & Horvitz, 2016). Within their systematic review on active video games in children and youth, Biddiss and Irwin (2010) describe a light to moderate physical activity in playing active video games in children. In contrast, the predominant use of particularly passive forms of digital media, such as watching videos or playing non-active video games, is linked to several negative health outcomes, including obesity, musculoskeletal problems, and metabolic disorders. A meta-analysis by Costigan, Barnett, Plotnikoff, and Lubans (2013) reported a significant association between high screen time and increased body mass index in children and adolescents. Furthermore, Tremblay et al. (2011) found that excessive screen time is correlated with poor physical fitness and increased risk of chronic diseases. Linked to physical well-being is also satisfaction with one's own body appearance. Here it has been shown that social media can pressure young users via photoshopped pictures resulting in body dissatisfaction and perhaps even eating disorder symptoms (Dane & Bhatia, 2023; Rozgonjuk et al., 2023). A recent study also showed that abstinence from social media on the smartphone could lower body dissatisfaction (de Hesselde & Montag, 2024).

Digital media can facilitate social interaction and social development, providing platforms for communication and community building. Social media enables users to maintain connections with family and friends, participate in interest-based groups, and access social support networks, which can enhance social well-being (Ellison, Steinfield, & Lampe, 2007). Interestingly, it has been shown that positive feedback on social media profiles led to an increase in adolescents' social self-esteem and overall well-being, whereas negative feedback can undermine both their self-esteem and well-being (Valkenburg, Peter, & Schouten, 2006). A study by Primack et al. (2017) found that higher social media use was associated with perceived social isolation, highlighting the complex nature of digital interactions.

Besides the fact that most of the studies were correlational and the direction of effects remains unclear, the controversy surrounding whether digital media use is beneficial or harmful highlights that simply measuring the frequency or duration of usage is not very meaningful. Instead, it is crucial to classify media use into functional and dysfunctional categories based on the psychological mechanisms and processes that influence its impact (Brailovskaia et al., 2018; Kross et al., 2021). The clinical relevance of dysfunctional media use, in contrast to functional media use, has put it into focus of previous research. Within the literature, dysfunctional media use is often conceptualized as an addiction-like use with increasing priority over other activities, reduced control over use, continued media use despite negative consequences, as

well as functional impairment and increasing distress (Bralovskaia & Margraf, 2022; Müller et al., 2022; Paschke et al., 2020, 2021). However, dysfunctional media use can also describe risky or other use patterns that result in negative or a reduction of positive outcomes (Kowalski, Giumetti, Schroeder, & Lattanner, 2014; Livingstone, Mascheroni, & Staksrud, 2018; Notten & Nikken, 2014). Based on previous empirical findings, psychological mechanisms underlying dysfunctional media use have often been summarized in well-known theories and models aiming to explain the aetiology of specific disorders (Brand et al., 2019; Davis, 2001; Dong & Potenza, 2014). While these theories and models are important, especially in the context of children and adolescents where such disorders may not have developed yet, a broader view on the positive and negative impacts of digital media use, considering both short- and long-term effects, is relevant.

Functional digital media use is less frequently the focus of interest and often simply described as the absence of dysfunctional use or negative consequences (Schønning, Hjetland, Aarø, & Skogen, 2020). However, building on the conceptualization of mental health and psychopathology (Iasiello & van Agteren, 2020; Suldo & Shaffer, 2008), we argue that functional digital media use extends beyond merely avoiding negative effects. It encompasses types of media engagement that actively promote positive mental, physical, and social outcomes, thereby enhancing mental health in both the short and long term. Moreover, functional media use fosters cognitive, emotional, and social development (Garrison & Christakis, 2012; Weinstein, 2018).

Research that conceptualizes the determinants of functional digital media use and its underlying psychological mechanisms remains scarce. Most existing models, like those proposed by Kross et al. (2021) tend to focus on specific media contexts, such as social media, rather than offering a comprehensive understanding of functional digital media use. Kross et al. (2021) present a pictorial model illustrating the impact of social media platforms on various aspects of well-being, emphasizing the importance of considering how interacting psychological processes, such as self-presentation and emotional sharing, influence these outcomes. These processes can have both positive and negative effects depending on contextual factors, such as the quality of interactions and the user's emotional state. The Differential Susceptibility to Media Effects Model (Valkenburg, Piotrowski, Hermanns, & de Leeuw, 2013) suggests that individuals vary in their susceptibility to media effects based on the following four key propositions:

1. Media effects depend on three differential susceptibility variables: These include dispositional (personality, cognitive style), developmental (age, maturity), and social (peer, family, cultural context) factors, all of which shape how media influences individuals.
2. Three media response states mediate the relationship between media use and effects: These are cognitive (how media content is processed), emotional (how media triggers feelings), and excitative (physiological arousal), which together influence the impact of media.
3. Differential susceptibility variables act as both predictors and moderators: They not only predict media engagement but also moderate the strength and direction of media effects.
4. Media effects are transactional: Media use and its effects are dynamic, constantly influencing each other over time, creating a feedback loop that shapes both media consumption and its impacts.

The EU Kids online revised model of children's outcomes of internet use describes three levels that influence children's well-being: 1) individual level, 2) social level, and 3) country level (Livingstone et al., 2018). Reinecke and Oliver (2016) provide a schematic model of the interplay of media use and well-being. In their model, the authors distinguish between short-term and long-term effects on well-being. They describe reception processes as the central drivers of media effects on well-being. Furthermore, reception processes are triggered by the selection of the media. This concept highlights how individuals' engagement with media shapes their emotional and cognitive outcomes over time. Additionally, the online and offline integration hypothesis by Lin, Su, and Potenza (2018) suggests that a harmonious integration of both parts contribute to a healthier pattern of internet usage.

Integrating the factors contributing to functional and dysfunctional digital media use, as identified in previous models, three broad categories emerge: A) **Psychological mechanisms in the situation** (e.g., aim of use, usage patterns), B) **Proximal context of media use** (e.g., characteristics of the situation, media features), and C) **Distal context of media use** (e.g., social environment). Initial research, such as Hall (2016), has already emphasized the role of these factors as moderators and mediators between digital media use and well-being. While existing models provide a useful framework, they often focus on specific aspects of digital media use. For instance, Kross et al. (2021) concentrated on social media use in the general population but did not explore the interaction between various psychological mechanisms. Valkenburg and Peter (2013) offered a broader model addressing interactions between mechanisms in digital media use, but their focus was primarily on broad categories like dispositional, developmental, and social factors, leaving the specific mechanisms that drive media effects less defined. Livingstone et al. (2018) addressed digital media use in children but limited their analysis to online behaviors, overlooking offline media interactions.

Given these limitations, the present work seeks to advance our understanding of how various factors and mechanisms influence functional and dysfunctional digital media use, particularly concerning the mental health of children and adolescents. By introducing a new model grounded in prior theoretical and empirical findings, synthesized from systematic reviews and meta-analysis that address digital media use and its psychological, social, and developmental impacts, this work aims to provide a clearer distinction between positive and negative impacts of digital media use and to identify the specific mechanisms that

contribute to each. This model will address both short- and long-term effects, emphasizing the interplay of psychological mechanisms with proximal and distal contextual factors.

THE DIGITAL MEDIA-USE EFFECTS IN CHILDREN AND ADOLESCENTS MODEL (D-MUSE MODEL)

The d-MUSE model consists of four categories (A-D) (see Fig. 1). The first category (A) includes variables that describe psychological mechanisms relevant to specific situations of digital media use, functioning primarily as mediators or moderators (e.g., affective states like boredom or stress). These psychological factors can interact with one another and may be influenced by the more proximal context of media use (category B). Category B encompasses factors that define the specific media-use situation (e.g., type of media content, availability of alternatives) and often act as mediators. They may themselves be influenced by more distal variables from the digital media use context (category C), which function as predictors. These category C factors are more stable across different media-use situations and include individual characteristics (e.g., personality traits) as well as social and cultural contexts. Together, these factors shape whether the effects of digital media use are beneficial or harmful to physical, mental, and social well-being. When considering outcome variables (category D), it is important to distinguish between short-term effects (e.g., mood changes) and long-term outcomes (e.g., mental health development).

In the following sections, we describe in detail the three categories of the d-MUSE model—psychological

mechanisms, proximal context, and distal context—along with their variables, examples, and how they relate to the short- and long-term outcomes of digital media use. These categories are based on both theoretical considerations and empirical evidence. While we focus on highlighting the most critical factors, this list is not exhaustive.

Psychological mechanisms in the situation of media use (category A)

This category summarizes the psychological mechanisms that occur within an individual during specific instances of digital media use. These factors encompass affective, cognitive, and behavioral responses that arise in the moment. Stable characteristics of the individual, such as personality traits, are not included in this category, as they persist across multiple media-use situations and are considered more constant influences.

Current affective and cognitive state of the individual. - Previous research, particularly in the context of internet use disorders (aka internet addiction), suggests that current state variables—such as mood, affect, and stress—can significantly influence media-specific emotions and cognitions, including the motivation to use digital media or the urge to engage with it. These factors also shape how individuals interact with digital media (Brand, Young, Laier, Wölfling, & Potenza, 2016; Jones, Christiansen, Nederkoorn, Houben, & Field, 2013). Therefore, the current affective and cognitive state of the individual might not have a direct effect on the degree of positive or negative effects of digital media use but might be a predisposing factor for further psychological mechanisms. Empirical research on associations between current mood and psychological mechanisms associated

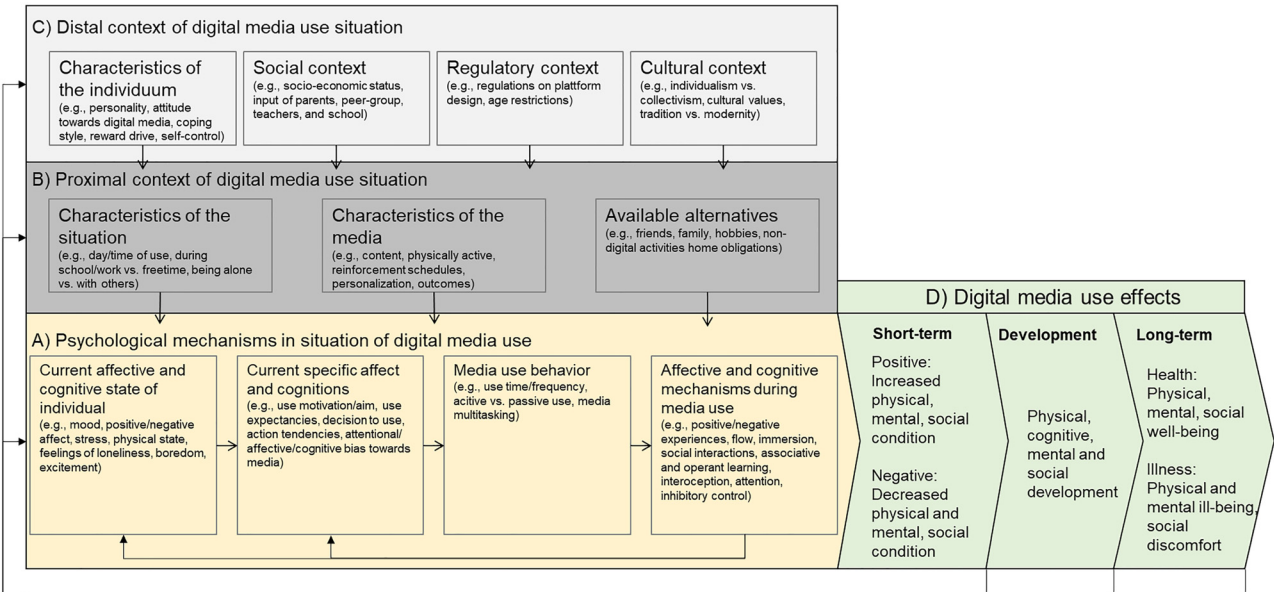


Fig. 1. The theoretical Digital Media-use Effects in Children and Adolescents model (d-MUSE Model) describing interactions between psychological mechanisms with proximal and distal contextual aspects contributing to functional and dysfunctional digital media use in short- and long-term

with digital media use in children and adolescents is rare. In college students, increased positive or negative mood was related with reduced positive and negative mood during social media use (Tuck, Long, & Thompson, 2023). In addition, reinforcement learning processes can strengthen these associations (Brand et al., 2019). For example, an individual could learn that using digital media when being stressed reduces their physical arousal in short-term although there might be negative consequences in long-term (e.g., child does not finish its homework properly).

An individual's physical condition, such as fatigue or arousal, can directly affect their choice and engagement with digital media. Fatigue may lead individuals to prefer passive media use, such as watching videos or browsing social media, which requires less cognitive effort (Yee, Krause, Meier, Ng, & Loy, 2024). Conversely, heightened physical arousal—such as following physical activity—may prompt individuals to engage in more active or stimulating forms of media use, like gaming (Staiano & Calvert, 2011). Furthermore, we suggest that matching media use to one's physical state can have both short-term effects, such as relaxation or stimulation, and long-term consequences on health and well-being.

Boredom is a well-established precursor to digital media use, especially among adolescents (Mougharbel & Goldfield, 2020). When bored, individuals often seek media as a form of entertainment and stimulation. Social media and gaming platforms, in particular, offer immediate and easily accessible content to alleviate boredom (Király et al., 2022). However, habitual use of digital media to cope with boredom can foster patterns of excessive media use, potentially leading to problematic outcomes such as decreased attention span, lower academic performance, and increased impulsivity (Montag & Elhai, 2023; Sapci, Elhai, Amialchuk, & Montag, 2021; Sunday, Adesope, & Maarhuis, 2021).

Loneliness plays a complex role in influencing digital media use. Adolescents who feel isolated may turn to social media platforms for connection, support, and interaction (Primack et al., 2017). Also for the COVID-pandemic it has been discussed how emotional disbalance might interact with media use and result in adverse consequences (Montag & Elhai, 2020). While this can temporarily reduce feelings of loneliness, studies show that excessive use of social media can also exacerbate loneliness by fostering negative social comparisons or leading to shallow interactions (Valkenburg, Meier, & Beyens, 2022; Yoon, Kleinman, Mertz, & Brannick, 2019). For example, social media use in response to loneliness has been linked to both positive and negative outcomes depending on the quality of the interactions and the social support received (Best, Manktelow, & Taylor, 2014; Gilmour, Machin, Brownlow, & Jeffries, 2020). Moreover, studies suggest that loneliness can create a cycle of media use where individuals increasingly rely on digital platforms for social interaction, potentially worsening their social well-being over time (Deters & Mehl, 2013).

Current state variables significantly influence how individuals engage with digital media as well as drive motivations for use and shape interactions, with emotional states often acting as predisposing factors for media consumption.

While fatigue leads to increasingly passive use, boredom and loneliness drive media engagement for stimulation or connection. However, habitual use in response to these states can lead to problematic patterns, such as decreased attention or increased social isolation, impacting long-term well-being.

Current specific affect and cognitions. This category focuses on specific emotions and cognitions related to digital media use, including goals and situational motivations. Research has identified several common motives for media engagement, such as seeking social support, communication, information search, and humorous coping, all of which can have both positive and negative effects (Valkenburg, Meier, & Beyens, 2022). For instance, seeking social support through platforms like Facebook while experiencing depression can result in different outcomes depending on the quality of interactions. Positive responses can alleviate loneliness and improve mood, while negative or absent responses may worsen emotional states (James et al., 2017; Vidal, Lhaksampa, Miller, & Platt, 2020). The goal of communication, especially with close friends and family, is frequently associated with positive outcomes, including reduced feelings of loneliness and increased well-being (Frisson & Eggermont, 2015a, 2015b). Additionally, the use of humorous content to cope with stress, such as during the COVID-19 lockdown, has been linked to an increase in happiness and emotional resilience (Cauberghe, van Wesenbeeck, de Jans, Hudders, & Ponnet, 2021).

Media use-specific decision-making refers to how individuals choose to engage with digital media based on their current emotional and cognitive state. Decisions are often influenced by the user's goals, such as seeking distraction, emotional regulation, or social connection. These decisions are not static but evolve based on past experiences with media use and learned associations between media and outcomes. For example, a person who experiences relief from stress by browsing social media may continue to rely on it as a coping mechanism, reinforcing this behavior through positive reinforcement (Brand et al., 2019).

Research also highlights that individuals weigh the perceived benefits and risks of media use. Adolescents, for example, may prioritize immediate gratification, such as the reward of social interaction, over potential negative outcomes like disrupted sleep or reduced attention (Király et al., 2022). The decision to engage in digital media can also be influenced by situational context (category B variables), such as the availability of alternative activities or environmental cues like boredom, which drive media consumption as a default behavior (Paschke et al., 2020).

Affective and cognitive biases play a significant role in how individuals interpret and respond to digital media content. Affective biases, such as mood-congruent memory, influence how users perceive and engage with media. For instance, individuals in a negative mood are more likely to recall and engage with negative content, reinforcing their current emotional state (Yoon et al., 2019). This can create a feedback loop where negative moods drive media use that

exacerbates these feelings, particularly in vulnerable populations like adolescents.

Cognitive biases, such as confirmation bias, can also shape how users interact with media. For example, individuals may seek out content that aligns with their pre-existing beliefs or attitudes, reinforcing cognitive distortions or social comparisons (Verduyn, Ybarra, Résibois, Jonides, & Kross, 2017). This is especially problematic in social media environments, where algorithmic filtering can further entrench these biases by continuously presenting users with similar content. These biases not only affect emotional well-being but also influence decision-making regarding media use, often leading to maladaptive patterns such as overconsumption or avoidance of healthier alternatives.

Media use behavior. The category media-use behavior includes all variables that describe the execution of the specific media use behavior. This includes description of media use pattern as the use time, active or passive use or if other digital media is used in parallel (media multitasking). Use time mostly encompasses findings from time spent on general screens, social network sites, and smartphones. The vast majority of research on effects between media use behavior and effects of media use addressed associations between general usage time and negative outcomes. For example, some reviews highlight the notion that an average duration of more than two hours a day might have negative outcomes for children and adolescents (Girela-Serrano et al., 2022; Glover, Ariefdjohan, & Fritsch, 2022; Lissak, 2018; Liu et al., 2022; Manwell, Tadros, Ciccarelli, & Eikelboom, 2022; Memon, Sharma, Mohite, & Jain, 2018; Mougharbel & Goldfield, 2020; Orben, 2020; Pardhan, Parkin, Trott, & Driscoll, 2022; Thomée, 2018; Zink, Belcher, Imm, & Leventhal, 2020). In other reviews evidence for negative effects starting from four-hour daily use or more is reported (Glover et al., 2022; Mougharbel & Goldfield, 2020; Thomée, 2018; Twenge, 2020; Vidal et al., 2020). An active use of digital media has been related with positive outcomes like well-being and decreased loneliness (Course-Choi & Hammond, 2021; Orben, 2020). Frison and Eggermont (2015a, 2015b) on the other hand, reported an increase in depression associated with active use, which was only significant in boys. In contrast to active use, passive use was predominantly associated with negative outcomes, such as diminishing subjective, emotional and affective well-being (Dienlin & Johannes, 2020; Valkenburg, van Driel, & Beyens, 2022; Verduyn et al., 2017).

Affective and cognitive mechanisms during media use. The psychological mechanisms during digital media use consist of social comparisons, positive and negative experiences, experience of authenticity and perceiving social support. Social comparisons were associated with negative outcomes only. Four reviews were regarded. For instance, Valkenburg, Meier, and Beyens (2022) referred to Yoon et al. (2019) showing that (i) general social comparisons are associated with depressive symptoms, (ii) upward social comparisons (e.g., believing others are doing better than oneself) being

even more strongly tied to depression and lastly, (iii) both measures weighing in stronger in their association with depression, compared to measures of usage.

Regarding positive and negative experiences, Magis-Weinberg, Gys, Berger, Domoff, and Dahl (2021) reported negative use experiences, like feelings of exclusion and rejection potentially leading to increased loneliness, whereas positive use experiences such as feeling valued and receiving advice lessens said loneliness. Another mechanism which might hold relations to functional media use is the experience of authenticity: Reinecke and Trepte (2014) report positive outcomes being associated with showcasing an authentic online self, like increased positive affect, life satisfaction and a decrease in negative affect. The last mechanism, perceiving social support, is differing from the previously described seeking social support, as the perception of social support is something that is experienced while being online, whereas seeking describes the motive of going online to receive the social support. Perceiving social support was associated with positive outcomes, namely decreased depression (Frison & Eggermont, 2015a, 2015b; Frost & Rickwood, 2017; Gilmour et al., 2020) and increased well-being (Best et al., 2014; Gilmour et al., 2020).

Proximal context of digital media use (category B)

The proximal context of digital media use refers to all factors closely related to the specific media-use situation but excludes the psychological mechanisms occurring within the individual. These factors can be media-specific, such as attitudes toward digital media or the type of content being consumed, or media-unspecific, such as individual personality traits or hobbies that influence how media is used and experienced.

Characteristics of the situation. In examining the characteristics of the situation, we highlight three key factors that have been the focus of previous research: the pandemic-related context, bedtime media use, and media use on weekends.

Regarding the pandemic context, previous studies consistently report positive outcomes. Limone and Toto (2021) summarized that gaming is associated with decreased anxiety and depression during the pandemic. Additionally, Hung (2022) observed that a stable and fast Internet connection was linked to improved mental health during this period. However, the author also noted that individuals who experienced digital exclusion due to a lack of Internet access showed decreased mental health. Another frequently discussed factor is bedtime media use. Studies so far examined various behaviors associated with media usage around bedtime and consistently found negative outcomes. Specifically, these studies linked bedtime media use to increased risks of depression, anxiety, and decreased overall well-being (Dienlin & Johannes, 2020; Fischer-Grote, Kothgassner, & Felnhöfer, 2021; Girela-Serrano et al., 2022; Lissak, 2018; Thomée, 2018; Wacks & Weinstein, 2021). Regarding media use on weekends, Thomée (2018) reported that smartphone use was associated with decreased mental health. However,

Przybylski and Weinstein (2017) found that general screen time on weekends was less strongly related to negative outcomes compared to weekdays.

Characteristics of the media. Media characteristics include aspects such as content, physical activity, reinforcement schedules, personalization, and outcomes. Within their review, Kelly and Leung (2021) highlight that engaging in physically active video games, such as WiiFit or Just Dance, can lead to positive outcomes. In contrast, games with violent content have been associated with depressive symptoms, while non-violent games did not show this association (Zink et al., 2020). Furthermore, the authors found that the negative effects were less pronounced for TV consumption compared to gaming or computer use. Regarding COVID-19, studies reported negative outcomes when media content was related to pandemic news (Haddad et al., 2021; Marciano, Ostroumova, Schulz, & Camerini, 2021). Moreover, Course-Choi and Hammond (2021) mention a study indicating that exposure to attractive individuals, whether peers or celebrities, is associated with negative self-perceptions.

Available alternatives. When examining the proximal context of media use, it is crucial to evaluate the availability of alternative offline activities that can fulfil similar emotional or cognitive needs. These alternatives play a significant role in shaping media consumption behaviors, especially among adolescents and children. Research indicates that when appealing offline options, such as spending time with friends, engaging in hobbies, or fulfilling family obligations, are readily accessible, individuals are less likely to engage in excessive or problematic media use (Lahti et al., 2024; Twenge, Joiner, Martin, & Rogers, 2018). These alternatives can provide important avenues for emotional fulfilment, cognitive stimulation, and social interaction, potentially offsetting the negative effects associated with overreliance on digital media. For example, social interactions with friends and family members offer important alternatives to digital media use (Xu, 2023). Additionally, time spent with friends in physical activities or shared hobbies can replace hours spent on social media, helping adolescents build stronger social bonds and develop communication skills that are often diminished in digital-only interactions (Darginidou, Goulmaris, Mavridis, & Genti, 2017; Madrona, Samalot-Rivera, Marín, Rodenas-Jiménez, & Rodenas-Jiménez, 2014). Moreover, positive reinforcement from family and friends in real-world interactions has been linked to higher levels of well-being compared to the fleeting rewards provided by social media (Fulcher, 2019). While digital platforms can offer social connection, the depth and quality of these interactions are often less meaningful than those that occur offline. Thus, promoting the availability of social alternatives can act as a protective factor against the development of dysfunctional media use patterns. Daily responsibilities and home obligations also serve as crucial alternatives to digital media use. Activities such as household chores, caring for pets, or participating in family routines can structure adolescents'

time, reducing their engagement with digital devices. When parents enforce balanced routines that include chores, homework, and family time, children and adolescents are more likely to develop time management skills and learn to prioritize real-world activities over screen-based entertainment (Hosokawa, Tomozawa, & Katsura, 2023; Selman & Dilworth-Bart, 2024). The availability of alternatives to digital media use is a critical factor in determining whether individuals engage in functional or dysfunctional media consumption. Friends, family, hobbies, physical activities, and home obligations all serve as important non-digital options that can provide emotional, cognitive, and social rewards. Encouraging the availability and attractiveness of these alternatives can help balance media use and reducing the risk of negative outcomes. By fostering real-world connections and responsibilities, adolescents are more likely to develop healthy media consumption habits and achieve well-being in both the short and long term.

Distal context of digital media use (category C)

This chapter explores the distal factors influencing the impact of digital media on well-being, categorized into individual characteristics, social, cultural, and regulatory contexts.

Characteristics of individual. Several characteristics influence how media use affects well-being. Trait procrastination, for example, is linked to negative changes in well-being, largely due to difficulties in controlling Internet use. Individuals who tend to procrastinate often experience increased stress and diminished well-being as a result of excessive or disorganized media consumption (Dienlin & Johannes, 2020). Additionally, those who place high importance on social media are more likely to encounter adverse psychological effects, such as a depressed mood and reduced self-esteem. This suggests that the greater the role social media plays in one's life, the higher the risk for negative emotional outcomes (Vidal et al., 2020). Cognitive reappraisal—a strategy for regulating emotions—has been associated with positive outcomes. Those who effectively use cognitive reappraisal can enhance their mental health through social media, demonstrating that how one manages emotional responses can greatly influence the benefits derived from media use (Haddad et al., 2021). These factors collectively illustrate the complex interplay between individual traits, socioeconomic contexts, and the impact of media use on well-being. A highly relevant approach to understand digital well-being stems also from personality psychology. Much research shows that in particular neuroticism and lower conscientiousness are robustly associated with overusing technology (e.g., smartphones, social media, games; Alshakhsi, Babiker, Montag, & Ali, 2023; Marengo et al., 2020; Montag, Kannen, Schivinski, & Pontes, 2021).

Social context. Among others this category includes the parental social context in which digital media is used. We identified three distinct subcategories: 1) restrictive,

2) supportive, and 3) inconsistent parental mediation. Previous research has associated restrictive parental mediation—such as limiting access time or controlling content types—with both positive and negative outcomes. On one hand, it can reduce the negative effects of media use, such as aggression, anxiety, depression, or poor social behavior (Coyne et al., 2017). On the other hand, it may also lead to decreased social well-being and increased ill-being (Beyens, Keijsers, & Coyne, 2022). Supportive mediation, which involves engaging in discussions with children about media use and content, is generally associated with positive outcomes. It has been linked to higher levels of well-being (Beyens et al., 2022) and a reduction in negative media effects (Coyne et al., 2017). Conversely, inconsistent parental mediation—characterized by the irregular enforcement of media rules—tends to correlate with negative well-being outcomes (Beyens et al., 2022).

Regulatory context. Different regulations exist to protect children and adolescents from detrimental digital media use effects. In particular noteworthy is the Digital Services Act by the European Union aiming to protect minors from harm on so called very large online platforms (VLOPs), which are defined by at least 45 million monthly users in the EU. After the launch of the DSA in February 2024 by the EU the industry is already investigating in the context of age-appropriate platform design. For instance, recently the TikTok Lite Rewards” have been banned (Representation in Germany of the European Commission, 2024). Such regulation initiatives will be also important, because research is hampered by the APIcalypse, hence closed Application Programming Interfaces make it very difficult for independent academics to investigate the objective digital use on the platforms (Bruns, 2021; Montag, Hall, & Lin, 2024; Montag, Hegelich, et al., 2021). Such research ultimately is also necessary to judge on how a healthy social media platform looks like (Dhawan, Hegelich, Sindermann, & Montag, 2022). Finally regulatory efforts could also support independent academics to get the sufficient funding to answer the relevant questions around digital media use in childhood/adolescents (Montag & Becker, 2024).

Cultural context. The cultural context plays a significant role in shaping digital media use and its effects, particularly among children and adolescents. Cultural factors influence the types of media content consumed, the social norms surrounding media use, and the broader societal attitudes towards technology. For example, research shows that higher levels of cultural individualism are associated with greater loneliness, which can affect how individuals engage with digital platforms (Barreto et al., 2021). In contrast, more collectivist cultures may use digital media in ways that reinforce community and family bonds, shaping different psychological outcomes (Hofstede, 2001). By examining these cultural nuances, we can better understand the potential long-term psychological impacts of digital media. This knowledge is crucial for developing interventions that are culturally sensitive, aiming to enhance positive

outcomes—such as social connectedness and learning—while minimizing negative effects like isolation or excessive screen time. Tailoring approaches to fit the specific cultural environment can ensure that digital media serves as a tool for positive development, rather than a source of harm (Valkenburg & Janssen, 1999).

DISCUSSION

The present work emphasizes the multifaceted impact of digital media use in children and adolescents, showing that its effects are neither universally positive nor negative. Instead, the distinction between functional and dysfunctional digital media use depends on several interconnected factors, including individual differences, media usage patterns, and both proximal and distal contexts. The d-MUSE model introduced here illustrates these dynamics, contributing to a more nuanced understanding of media’s influence on mental health and well-being, that can be used to develop hypotheses on positive and negative effects of digital media use in future. This model provides a framework for developing hypotheses that explore horizontal associations (e.g., within a single category, such as the relationship between mood and short-term media effects) and vertical associations (e.g., between categories, such as the influence of cultural context on individual psychological mechanisms). Future studies could apply this framework to explore how factors like age, socioeconomic status, and psychiatric diagnoses shape digital media’s impacts.

Previous studies have primarily concentrated on the negative impact of digital media, particularly in relation to conditions such as anxiety, depression, and addictive behaviors (Brailovskaia & Margraf, 2022; Twenge & Campbell, 2018). However, our model highlights the importance of viewing media use not solely in relation to negative outcomes, but also as a valuable tool for promoting cognitive, emotional, and social development, thereby contributing to enhanced mental health and well-being (Garrison & Christakis, 2012; Reinecke & Oliver, 2016; Schønning et al., 2020). Notably, we indicated that while certain digital media activities, such as active video games have the potential to promote physical health and enhance cognitive skills like problem-solving and creativity (Hirsh-Pasek et al., 2015; Staiano & Calvert, 2011), other forms of use, especially passive consumption, are more likely to yield negative outcomes. For instance, prolonged passive screen time has been linked to increased feelings of anxiety, depression, and social isolation (Kross et al., 2013; Twenge & Campbell, 2018).

The distinction between short-term and long-term effects of media use is another critical aspect of the d-MUSE model. Short-term consequences, such as temporary mood improvement or entertainment (Toma & Hancock, 2013), often contrast with long-term outcomes like decreased attention span, poorer physical health, or heightened susceptibility to mental health issues (Costigan et al., 2013; Twenge, 2020). Future research should adopt longitudinal designs to examine how short-term gratifications influence

long-term developmental trajectories (Steinberg et al., 2009). Additionally, understanding age-specific vulnerabilities, such as adolescents' susceptibility to social media validation, could inform interventions that target critical developmental periods.

The d-MUSe model also advances the field by detailing psychological mechanisms—both affective and cognitive—that influence whether media use has positive or negative impacts. Factors like boredom, loneliness, and the desire for social support frequently drive media engagement, yet these motivations can lead to different outcomes depending on the context and individual predispositions (Király et al., 2022; Valkenburg, Meier, & Beyens, 2022). For instance, seeking social support through social media may improve well-being when interactions are positive but worsen feelings of isolation when responses are absent or negative (Best et al., 2014). Additionally, cognitive and affective biases play a pivotal role in shaping the outcomes of media use. The influence of mood-congruent memory and confirmation bias, for example, can create a feedback loop that reinforces existing emotional states, potentially exacerbating negative moods in vulnerable individuals (Verduyn et al., 2017; Yoon et al., 2019). Expanding this framework, future research could investigate how interventions like mindfulness training or self-regulation strategies mitigate the influence of such biases, particularly among vulnerable populations. For instance, Domoff et al. (2024) discuss strategies for addressing dysregulated use patterns that could inform such interventions.

The model further underscores the importance of contextual factors—both proximal and distal—in shaping the effects of media use. At the proximal level, the type of media consumed and situational characteristics, such as media multitasking or pandemic-related media consumption, can either enhance or undermine well-being (Biddiss & Irwin, 2010; Limone & Toto, 2021). Meanwhile, distal factors like socioeconomic status and cultural context significantly modulate these effects, with children from lower socioeconomic backgrounds facing greater risks of psychological distress related to media use (Barreto et al., 2021; Hamilton, Nesi, & Choukas-Bradley, 2022).

While the present work provides a comprehensive overview of digital media use, several limitations should be considered when interpreting the findings. First, the selection of studies and theoretical frameworks for this work was guided by relevance to the proposed model rather than a systematic review process. Although this targeted approach enabled the integration of diverse empirical findings and conceptual insights, it inherently limits the ability to assess the comprehensiveness of the included literature. A systematic review approach in future research could provide a more structured evaluation of the evidence and reduce the risk of selection bias. Second, the present model primarily based on correlational studies, which limits the ability to draw causal inferences. Many of the studies reviewed rely on cross-sectional designs, which do not capture the dynamic nature of media use and its evolving effects over time. Future research should incorporate more longitudinal designs to

examine how short- and long-term consequences of media use unfold. Third, the present work focuses on broad categories such as well-being and mental health, potentially overlooking more nuanced or domain-specific effects. For example, while digital media may promote cognitive development in certain contexts, the same usage patterns may simultaneously hinder physical or emotional well-being. A more fine-grained analysis of different media effects across various domains of development would provide a clearer picture of the specific trade-offs involved. Fourth, we do not differentiate between types of digital media in great detail. Although general patterns of media use are discussed, the diversity of digital platforms—ranging from social media and gaming to educational apps—suggests that their impacts may vary considerably. We aimed to derive a model that can be applied to multiple types of digital media even those that have not yet been developed. Nevertheless, future research should address which media characteristics contribute to positive and negative impacts. Finally, within the model we aggregate findings from various studies without systematically evaluating the quality of each study. While an inclusive approach allows for a broader understanding of the topic, it may introduce biases due to the variability in methodological rigor across studies. Future reviews should assess the methodological quality of included studies to provide a more robust evaluation of the evidence.

The current findings reveal a complex interplay of factors that contribute to functional and dysfunctional digital media use, suggesting several avenues for future research. First, a comprehensive understanding of media use must go beyond measuring frequency or duration to include an examination of psychological and contextual mechanisms. For example, identifying how parental media rules and socioeconomic constraints shape media use behaviors could enhance our understanding of the role of external influences (Montag et al., 2025). Furthermore, research should explore how mindfulness, self-regulation, and interoceptive awareness might mitigate the negative consequences of digital media use (Antons & Brand, 2020; Hanley, Mehling, & Garland, 2017). Finally, interventions aimed at promoting healthy media use must be tailored to individual and situational differences. Programs fostering media literacy and mindfulness, particularly among adolescents, can help them develop a balanced relationship with digital technology, enhancing its potential for positive developmental outcomes while minimizing the risks of dysfunctional use.

CONCLUSION

The present work shows that digital media use is neither good nor bad. We expect that a balance between the different outcomes (short- and long-term consequences) as well as the various mechanisms involved in functional digital media use could be the key to a functional digital media use. Systematic investigations of interactions between these factors will contribute to a better understanding of the mechanisms relevant for functional digital media use. When

aiming to promote a functional digital media use, we recommend starting to give an understanding of what functional digital media use is. Developing an awareness on how different ways of digital media use affect our physical, mental, and social well-being might not only be important for children and adolescents but also for adults.

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