MASARYK UNIVERSITY

FACULTY OF SOCIAL STUDIES

Adolescents and Information and Communication Technologies: Effects on Digital Engagement and Well-Being

Habilitation thesis

(A collection of previously published scholarly works with commentary)

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Brno 2025

Abstract

This habilitation thesis provides a comprehensive and methodologically rigorous examination of the relationship between adolescents' digital engagement and well-being. Synthesizing findings from eight empirical studies, the work addresses major shortcomings of prior research by moving beyond simple screen-time metrics to explore the conditional, context-dependent, and bidirectional nature of digital effects. The research is conceptually grounded in the Integrative Model of ICT Effects on Adolescent Well-being (iMEW). The thesis employs a multi-method approach, including cross-sectional, experimental, and, critically, both intensive and long-term longitudinal designs. The use of advanced statistical models, such as random-intercept cross-lagged panel models, enables the novel and crucial distinction between stable, trait-like individual differences (between-person effects) and dynamic, day-to-day fluctuations (within-person effects), providing a stronger basis for causal inference.

The collective evidence consistently challenges alarmist narratives about digital risks. Findings demonstrate that adolescents are not passive victims of digital harm but active agents who often show resilience. For instance, digital media can serve as a coping resource, and evening smartphone use is not uniformly detrimental to sleep. The work highlights the primacy of individual and contextual factors, revealing that effects are deeply conditioned by psychological dispositions, gender, and the specific motivations for use. Strikingly, gender emerged as a fundamental moderator, with social gaming having opposite effects on loneliness and depressive mood for boys versus girls. Together, these studies provide an integrated scholarly framework that reframes the debate on digital technology from one of inevitable harm to one of conditional effects and individual resilience.

Declaration of the Use of Artificial Intelligence

I hereby declare that I have used artificial intelligence tools, specifically the language model GPT-5 Mini developed by OpenAI, to assist in drafting, proofreading, and summarizing portions of the text in this habilitation thesis. The AI was used as a supportive tool for organizing ideas, refining language, and ensuring clarity of expression. All conceptual, analytical, and interpretive contributions remain my own, and I take full responsibility for the content, accuracy, and integrity of the work. The AI was not used to generate original research data, results, or interpretations, nor to replace my scholarly judgment.

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1 The Structure of the Thesis

The structure of this habilitation thesis is organized as follows: First, I outline the key developmental processes and changes occurring during childhood and adolescence and discuss how these shape, and are shaped by, the use of digital technologies and adolescents' engagement with them.

Second, I summarize research on the effects of information and communication technologies (ICTs) on adolescent well-being, with particular attention to the topics examined in the publications included in this thesis—namely credibility, sleep, body image, aggression and empathy, and loneliness and depression. This section also distinguishes between different ICTs (e.g., smartphones, video games, and social networks) and considers emerging formats such as novel advertising techniques and live-streaming platforms.

Third, I present the main theoretical frameworks that guide the research contained in this thesis: Integrative Model of ICT Effects on Adolescent Well-being (iMEW). This section also briefly introduces complementary theories that inform specific aspects of the research, namely the Self-Determination Theory (SDT) and the General Aggression Model (GAM).

Fourth, I introduce the eight included publications. For each, I describe my role and contribution, the research questions, and the methodology, structured around five thematic outcome areas: digital engagement, perceived credibility, quality of sleep, depression and loneliness, and aggression and empathy.

Finally, I provide a general discussion that synthesizes the findings across studies, highlights the core insights into how ICTs affect digital engagement and well-being, and considers shared limitations as well as broader conclusions. Details of each study can be found in the respective publications and their supplementary materials. The full texts of all eight publications are provided in the Appendix.

2 Introduction

2.1 Adolescence as a Period of Profound Change

Childhood, adolescence, and, partly, young adulthood are sensitive periods of social, emotional, and cognitive development (Blakemore & Mills, 2014; Crone & Dahl, 2012; Dahl et al., 2018). These years are marked by rapid growth, foundational learning, brain maturation, identity formation, and other key developmental processes, all occurring in ways that are qualitatively and quantitatively different from earlier or later stages. Children and adolescents undergo profound biological, hormonal, neural, cognitive, and behavioral changes (Dahl et al., 2018).

Such changes contribute to increased sensation-seeking and a reorientation of attention and motivation toward peers, social evaluation, status and prestige, as well as sexual or romantic interests (De Lorme et al., 2013; van den Bos, 2013). Consequently, adolescents are particularly sensitive to social, emotional, and cognitive influences in their environments. This developmental window is also fraught with risks and vulnerabilities, including accidents, suicide, violence, depression, alcohol and substance use, sexually transmitted diseases, unintended pregnancies, and the establishment of long-term health-related risk factors such as smoking, unhealthy diet, and sedentary behavior (Crone & Dahl, 2012; Dahl, 2004). Importantly, adolescence is also a period of heightened vulnerability to psychiatric conditions, during which stress exposure can have longer-lasting and qualitatively different consequences compared to other stages of life (Blakemore & Mills, 2014).

More specifically, developmental changes in adolescence related to perceived credibility, sleep, body image, aggression, and socio-emotional outcomes such as loneliness and depression are particularly relevant to the topics addressed in this habilitation thesis. During these years, critical thinking skills advance, and the ability to assess the credibility of information becomes more realistic and sophisticated with age (Buijzen et al., 2010; van Dam & van Reijmersdal, 2019; Van Reijmersdal & van Dam, 2020). Sleep patterns also undergo major shifts, with adolescents showing later bedtimes, shorter sleep duration, increased daytime sleepiness, higher prevalence of sleep problems, and pronounced discrepancies between school and non-school days, often leading to so-called “social jetlag” (Moore & Meltzer, 2008). This period is likewise crucial for body image development: rapid changes in body weight and shape, heightened peer influence, and increased self-awareness make adolescents particularly attentive to physical appearance and amplify the perceived importance of body image (Rodgers & Paxton, 2014).

Adolescence is also a key stage for the development of aggression and empathy (Decety & Holvoet, 2021; Farrell & Vaillancourt, 2023; Kahhale et al., 2024; Silke et al., 2018). Factors that foster heightened aggression and reduced empathy can increase

the likelihood of antisocial and aggressive behavior (Chen et al., 2019; Michalska et al., 2016). At the same time, as adolescents' need for relatedness extends beyond primary caregivers, peer relationships and broader social contexts gain central importance (Soenens & Vansteenkiste, 2023). Consequently, the need for peer approval, social comparisons, and avoidance of social exclusion are particularly pronounced in this period, and unmet social needs may intensify adverse emotional and psychological outcomes (Tomova et al., 2021).

Taken together, these developmental trajectories highlight adolescence as a particularly sensitive life stage in which digital media can play a profound role, both positively and negatively. This habilitation thesis, therefore, focuses on examining the intersections between adolescence, digital media, and psychosocial outcomes.

2.2 Adolescents in a Digital Age

Adolescents are not only undergoing rapid developmental changes themselves but are also growing up in a world that is transforming at an unprecedented rate due to technological advancements. Today's youth have virtually unlimited access to the internet, remain constantly connected through smartphones, and participate in a wide range of online activities, making them the most digitally connected generation in history (Odgers & Jensen, 2020a). Such broad and diverse participation is commonly labelled digital engagement, which covers a spectrum from passive consumption (e.g., scrolling through social-media feeds) to active participation (e.g., gaming, content creation, civic engagement; Beyens et al., 2020), and can further be distinguished as friendship-driven vs. interest-driven (Hakkarainen et al., 2015) or as private vs. public forms of engagement (Valkenburg et al., 2022).

Nowadays, adolescents commonly communicate through social networks, play online games with peers across the globe, follow YouTubers and streamers, use wearable devices to monitor fitness and health, and are increasingly exposed to artificial intelligence technologies such as large language models—tools expected to transform social, educational, and occupational life far beyond what previous generations experienced. In many of these digital environments, adolescents are also exposed to more or less visible advertising, which can influence their preferences, attitudes, and behaviors.

Access to digital technologies has become nearly universal. Nearly all adolescents in industrialized countries own a smartphone (Pew Research Center, 2024), and their online time increases steadily with age: from about 2 hours per weekday among 9–11-year-olds to over 4 hours among 15–16-year-old adolescents (Smahel et al., 2020). By mid-adolescence, they typically spend three to five hours per day on digital devices (Tomczyk & Selmanagic Lizde, 2023), mostly on social media and entertainment applications (Blahošová et al., 2023). Online gaming represents another central component

of adolescents' digital lives. Globally, an estimated 3.2 billion people play video games, with about 1.13 billion engaging specifically in online gaming (Clement, 2024), and adolescents are particularly attracted to multiplayer experiences (Elliott, 2024). Furthermore, platforms such as Twitch.tv, the world's largest live-streaming service, attracted an average of 2.78 million concurrent viewers and 8.46 million monthly broadcasters in 2021 (TwitchTracker, 2022).

The revolutionary pace of information technology arguably has its greatest impact on adolescents, who are especially sensitive due to the rapid biological, cognitive, and social changes characteristic of this developmental period. As the earliest adopters of new digital environments, adolescents are particularly likely to experience both the risks and benefits associated with these innovations. On the one hand, they may face intensified vulnerabilities such as exploitation, exposure to harmful content, or susceptibility to radicalization. In navigating this information-rich environment, perceptions of credibility, that is, the extent to which digital content, sources, and platforms are judged as trustworthy, play a crucial role in determining what information adolescents believe and how they behave online (Metzger, 2007). On the other hand, digital technologies provide unprecedented opportunities for education, social connection, identity exploration, creativity, and learning (Dahl et al., 2018).

Together, these developmental and technological dynamics underscore the need to examine how digital environments interact with adolescent developmental processes, and when and how interventions can best mitigate harmful effects while promoting well-being and resilience.

2.3 Digital Technology and Adolescent Well-Being

Well-being is a holistic concept that goes beyond simply not being sick; it is a state of thriving and flourishing that usually comprises three interrelated dimensions: physiological (physical health), psychological (mental and emotional state), and social (relationships and connectedness). In the context of digital technologies, well-being is usefully described both in hedonic terms (experienced pleasure, positive affect, and reduction of distress) and in eudaimonic terms (meaning, identity development, personal growth, and social connectedness). This dual and multi-dimensional perspective follows established psychological and public-health distinctions and emphasizes that digital experiences can influence short-term affective states, longer-term developmental processes, and physical functioning (Dienlin & Johannes, 2020; Ryan & Deci, 2001)

The relationship between ICT use and adolescent well-being has become the subject of intense debate among researchers, policymakers, the media, and the public. Popular discourse is often shaped by sensationalized media reports that highlight risks, amplifying fears that digital technologies are inherently harmful to young people (Odgers & Jensen, 2020b). At the same time, other narratives emphasize the potential

of digital technologies to support learning, social connection, and creativity, illustrating the polarized nature of this discussion.

One of the most visible and long-standing debates concerns video games. In particular, the effects of violent video games on aggression, empathy, and prosocial behavior have been the focus of extensive research. Yet the evidence remains mixed, and the causal role of violent gaming is still contested. For example, several meta-analyses report small effects ($r \approx .20$) linking violent video games to increased aggression (Anderson, 2004; Anderson & Bushman, 2001; Anderson et al., 2010; Burkhardt & Lenhard, 2021; Greitemeyer & Mügge, 2014; Sherry, 2001, 2007). Other studies, however, suggest much smaller or even negligible associations (Prescott et al., 2018; Mathur & VanderWeele, 2019; Ferguson, 2007a, 2007b, 2015; Ferguson et al., 2020; Ferguson & Kilburn, 2009; Furuya-Kanamori & Doi, 2016). Similar mixed patterns have been observed for violent media content more broadly (Bushman, 2016; Bushman & Anderson, 2001; Coyne et al., 2018; Greitemeyer & Mügge, 2014; Martins & Weaver, 2019; Paik & Comstock, 1994).

Beyond aggression, research also points to potential positive effects of gaming, such as improvements in cognitive abilities and information processing (Powers et al., 2013; Wang et al., 2016), or contributions to psychological well-being (Halbrook et al., 2019; Pallavicini et al., 2018). Findings regarding social well-being are again mixed: while during the COVID-19 pandemic video games may have helped reduce feelings of social isolation (Pallavicini et al., 2018), more recent meta-analytical evidence suggests that gaming can be associated with greater loneliness (Luo et al., 2022). Furthermore, meta-analyses have found that gaming interventions can alleviate depressive symptoms (Li et al., 2014; Townsend et al., 2022), particularly through specific types of games, such as exergames (Li et al., 2016) or serious games (Abd-Alrazaq et al., 2022).

Another widely discussed issue concerns smartphone use. In public debates, this is often framed in terms of bans in schools, yet empirical evidence for the effectiveness of such policies remains inconclusive (Campbell et al., 2024). Smartphones are frequently linked to sleep difficulties, a narrative supported by several meta-analyses (Bartel et al., 2015; Carter et al., 2016; Hale & Guan, 2015; Lund et al., 2021; Kumar et al., 2025). However, many of these studies are based on self-reports and cross-sectional data, raising concerns about causality and limiting the strength of these conclusions. Smartphones have also been examined in relation to stress and well-being, with findings pointing in different directions. Some studies suggest that smartphones may be stress-inducing (Vahedi & Saiphoo, 2018), while others highlight their potential stress-buffering role (Duvenage et al., 2020; Scott et al., 2023).

The rapid development of ICTs further complicates this picture, as older evidence may not apply to newer technologies. For example, research on website credibility has shown that the mere presence of advertising can reduce perceived credibility (Sbaffi & Rowley, 2017). However, since then, more subtle forms of advertising—such as embedded, native, and influencer-driven marketing—have proliferated across

social media and streaming platforms. Similarly, live-streaming services like Twitch have transformed the entertainment landscape by combining features of television, gaming, and interactive communication in ways that differ fundamentally from both traditional media and video games (Taylor, 2018). These shifts highlight the need to revisit assumptions based on earlier media environments and reassess their validity for contemporary digital platforms.

Importantly, the effects of ICT use cannot be reduced to the mere presence of devices or the total time spent online. Research increasingly shows that outcomes depend on what adolescents do online, why they engage in particular activities, and how they use digital technologies. Importantly, the effects of ICT use cannot be reduced to the simple metric of total time spent online or the mere presence of devices. Research increasingly shows that outcomes depend on the specific content and activities adolescents engage in, their motivations for engaging in particular activities, and the social and psychological context in which they use digital technologies. For instance, video games encompass a wide variety of genres and social contexts, while smartphone use may include educational purposes, mood-regulatory behaviors such as relaxation and entertainment, or interpersonal communication. Even social media engagement is far from uniform, as evidenced by research demonstrating that exposure to body-positivity content at social media may buffer negative effects (Jiménez-García et al., 2025), whereas appearance-focused content tends to worsen them (Bonfanti et al., 2025).

Despite these advances, the knowledge base remains constrained by significant methodological limitations. Much of the existing evidence relies on cross-sectional, correlational data that limit causal inference (Odgers & Jensen, 2020a). The prevalence of self-report measures, the lack of longitudinal designs, and limited attention to individual differences or contextual factors further restrict the conclusions that can be drawn. Consequently, it is often unclear whether ICTs are causal drivers of well-being outcomes, reflections of pre-existing vulnerabilities, or both.

Together, these debates underscore the need for more nuanced approaches that move beyond simple "screen time" metrics to examine how, why, and under what conditions adolescents' engagement with digital technologies influences their psychological, physiological, and social well-being.

2.4 The Goal of the Thesis

Therefore, this habilitation thesis aims to provide a nuanced understanding of adolescents' experiences in digital environments by focusing on three interconnected research pillars: susceptibility factors, ICT use, and well-being. Specifically, the thesis examines (a) how adolescents engage with digital technologies across different contexts, (b) how they evaluate the credibility of digital content and sources, and (c) how digital technologies influence their psychological, physiological, and social well-being. Each of

these themes is addressed in a dedicated set of studies, yet together they form a coherent account of adolescents' digital lives.

Importantly, this thesis not only synthesizes evidence across these pillars but also addresses major shortcomings of prior research. It does so by employing methodologies with stronger causal inference, the use of objective measures, and a focus on developmentally relevant outcomes such as sleep, body image, aggression, empathy, loneliness, and depression.

Although the three pillars are investigated separately, they are conceptually related and complementary. Taken together, the eight studies demonstrate that the ways adolescents engage with digital technologies, the credibility of the information and sources they encounter, and the effects on their well-being are deeply intertwined aspects of growing up in a digital age. By addressing these topics side by side and with more rigorous methods, the thesis provides an integrated and methodologically robust perspective that extends beyond isolated debates about screen time, misinformation, or digital harm, and instead highlights the complex interplay between adolescents and their digital environments.

3 Theoretical Background

3.1 Model of ICT Effects on Adolescent Well-being (iMEW)

All studies included in this habilitation thesis can be conceptually anchored in the Integrative Model of ICT Effects on Adolescent Well-being (iMEW; Smahel et al., 2022). The iMEW provides a comprehensive framework for understanding adolescents' development in the context of the opportunities and challenges associated with the use of ICTs. It integrates influential theories from media and communication, developmental psychology, and health behavior research into a unified model that accounts for both individual and contextual processes affecting well-being. Specifically, iMEW draws primarily on the Differential Susceptibility to Media Effects Model (DSMM; Valkenburg & Peter, 2013), the Problem Behavior Theory (PBT; Jessor, 2014), the Health Belief Model (HBM; Champion & Skinner, 2008), and the Ecological Systems Theory (EST; Bronfenbrenner, 1977). Furthermore, it incorporates key developmental tasks of adolescence, such as identity formation, peer relationships and friendships, sexuality and intimacy, and the negotiation of autonomy and dependence, reflecting the period's unique psychological and social demands (Havighurst, 1972).

Similarly to the DSMM, the iMEW is organized around several core propositions. First, media effects are not uniform but depend on a set of differential susceptibility variables that stem from individual dispositions, developmental stages, and the social environment. Second, the relationship between media use and long-term effects, such as social connectedness or well-being, is mediated by short-term response states that can be cognitive, emotional, or physiological. Third, susceptibility variables have a dual role: they directly influence media use and simultaneously moderate the effects of media use on response states. Fourth, media effects are transactional in nature, influencing susceptibility variables, media use patterns, and subsequent responses over time, creating dynamic feedback loops between adolescents and their media environments (Valkenburg & Peter, 2013).

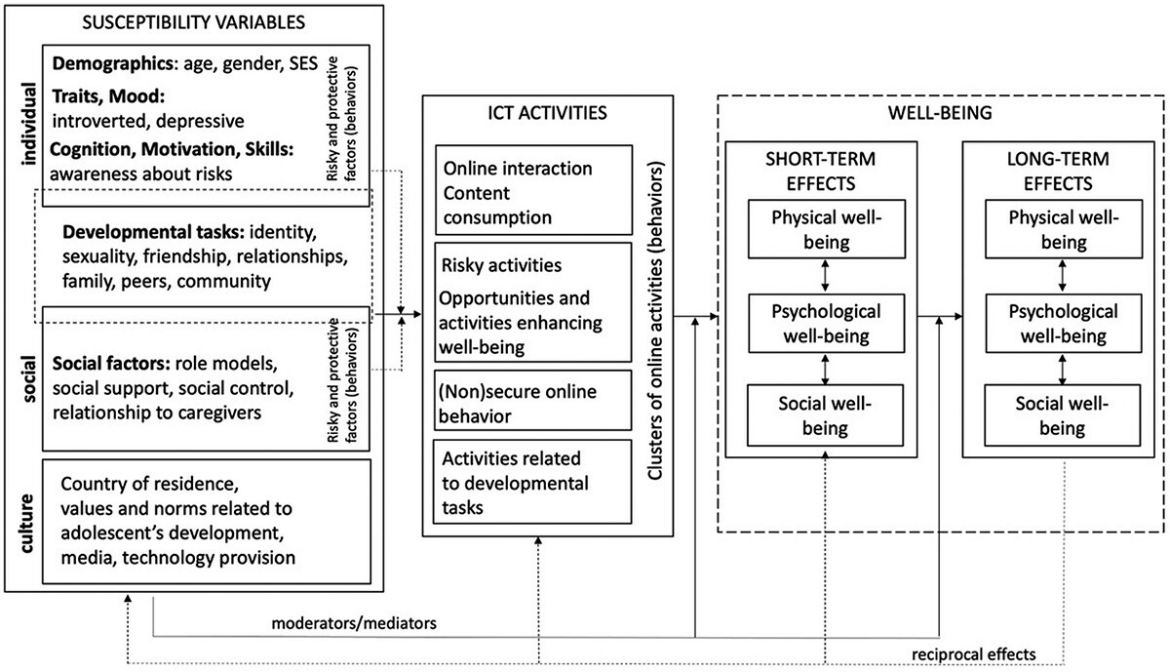
From the Problem Behavior Theory, the iMEW adopts the conceptual distinction between risk and protective factors that shape adolescents' media-related behaviors and well-being. Risk factors directly increase the likelihood of maladaptive outcomes and include model risks (such as exposure to risky behaviors in peers or parents), opportunity risks (such as the accessibility of harmful or inappropriate online content), and vulnerability risks (such as impulsivity or sensation seeking). Protective factors, by contrast, either directly promote adaptive outcomes or buffer the negative influence of risk factors. These include model protectives (for example, exposure to prosocial or health-promoting behaviors), social support from family or peers, and control protectives such as parental monitoring and the consistency of behavioral

rules. In the absence of risk, protective factors further operate as positive predictors of desirable developmental outcomes.

From the Health Belief Model, the iMEW incorporates cognitive and motivational mechanisms that guide adolescents' voluntary actions to prevent risk and promote well-being. These mechanisms include beliefs about personal susceptibility, perceived benefits and barriers to behavioral change, and self-efficacy in managing online interactions. Such cognitive processes shape how adolescents interpret and engage with ICTs, thereby influencing whether digital engagement supports or undermines their well-being.

Drawing on the Ecological Systems Theory, the iMEW also acknowledges that media effects occur within nested and interacting social systems. Adolescents' individual characteristics and behaviors are situated within family, peer, and school contexts, which are themselves embedded in broader cultural and societal environments. This perspective highlights the importance of social-level variables and emphasizes that the cultural context—such as country-specific values, norms, and media infrastructures—plays a significant role in shaping susceptibility factors and the outcomes of ICT use. Figure 1 illustrates the overall structure of the iMEW.

Figure 1. *iMEW model.*



Source: Smahel et al., 2022.

The first section of the model represents susceptibility variables conceptualized at individual, social, and cultural levels. Individual variables include demographic

characteristics, psychological traits, mood, cognition, motivation, and digital skills. The developmental tasks of adolescence, such as identity formation, intimacy, and peer relationships, are closely linked to these individual-level factors. Social variables encompass the quality of relationships with family, peers, and community, while cultural variables include country-level norms, values, and patterns of media access and use. In the iMEW, susceptibility variables may function as both moderators and mediators of ICT effects.

The central component of the model represents online activities, which are divided into several dimensions: online interaction and content consumption, engagement with risks and opportunities, (non)secure online behaviors, and activities related to developmental tasks. These dimensions are independent yet complementary, offering different perspectives on how adolescents use digital media.

The final part of the model represents short- and long-term effects on well-being. Short-term effects refer to transient emotional or cognitive states (such as feeling happy or stressed), whereas long-term effects correspond to more stable outcomes such as overall life satisfaction or mental health. Importantly, the same online activity can have different, or even opposite, impacts in the short and long term. The model also assumes reciprocal relationships whereby well-being outcomes can, in turn, influence subsequent developmental tasks and patterns of online activity.

Given its broad and integrative nature, all studies included in this habilitation thesis can be meaningfully situated within iMEW. In several cases, the studies not only fit within the existing framework but also extend it by incorporating additional susceptibility variables or by examining reciprocal effects that further elaborate the model's dynamic processes.

Study 1 directly corresponds to the central component of the iMEW, focusing on online activities and their contextualization through various susceptibility variables. Specifically, it examines individual-level factors such as demographic characteristics (age, gender, socioeconomic status) and digital skills, social-level factors such as family environment, and cultural-level influences reflected in the country of residence. Moreover, this study investigates the potential moderating role of these susceptibility variables in shaping online engagement patterns.

Studies 2 and 3 address individual cognitive susceptibility factors, particularly perceived credibility, and their influence on ICT-related activities such as content consumption and exposure to potentially risky information. **Study 2** additionally examines gender as a moderator, thereby extending the iMEW by specifying individual differences that condition media effects.

Study 4 investigates the short-term effects of ICT use—specifically, the use of smartphones and other technologies before sleep—on physical well-being (sleep quality), while accounting for individual characteristics such as age, gender, and insomnia

symptoms. In line with iMEW, this study situates media effects as conditional on both stable dispositions and momentary states.

Study 5 explores body image as an individual-level susceptibility variable and its relation to long-term psychological well-being, operationalized as depressive symptoms. It also considers gender moderation, thereby illustrating how individual characteristics and socialized gender differences jointly shape ICT-related outcomes within the iMEW framework.

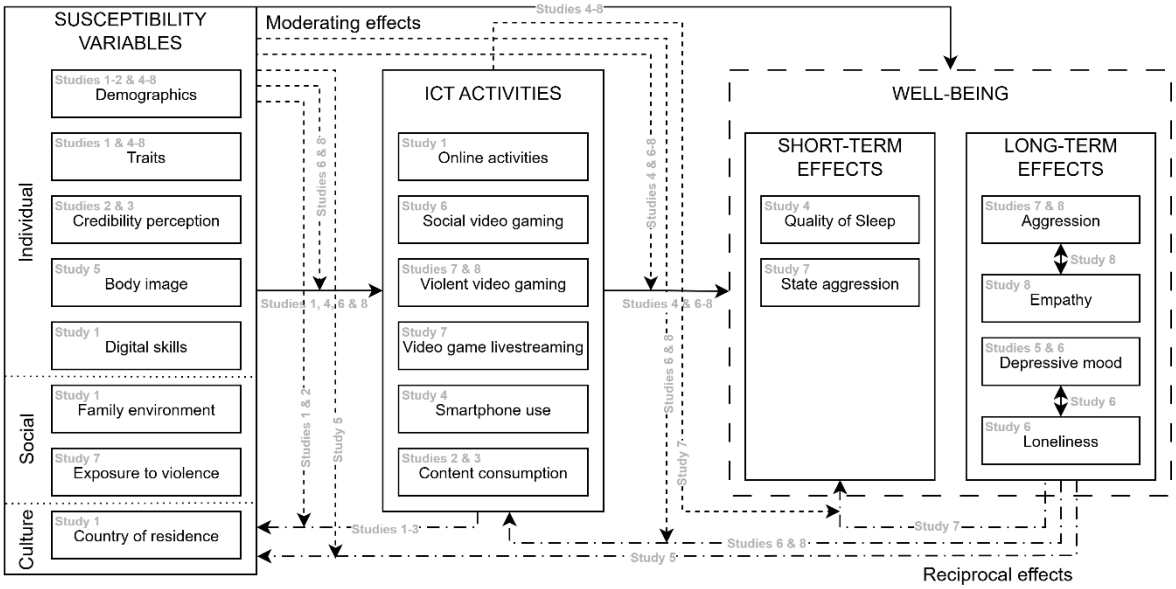
Study 6 examines social gaming as a specific type of ICT activity and its effects on both long-term psychological well-being (depression) and social well-being (loneliness). Consistent with iMEW's transactional premise, this study not only tests gender as a moderator but also explores reciprocal effects, showing how well-being outcomes can influence subsequent ICT engagement.

Study 7 focuses on video streaming as an ICT activity and its short-term psychological effects, specifically on aggression and empathy. The study integrates multiple individual and social susceptibility variables, thereby addressing the interplay between media content, personal dispositions, and social context in shaping immediate emotional and behavioral responses.

Finally, **Study 8** investigates violent video gaming as an ICT activity and its long-term psychological effects on aggression and empathy. It includes moderating influences of gender and age and examines reciprocal pathways between media use and well-being. In doing so, it provides one of the most complete empirical illustrations of the iMEW's transactional nature, linking susceptibility variables, online activities, and well-being outcomes across time.

Collectively, these studies demonstrate how the iMEW provides a coherent and integrative theoretical framework for organizing diverse empirical findings. Importantly, this habilitation thesis does not merely apply the iMEW but also extends and refines it in several substantive ways. Conceptually, it broadens the model by introducing new variables that were not part of the original framework or its empirical foundations - such as body image, credibility perception, and other psychological dispositions that function as individual susceptibility factors. Furthermore, it expands the model's explanatory precision by systematically testing moderating effects on various reciprocal relationships, identifying when and for whom digital engagement yields beneficial or detrimental outcomes. Together, these contributions enhance the iMEW's conceptual richness and empirical applicability for understanding the complex interplay between adolescents' digital engagement and their short- and long-term well-being. The contribution of all studies to the iMEW is visually summarized in Figure 2.

Figure 2. *Integration of Empirical Studies within the iMEW model.*



Note: Only the paths that were directly tested in the included studies are depicted in the figure; not all possible moderating and mediating pathways are shown.

The emphasis on moderating effects within reciprocal pathways was inspired by two influential theoretical models: the General Aggression Model (GAM) and Self-Determination Theory (SDT). These models provide a theoretical rationale for examining when and for whom digital engagement influences well-being. By integrating insights from GAM and SDT, this habilitation thesis novelly extends the iMEW. Both models are described in detail in the sections that follow.

3.2 Self-Determination Theory (SDT)

Self-Determination Theory (SDT; Ryan & Deci, 2000; 2023) is an organismic macro-theory of human motivation that explains how social and contextual factors shape human behavior, engagement, and well-being. SDT is rooted in research that distinguishes between intrinsic motivation (engaging in an activity for inherent satisfaction) and extrinsic motivation (engaging for instrumental reasons), and it proposes that the quality of motivation depends on the extent to which basic psychological needs are supported or thwarted. To account for different aspects of motivation, SDT is divided into several mini-theories: Cognitive Evaluation Theory (CET), Organismic Integration Theory (OIT), Causality Orientations Theory (COT), Basic Psychological Needs Theory (BPNT), Goal Contents Theory (GCT), and Relationship Motivation Theory (RMT).

For the purposes of this habilitation thesis, the most relevant of these is Basic Psychological Needs Theory (BPNT; Vansteenkiste et al., 2020), which posits that three needs—autonomy, competence, and relatedness—are essential for psychological

growth, intrinsic motivation, and well-being. Autonomy refers to the experience of volition and self-direction in one's actions. Competence reflects feeling effective and capable of achieving desired outcomes. Relatedness captures the sense of being connected to, cared for, and valued by others. Satisfaction of these needs fosters well-being and adaptive functioning, whereas their frustration undermines motivation and contributes to maladaptive outcomes such as anxiety, depression, and social withdrawal.

The need for relatedness is particularly important for adolescents, as it aligns with their developmental drive to expand social ties beyond family and establish meaningful peer relationships. When relatedness is satisfied, it strengthens resilience and social well-being. Conversely, when this need is frustrated, individuals are at greater risk of experiencing social isolation and loneliness, which are strongly associated with adverse psychological outcomes such as depression, diminished life satisfaction, and even poorer physical health (Baumeister & Leary, 1995; Park et al., 2020). Digital technologies, and video games in particular, provide a unique arena where these needs can be met or frustrated. Games often support autonomy by allowing volitional choices, competence through optimally challenging tasks, and relatedness through shared online play and social interaction (Ryan et al., 2006). Yet, when these needs are not met, such as when games foster exclusion or highlight social comparison, they may instead contribute to frustration and negative emotional outcomes.

Within the extended iMEW framework, SDT is incorporated as a theoretical basis for modeling individual-level susceptibility variables related to motivation and psychological needs, and it provides a rationale for examining moderating effects on the reciprocal pathways between ICT activities and well-being outcomes.

In this habilitation thesis, SDT is used most explicitly in **Study 6** as a theoretical framework to explain the effects of social gaming on loneliness and depressive mood. Although the need for relatedness was not directly measured, it serves as a central interpretive lens to understand why gaming might alleviate or exacerbate social-emotional difficulties among adolescents. Similarly, SDT might be relevant to **Study 5**, although it is not explicitly mentioned in the article, given prior evidence that autonomy need satisfaction is negatively associated with body image concerns (Thøgersen-Ntoumani & Ntoumanis, 2007). More broadly, SDT provides a unifying conceptual perspective across the thesis, offering insights into why adolescents turn to digital technologies such as video games, social media, or online communities as potential sources of need satisfaction. At the same time, it highlights how need frustration, particularly of relatedness and autonomy, may contribute to risks for psychological well-being, including loneliness, depression, and body image difficulties.

3.3 General Aggression Model (GAM)

The General Aggression Model (GAM; Anderson & Bushman, 2002; 2018; Bushman & Anderson, 2001; DeWall et al., 2011; Allen et al., 2018) is one of the most comprehensive frameworks for explaining the processes through which exposure to violent content influences aggressive behavior and empathy. The model is meta-theoretical, integrating multiple earlier perspectives, including frustration–aggression theory (Dollard et al., 1939), cognitive neoassociation theory (Berkowitz, 1989), social learning theory (Bandura, 1978), script theory (Huesmann, 1986), excitation transfer theory (Zillmann, 1971), and social interaction theory (Tedeschi & Felson, 1994). More recently, it has been generalized into the General Learning Model to explain a broader range of media-related learning beyond aggression (Barlett & Anderson, 2012).

GAM distinguishes between proximate and distal processes. Proximate processes describe short-term episodes of aggression and consist of three stages: inputs, routes, and outcomes. Inputs include personal factors (e.g., trait aggression, self-control, empathy, self-esteem, neuroticism, behavioral scripts, attitudes toward aggression) and situational factors (e.g., exposure to violence, social stress, frustration, provocation, aggressive cues, drug use). These inputs influence an individual's present internal state through three interconnected routes: affect (e.g., emotions, hostility, expressive motor responses), cognition (e.g., aggressive thoughts, scripts, normative beliefs about aggression; Huesmann & Guerra, 1997), and arousal (both physiological and psychological). These routes interact and shape behavior, or outcomes, through either immediate, automatic appraisal (leading to impulsive action) or more deliberate, conscious reappraisal (allowing thoughtful responses). Behavior, whether aggressive or non-aggressive, in turn feeds back into the social encounter, influencing personal and situational factors for future episodes.

Distal processes capture long-term effects of repeated exposure to violent media and social encounters. They focus on biological factors (e.g., ADHD, hormone imbalances, serotonin, testosterone) and persistent environmental influences (e.g., cultural norms that condone violence, chronic exposure to violent media, maladaptive families or parenting). These long-term influences can gradually shape personality, reinforcing aggressive behavioral scripts, increasing desensitization to violence, and reducing empathy. In this way, distal processes alter how individuals react in proximate processes over time.

Empirically, GAM predicts that even a brief exposure to violent content can increase state aggression, typically operationalized through both cognitive components (e.g., accessibility of aggressive thoughts and normative beliefs; Huesmann & Guerra, 1997) and affective components (e.g., heightened state hostility; Anderson & Carnagey, 2009). With repeated exposure, these state-level changes may consolidate into trait-level changes, such as more hostile worldviews, greater acceptance of aggression, or reduced empathy. Despite GAM having been criticized for underestimating personal

and environmental factors, overestimating the effects of violent media exposure, lacking practical significance criteria (Ferguson & Dyck, 2012), relying on insufficiently validated axioms and measures with inadequate psychometric properties (Ferguson & Kilburn, 2009), and being unfalsifiable by negative results (Finkel, 2014), it has remained dominant in research on violent media content.

Within the extended iMEW framework, GAM is incorporated as a theoretical basis for modeling individual-level susceptibility variables related to aggression and empathy, and it informs the testing of moderating effects on reciprocal pathways not only between ICT activities and well-being, but also between ICT activities, well-being, and susceptibility variables themselves.

In this habilitation thesis, GAM serves as the primary theoretical framework for **Study 7** and **Study 8**, which investigate the short-term and long-term effects of violent video games and violent live-streaming content on adolescents' aggression and empathy. **Study 7** examines proximate processes by analyzing whether aggressive commentary from a streamer (a situational input) increases state aggression in viewers through affective and cognitive routes. The cognitive route refers to normative beliefs about aggression (Huesmann & Guerra, 1997), and the affective route refers to state hostility (Anderson & Carnagey, 2009). **Study 8** addresses distal processes by testing bidirectional longitudinal associations between violent video gaming and aggression/empathy, thereby exploring desensitization and selection mechanisms. Together, these studies show how GAM not only guides the investigation of violent media effects but also connects these effects to broader questions of adolescent psychological and social development.

4 Overview of the Studies

4.1 List of Included Studies and Author Contribution

Study 1

Cino, D., **Lacko, D.,** Mascheroni, G., Smahel, D. (2023). Predictors of children's and young people's digital engagement in informational, communication, and entertainment activities: findings from ten European countries. *Journal of Children and Media, 17*(1), 37–54. Doi: https://doi.org/10.1080/17482798.2022.2123013.

As the second author, I was responsible for data analyses. I wrote the first draft of the manuscript (primarily the Methods and Results sections) and contributed to the manuscript revisions. I was also responsible for preparing the open data and other online materials (https://osf.io/mbkwq/).

Study 2

Lacko, D., Machackova, H., & Slavík, D. (2024). Adolescents' Perceptions of the Credibility of Informational Content on Fitness and Dietary Supplements: The Impact of Banner and Native Advertising. *Journal of Adolescence, 96*(8), 1956-1968. Doi: https://doi.org/10.1002/jad.12394

As the first and corresponding author, I led the article and was responsible for the study's conceptualization, methodological design, investigation, and data analyses. I drafted the entire manuscript and contributed to the manuscript revisions. I was also responsible for preparing the open data and other online materials (https://osf.io/khqat/), as well as for the pre-registration (https://osf.io/4pvz6).

Study 3

Slavík, D., **Lacko, D.,** & Macek, J. (2025). The Effect of The Chain of Trust on Credibility of News On Facebook. *International Journal of Communication, 19*, 1058–1080. Url: https://ijoc.org/index.php/ijoc/article/view/23331

As the second author, I was responsible for the data analyses. I wrote the Results sections and contributed to the manuscript revisions.

Study 4

Tkaczyk, M., **Lacko, D.,** Elavsky, S., Tancoš, M., & Smahel, D. (2023). Are smartphones detrimental to adolescent sleep? An electronic diary study of evening smartphone use and sleep. *Computers in Human Behavior, 149*, 107946. Doi: https://doi.org/10.1016/j.chb.2023.107946

As the second author, I was responsible for the validation, and data analyses. I wrote the first draft of the manuscript (primarily the Methods and Results sections,

and detailed Supplementary Materials) and significantly contributed to the manuscript revisions.

Study 5

Kvardová, N., **Lacko, D.,** & Machackova, H. (2023). The validity of the Czech version of Body Appreciation Scale-2 for adolescents. *Journal of Eating Disorders, 11*(1), 176. Doi: https://doi.org/10.1186/s40337-023-00897-7

As the second author, I was responsible for the supervision, and data analyses. I wrote the Results sections and contributed to the manuscript revisions.

Study 6

Lacko, D., Kyslík, F., Smahel, D., & Machackova, H. (2025). Gaming Together, Feeling Better—or Feeling Worse? How Social Video Gaming Impacts Loneliness and Depressive Mood Differently for Boys and Girls. *Computers in Human Behavior, 172,* 108752. Doi: https://doi.org/10.1016/j.chb.2025.108752

As the fist and corresponding author, I led the article and was responsible for the study's conceptualization, methodological design, investigation, and data analyses. I drafted the entire manuscript and contributed to the manuscript revisions. I was also responsible for preparing the open data and other online materials (https://osf.io/u28mv/).

Study 7

Lacko, D., Machackova, H., & Dufková, E. (2023). Does Aggressive Commentary by Streamers during Violent Video Game Affect State Aggression in Adolescents? *New Media and Society, 27*(2), 655-680. Doi: https://doi.org/10.1177/14614448231182620

As the first and corresponding author, I led the article and was responsible for the study's conceptualization, methodological design, investigation, and data analyses. I drafted the entire manuscript and contributed to the manuscript revisions. I was also responsible for preparing the open data and other online materials (https://osf.io/d29xc/), as well as for the pre-registration (https://osf.io/anhsg).

Study 8

Lacko, D., Machackova, H., & Smahel, D. (2024). Does Violence in Video Games Impact Aggression and Empathy? A Longitudinal Study of Czech Adolescents to Differentiate Within- and Between-Person Effects. *Computers in Human Behavior, 159*, 108341. Doi: https://doi.org/10.1016/j.chb.2024.108341

As the first and corresponding author, I led the article and was responsible for the study's conceptualization, methodological design, investigation, and data analyses. I drafted the entire manuscript and contributed to the manuscript revisions. I was also responsible for preparing the open data and other online materials (https://osf.io/q5wv6/).

4.2 Summary of Research Questions and Hypotheses

The research questions of the articles included in this thesis can be grouped into five thematic categories: (1) digital engagement, (2) perceived credibility, (3) quality of sleep, (4) depression and loneliness, and (5) aggression and empathy.

4.2.1 Digital Engagement

This category is represented by **Study 1** included in the thesis (Cino et al., 2023), complemented by a broader collaborative research report not formally included here (Mascheroni et al., 2020). Building on the premise that engaging in different online activities can foster distinct personal, social, cultural, and economic outcomes (Van Deursen & Helsper, 2018), the study sought to advance this line of inquiry by identifying predictors of adolescents' engagement in specific digital activities.

As already mentioned, the impact of ICT use is not universal but depends heavily on what type of activity is involved (Mannerström et al., 2018). Therefore, the article distinguished between informational, social, and entertainment online activities and asked how different dimensions of digital skills relate to these activities (RQ1). It further examined how individual characteristics, such as sensation seeking, are associated with engagement in specific activities (RQ2), and how environmental and social characteristics, such as parental mediation and family environment, relate to engagement in different activity domains (RQ3–RQ5).

4.2.2 Perceived Credibility

This thematic category is represented by **Study 2** (Lacko et al., 2024) and **Study 3** (Slavík et al., 2025). As adolescents increasingly rely on digital environments for information, their ability to evaluate the credibility of online content becomes crucial for informed decision-making and broader well-being. Misleading or manipulative content can influence health behaviors, reinforce misperceptions, and undermine trust in institutions, potentially affecting psychological and social adjustment. This is particularly important in contexts related to health, where many advertisements lack a solid grounding in research (Grunewald & Bailey, 1993), promote products intended for older populations (Herriman et al., 2017), or conceal potential side effects (Pomeranz et al., 2015). Moreover, in contemporary digital environments, credibility is shaped not only by content but also by intermediaries such as social media algorithms and human actors like influencers, which can serve as new sources of news and amplify misleading information (Karlsen & Aalberg, 2023).

Study 2 examined how modern native advertising (Wojdynski & Evans, 2016) influences adolescents' perceived credibility of online informational content about fitness and dietary supplements. Specifically, it asked whether content processed

systematically without commercial cues is perceived as more credible than content with heuristic processing and strong commercial cues (RQ1), whether banner and native ads elicit different credibility perceptions (RQ2), and whether older adolescents are more likely than younger ones to identify advertising (RQ3). **Study 3** focused on news credibility on Facebook, investigating whether perceived credibility is primarily linked to trust or distrust in the media outlet (RQ1), whether credibility is influenced by trust in the intermediary sharing the news (RQ2), and whether these two trust sources interact through amplification or substitution effects (RQ3–RQ6).

4.2.3 Quality of Sleep

This category is represented by a single study—**Study 4** (Tkaczyk et al., 2023). Sleep is a core component of adolescents' physiological well-being, influencing brain development, emotional regulation, cognitive performance, and overall health. **Study 4** is, nevertheless, part of a broader line of research using ecological momentary assessment (EMA) to examine the effects of smartphones on adolescent well-being. Specifically, I contributed to two related studies currently under review: one investigating dynamic effects of time spent on smartphones on stress (Šaradín Lebedíková, Lacko et al., 2025) and another examining how time spent in entertainment and social apps relates to positive and negative affect (Šaradín Lebedíková, Lacko et al., under review). These findings are also summarized in a research report (Smahel et al., 2025).

As previously discussed, both theoretical frameworks and empirical evidence suggest that smartphone use can negatively impact adolescents' sleep. However, prior research has faced significant methodological limitations. Therefore, **Study 4** specifically examined how smartphone use before sleep affects five key dimensions of adolescent sleep that are central to sleep health: sleep timing, duration, efficiency, quality, and daytime sleepiness (Matricciani et al., 2018). More specifically, we hypothesized that greater smartphone use before sleep would be associated with poorer sleep across both between-person (H1a–H1e) and within-person (H2a–H2e) levels. Additionally, we expected that these associations would be moderated by age (H3a–H3e), gender (H4a–H4e), insomnia symptoms (H5a–H5e), weekends versus weekdays (H6a–H6e), daily stressors (H7a–H7e), the random intercept of smartphone use (H8a–H8e), and other digital media usage (H9a–H9e).

4.2.4 Depression and Loneliness

Study 5 (Kvardová et al., 2023) and **Study 6** (Lacko et al., 2025) are primarily connected via the topic of depression. Adolescents have heightened needs for relatedness and engage in frequent social comparison (Blakemore & Mills, 2014; Crone & Dahl, 2012), both of which are strongly facilitated by modern technologies such as social networking and online video gaming. These social and emotional processes are central to adolescents' psychological well-being, as unmet relatedness needs can exacerbate

loneliness and contribute to depressive symptoms. Understanding how digital environments shape these experiences is therefore crucial for capturing their impact on adolescent social-emotional health.

Both studies can be considered exploratory, given the novelty of examining these specific mechanisms in digital contexts. **Study 5** focuses on body image, primarily validating a scale measuring body appreciation (Tylka & Wood-Barcalow, 2015). Although a psychometric study, it is highly relevant to this thesis because 1) body image is often shaped through social comparison on social media, and 2) the study examines associations between body image and constructs related to depressive symptoms. **Study 6** directly investigates the effects of social gaming, specifically its social interaction potential (Maitland et al., 2018), on depressive symptoms and loneliness. The exploratory nature of these studies allows them to present novel insights into how digital engagement interacts with adolescents' social-emotional well-being, including potential gender differences in these associations.

4.2.5 Aggression and Empathy

The final two studies, **Study 7** (Lacko et al., 2023) and **Study 8** (Lacko et al., 2024), build on the traditional research linking violent media content to aggression and empathy, grounded in the GAM, which proposes that exposure to violence can increase aggression and decrease empathy in adolescents (Anderson & Bushman, 2018). Video games provide highly interactive experiences of potentially violent content, and live-streaming introduces additional exposures, including games adolescents might not normally play, toxic chat, cyberbullying, or aggressive streamer behavior. These dynamics are relevant for adolescent well-being because increased aggression and reduced empathy can compromise social functioning and interpersonal relationships, key aspects of social-emotional health.

Many prior studies have relied on cross-sectional designs, limiting causal inference, and research on live-streaming has been particularly scarce. The present studies address these gaps using experimental and longitudinal designs. **Study 7** examines short-term effects, investigating whether aggressive commentary by streamers in violent games increases state aggression in viewers. **Study 8** focuses on rather longer-term, bidirectional, within-person associations between violent video gaming and aggression/empathy.

Specifically, **Study 7** hypothesized that the streamer's commentary in a violent game affects state aggression (H1), that personal factors (trait aggression and trait empathy) are associated with state aggression (H3), and that environmental factors (long-term exposure to online and offline violence, playing violent video games) are positively associated with state aggression (H4). Furthermore, it was expected that associations between personal and environmental factors and state aggression would be moderated by the streamer's commentary (H2). In **Study 8**, it was hypothesized that

aggression is positively associated with violent video gaming (VVG; H1–H2) and empathy is negatively associated with VVG (H3–H4). At the within-person level, selection effects were assumed for aggression (H5–H6) and empathy (H7–H8), meaning that increases in aggression and decreases in empathy would predict greater engagement in VVG. Regarding desensitization effects, VVG was expected to be negatively associated with aggression (H9–H10) and positively associated with empathy (H11–H12). In addition, both studies explored, in a more exploratory manner, the potential moderating influence of age and gender on these associations.

4.3 Summary of Methods

This thesis is based on a series of published studies employing quantitative methodologies. These include cross-sectional designs (**Studies 1 and 5**; in the case of **Study 1** also cross-cultural), longitudinal designs (**Studies 7 and 8**), intensive longitudinal designs (**Study 4**), and experimental designs (**Studies 2, 3, and 6**). Across the studies, self-report measures were complemented by expert rating of content and objective trace data, and causal modeling approaches were used to gain a more nuanced understanding of underlying mechanisms and causal relationships.

Appropriate statistical modeling techniques were employed based on the study design. These ranged from traditional techniques such as ANOVAs, MANOVAs, and latent mean comparisons in experimental studies, to (multi-group) confirmatory factor analysis (MG-CFA), (multi-group) structural equation modeling (MG-SEM), measurement invariance testing, common method bias assessments, and latent interactions in cross-sectional studies. In addition, longitudinal analyses included the use of (multi-group) random-intercept cross-lagged panel models (MG-RI-CLPM), while intensive longitudinal data were analyzed using generalized linear mixed models (GLMM).

With the exception of two studies, all included studies provide open materials, including datasets and R syntax files, to facilitate future replications. Two experimental studies were preregistered prior to data collection. All studies are publicly accessible either through open-access journal publications or as preprints and postprints.

Study 1 was a re-analysis of existing cross-cultural survey data from the EU Kids Online IV project, designed to explore how digital skills and individual and social characteristics predict children's and young people's engagement in informational, social, and entertainment online activities across Europe. The study utilized a substantial sample of 9,731 participants aged 11-17 from 10 European countries (Belgium, Czech Republic, Finland, Malta, Poland, Portugal, Republic of Serbia, Romania, Spain, and Switzerland). The original data were collected between October 2017 and April 2019 through schools using proportional stratified random-cluster sampling, with questionnaires administered by trained administrators. Online activities were measured using 10 dichotomized items grouped into three thematic clusters: informational, social, and

entertainment activities. Predictors included emotional problems, sensation seeking, enabling and restrictive parental mediation, family environment, and perceived social and informational digital skills. Socioeconomic status (SES) and time spent online were also included as control variables. Data analysis primarily employed MG-SEM to specify explanatory variables as latent constructs and online activities as manifest variables. A latent interaction term for enabling parental mediation by family environment was created, and common-method variance was specified to control for response bias.

Study 2 was a survey-based preregistered experiment designed to examine the impact of advertising formats on adolescents' perceived credibility of informational content regarding fitness and dietary supplements. A sample of 681 Czech adolescents (aged 13-18, 52% girls) was recruited in November 2020 through an online panel using nonprobabilistic quota sampling to ensure demographic balance. Participants were randomly assigned to one of three between-subjects experimental conditions: exposure to informational text without an ad, with a clearly delineated banner ad, or with a seamlessly integrated native ad. Stimuli were gender-tailored and displayed on a fictional website simulating a focus on fitness and healthy lifestyle, featuring a fictitious active substance to control for pre-existing product perceptions. Perceived credibility was assessed using two subscales from the Trust in Online Health Information (TOHI) scale (Credibility and Reliability of the Content), complemented by control variables such as eHealth Literacy, Trust in Health Information Websites, eHealth Sources Online Seeking, and Health Online Shopping. Data analysis involved MANCOVA followed by ANCOVAs and planned contrasts with Holm-Bonferroni correction, and Fisher's exact test for advertisement identification.

Study 3 employed experimental a 2×3 between-subjects quasi-experimental survey design to examine how institutional trust in news media and interpersonal trust in news intermediaries, and their interplay, contribute to news credibility on Facebook. The sample comprised 702 young adult (18+) students from Masaryk University in Czechia who were active Facebook users, recruited through various university channels. A unique aspect of the design involved participants individually identifying their own trusted and distrusted news media outlets, as well as high-trusted and low-trusted Facebook friends, based on self-reported trust scores prior to the experiment. Participants were then randomly assigned to one of six experimental groups, viewing a customized simulation of a Facebook Timeline with a news article either directly posted by their identified media outlet or shared by their identified Facebook friend. The news article itself was a non-polarizing health-related topic, customized to appear from the participant's chosen media outlet. Manipulation variables included Trust and Distrust in News Media and Trust in News Intermediaries, while the dependent variable was News Article Credibility. Control variables such as propensity to trust, news relevance, and intermediaries' opinion leadership and competence were also included. Data analysis involved CFAs for scale structures, MG-CFAs for measurement invariance, and a two-way ANCOVA for main effects and interactions. Equivalence tests

(TOST) were used for specific hypotheses to verify practical (non-)significance of results.

Study 4 was an electronic daily diary study designed to examine both between-person and within-person associations between smartphone use and multiple sleep outcomes in adolescents. The study involved 201 Czech adolescents (aged 13-17, 41% girls) recruited via non-probabilistic convenience sampling, with specific inclusion criteria for Android smartphone users. Data were collected over a 14-day measurement burst in May and June 2021, using a custom-made mobile application installed on participants' smartphones. This app objectively collected smartphone usage logs (screen-on/off status) and administered short surveys four times daily to capture self-reported sleep outcomes (sleep onset time, sleep onset latency, sleep duration, subjective sleep quality, and daily sleepiness). Key independent variables included objective smartphone use (total screen-on time within two hours before bedtime) and self-reported other digital media use. Covariates such as age, gender, insomnia symptoms, daily stressors, and school/non-school days were also assessed. Data analysis involved meticulous cleaning and transformation, followed by multiple imputation for missing values, and GLMM to analyze the nested data structure. Various statistical models (zero-inflated Poisson, Gamma, Gaussian) with appropriate link functions were employed based on outcome variable distributions, with random intercepts and slopes specified.

Study 5 was a psychometric validation study designed to examine the factor structure, gender and age invariance, and associations with other theoretically relevant constructs of the Czech version of the Body Appreciation Scale-2 (BAS-2) for adolescents. Two large, independently collected samples of Czech adolescents were utilized: Sample 1 comprised 613 participants (52% girls, aged 13-18) collected in August 2021, and Sample 2 consisted of 1,530 participants (50% girls, aged 13-18) collected in November 2020. Both samples were recruited through online surveys using Computer-Assisted Web Interviewing (CAWI) with quota sampling to ensure representativeness of Czech households. The core instrument, BAS-2, was meticulously translated and adapted through a collaborative iterative process involving multiple experts and cognitive interviews. Other measures included body satisfaction, media-ideal internalization, appearance schematicity, self-esteem, and depression. Data analysis primarily involved CFA for factor structure, MG-CFA for measurement invariance across gender and age groups, and MG-SEM for latent correlations and gender differences in association strengths.

Study 6 was a longitudinal study designed to examine the complex interplay between social video gaming, loneliness, and depressive mood among adolescents, differentiating between within-person and between-person associations. A representative sample of 3,010 Czech adolescents (aged 13-17 at Time 1, expanding to 11-18 across waves) was recruited through an online panel using non-probability quota sampling based on gender, age, household income, and NUTS-3 region, with incentives to

encourage participation and retention. Depressive mood was assessed using a four-item scale, and loneliness was measured with four negatively worded items from Roberts' version of the UCLA Loneliness Scale. Social video gaming exposure was assessed through open-ended responses where participants named up to three frequently played games, which were then coded for their social interaction potential using a modified Social Interaction Potential Assessment (SIPA) tool (SIPA 2.0) by four independent raters. The highest SIPA score across a participant's reported games per wave served as the proxy indicator for social video gaming. Moderating variables included gender (boys vs. girls) and age (dichotomized into early vs. mid-adolescence). Data analysis primarily involved a RI-CLPM to distinguish stable between-person differences from within-person fluctuations, incorporating time-invariant predictors and multiple indicators for outcomes. Moderation effects were tested using a multigroup extension of the RI-CLPM.

Study 7 employed an experimental design to examine the short-term effects of streamer commentary during violent video game gameplay on state aggression in adolescents. A sample of 604 Czech adolescents (aged 13-18, 54% girls) was recruited in August 2021 through an online panel using non-probability quota sampling to ensure demographic balance. Participants were block-randomized into three experimental conditions: exposure to a 2-minute recording of *Superhot: Mind Control Delete* gameplay with aggressive commentary, non-aggressive commentary, or no commentary. The streamer's monologues were carefully timed and differentiated only by violent or non-violent content, while mimicking the Twitch.tv platform for realism. Predictors included trait aggression (BPAQ-SF), trait empathy (AMES), exposure to violence (adapted EVS), and long-term exposure to violent gaming and streams. Outcomes, representing state aggression, were assessed as an affective component (State Hostility Questionnaire - SHQ) and a cognitive component (Normative Beliefs about Aggression Scale - NOBAGS). Data analysis was preregistered and conducted using MG-SEM and latent mean comparisons followed by equivalence testing.

Study 8 employed a four-wave longitudinal study design over 1.5 years, with six-month intervals, to differentiate within-person and between-person effects of violent video game (VVG) exposure on aggression and empathy in adolescents. It used data from same collection as **Study 6**. Aggression was assessed using the Buss-Perry Aggression Questionnaire-Short Form (BPAQ-SF), focusing on physical and verbal aggression, while empathy was measured with the Adolescent Measure of Empathy and Sympathy (AMES), distinguishing cognitive and affective empathy. A key methodological strength was the objective measurement of VVG exposure, where participants reported up to three frequently played games, which were then rated for violence using Common Sense Media and a rigorous inter-rater reliability protocol for unrated games. Data analysis primarily involved a RI-CLPM to disentangle stable individual differences from dynamic intra-individual changes, incorporating gender and age as time-invariant predictors of random intercepts.

5 General Discussion

5.1 Summary of Findings

Study 1 examined how children's and adolescents' perceived digital skills, demographic factors, and psychosocial characteristics relate to engagement in informational, social, and entertainment online activities. Perceived informational skills consistently predicted broader online participation across all activity types, while perceived social skills were only negatively associated with informational activities. Age and gender influenced usage patterns, with older children engaging more broadly, girls favoring social activities, and boys favoring entertainment. Emotional problems were linked to all activity types, particularly informational activities, suggesting online coping or health-information seeking. Sensation-seeking positively predicted engagement, and parental mediation shaped participation: enabling mediation supported informational and social use, whereas restrictive mediation hindered social and entertainment engagement. Socioeconomic status also differentiated activity patterns, with higher SES promoting informational and social uses and lower SES favoring entertainment. Social well-being, measured via family environment, did not moderate these relationships.

Study 2 examined how banner and native advertisements influence adolescents' perceptions of the credibility of online health and fitness content. Results showed that both types of ads reduced perceived content credibility compared to ad-free content, with no significant difference between banner and native ads. Gender differences emerged: boys rated native ads as slightly more credible and reported higher purchase intentions than girls, potentially reflecting heuristic processing tendencies and differences in parental mediation. Adolescents across age groups were generally able to detect advertisements, suggesting that even younger participants possess sufficient recognition skills. Overall, the study highlights that native advertising does not necessarily mitigate credibility concerns among adolescents and that gendered patterns in advertising evaluation may relate to differential experience, socialization, and mediation.

Study 3 examined how trust in news media outlets and individual social network site intermediaries affects adolescents' perceptions of news credibility on Facebook. Results showed that institutional trust in media outlets had a small positive effect on perceived credibility, whereas trust in individual intermediaries, such as friends, did not influence credibility judgments. Neither amplification nor substitution effects of interpersonal trust were observed. Findings suggest that Facebook users may rely more on content characteristics than source trustworthiness when evaluating news, possibly due to default skepticism toward the platform or the fragmentary "news snacking" behavior common on social network sites. These results highlight the limited

role of interpersonal trust in shaping credibility perceptions for everyday users, contrasting with prior findings on high-profile or opinion-leader intermediaries.

Study 4 examined both between-person and within-person associations between smartphone use before sleep and multiple sleep outcomes—duration, timing, quality, and efficiency. At the between-person level, no significant associations were found, indicating that adolescents who generally use smartphones more do not necessarily have worse sleep outcomes. At the within-person level, on nights when adolescents used smartphones more than usual, they went to sleep earlier and slept longer, with no significant effects on other sleep parameters. Moderators such as age, gender, insomnia symptoms, typical smartphone use, day of the week, and daily stressors did not significantly influence the within-person associations. Overall, these findings suggest that, contrary to common assumptions, evening smartphone use is not uniformly detrimental to sleep and may, in some cases, support better sleep patterns, potentially through mood regulation or displacement of more disruptive media use.

Study 5 validated the Czech version of the Body Appreciation Scale-2 (BAS-2) for adolescents and examined its associations with related body image and well-being constructs. Psychometrically, the scale showed sufficient consistency, factor structure, and measurement invariance. Regarding results relevant for this habilitation thesis, body appreciation was moderately negatively correlated with internalization of thin- (girls) and muscular- (boys) ideals, depression, and appearance schematicity, and strongly positively correlated with self-esteem and body satisfaction. Exploratory analyses revealed that the protective associations of body appreciation with body satisfaction, media-ideal internalization, and depression were stronger for girls, suggesting that body appreciation may play a particularly important role for adolescent girls' well-being.

Study 6 investigated how social gaming effects on loneliness and depressive mood. The results showed a complex pattern of effects across between- and within-person levels. Adolescents who generally played games with higher social interaction potential reported higher levels of loneliness, suggesting that those with chronically unmet relatedness needs may be drawn to social gaming without fully satisfying these needs. In contrast, when adolescents played more social games than usual, they experienced a reduction in loneliness, indicating that social gaming can temporarily fulfill the need for relatedness. No within-person effects were found for depressive mood, suggesting that social gaming influences situational connection rather than broader mental health. More importantly, gender moderated these associations: for boys, increased social gaming reduced loneliness and depressive symptoms, whereas for girls, it either failed to alleviate or even worsened these outcomes, possibly due to unmet expectations for deeper emotional connections, exposure to gendered toxicity in online environments, or ineffective coping strategies. Age differences also emerged, with early adolescents benefiting more from social gaming for alleviating depressive mood, while mid-adolescents' depressive mood predicted engagement in games with

lower social interaction potential, likely reflecting developmental shifts in coping strategies and the increasing importance of reciprocal, emotionally intimate social interactions. Overall, the findings suggest that social gaming can transiently satisfy relatedness needs and reduce loneliness, but its psychological benefits depend on gender, age, and the social context of gameplay.

Study 7 examined the effects of violent video game streaming on adolescents' state aggression, considering the roles of situational exposure to aggressive commentary, personal traits, and long-term environmental exposure. The results indicated that short-term exposure to streamers and their aggressive commentary did not increase state hostility or normative beliefs about aggression, nor did it moderate the effects of personal or environmental factors, suggesting that mere exposure to aggressive streaming does not amplify aggressive thoughts. In fact, the effects were so negligible they could be considered also practically insignificant. Personal traits were stronger predictors of state aggression than environmental factors, with trait sympathy serving as a protective factor, while trait affective empathy unexpectedly related to higher state hostility, potentially due to heightened emotional responses to characters or streamers in threatening situations. Trait aggression predicted higher state hostility, and boys reported higher retaliation normative beliefs than girls, whereas age was not related to state aggression. Among environmental factors, only long-term exposure to violence, rather than frequent violent streaming or violent video game play, was associated with higher normative beliefs about retaliation, aligning with prior research that underscores the limited role of violent media exposure in eliciting short-term aggressive responses and emphasizing the importance of individual differences in predicting state aggression.

Study 8 examined the effects of violent video game (VVG) play on adolescents' aggression and empathy, differentiating between within-person and between-person effects. The findings provide no causal evidence in favor of the desensitization hypothesis, as VVG exposure did not increase physical or verbal aggression nor decrease cognitive or affective empathy. Within-person analyses showed minimal and inconsistent effects, with changes in physical aggression sometimes predicting subsequent VVG engagement in both positive and negative directions, while verbal aggression and empathy largely showed no influence. Between-person analyses revealed that boys played more VVG than girls, and adolescents with higher overall aggression were more likely to engage with VVG, yet this association does not imply causality and highlights the importance of distinguishing between-person preferences from within-person causal effects. Interestingly, affective empathy showed a small counterintuitive positive correlation with general VVG engagement, suggesting that empathetic adolescents may be drawn to immersive narratives and character-driven violent games rather than rejecting violent content. Overall, these results indicate that VVG engagement does not meaningfully drive increases in aggression or decreases in empathy, and prior findings may overestimate effects due to reliance on between-person comparisons,

emphasizing the need for nuanced, longitudinal approaches to understand the complex dynamics of violent media consumption.

5.2 Synthesis of Findings

The eight studies included in this habilitation thesis, while distinct in their methodologies and specific research questions, are united by a common intellectual thread: a commitment to moving beyond simplistic, deficit-based models of digital effects on adolescents. This chapter synthesizes the collective findings of these studies to build a coherent scholarly narrative. It integrates evidence from diverse domains—from digital engagement and credibility to sleep, body image, and aggression—to demonstrate that the digital experience is not a monolithic force but a complex, multi-layered process. The synthesis is structured around four central themes that cut across the publications, revealing a cohesive framework for understanding adolescent life in a digital age: the need to rethink prevailing risk narratives, the primacy of individual and environmental differences, the fundamental role of gender, and the critical methodological distinction between within- and between-person effects. The Table 1 below serves as a roadmap, illustrating how each individual study contributes to the broader arguments advanced in this synthesis.

Table 1. *Table of Cross-Study Thematic Connections.*

Study ID	Study topic	Rethinking Digital Risks	Variability of Effects	Gendered Effects	Within- vs. Between-Person
Study 1	Predictors of digital engagement	✓	✓	✓	
Study 2	Ads & credibility	✓		✓	
Study 3	News credibility on Facebook	✓			
Study 4	Smartphone use & sleep	✓			✓
Study 5	Body Appreciation Scale		✓	✓	
Study 6	Social video gaming & well-being	✓	✓	✓	✓
Study 7	Streamer commentary & aggression	✓	✓	✓	
Study 8	Violent video games & aggression/empathy	✓	✓	✓	✓

5.2.1 Rethinking Digital Risks

The body of work presented here consistently challenges the prevailing public and academic discourse that frames digital technologies as an inherent and universal threat to adolescent well-being (for critical discussion, see Lebedíková et al., 2024; Smahel et

al., 2025). This narrative, often amplified by sensationalized media reports and simplified metrics of "screen time," is systematically dismantled by the findings across multiple studies. The evidence suggests that adolescents are not passive victims susceptible to inevitable harm, but rather active, and often resilient, agents whose experiences with digital media are complex, conditional, and, in many cases, adaptive.

A compelling example of this nuanced perspective comes from the potential coping mechanisms. **Study 1** found that adolescents with emotional problems were more likely to engage in a broad range of online activities, particularly informational ones. This finding challenges the assumption that pre-existing emotional distress is merely a vulnerability that is exacerbated by digital use. Instead, it posits that online environments may serve as a resource for coping or for seeking out health-related information, a potentially adaptive function (e.g., Jiménez-Pernett et al., 2010). Emotional problems were significantly related to all kinds of activities, but the strongest relationship was with informational activities, possibly because participants were looking for health information online related to their conditions and wellbeing.

Similarly, the studies on credibility and media literacy suggest that adolescents are more sophisticated than often assumed. Contrary to concerns about manipulation by subtle advertising, **Study 2** revealed that adolescents were highly successful at identifying both traditional banner ads and more seamlessly integrated native ads. This challenges the assumption in the Processing of Commercialized Media Content (PCMC) model that younger adolescents lack the skills to identify ads (Buijzen et al., 2010). The presence of either type of ad diminished the perceived credibility of the content, indicating a robust "commerciality-penalizing heuristic" at play. While adolescents possess the skills to recognize ads, disclosure alone may not be enough to elicit a critical view of the product, as adolescents may also have a default skepticism towards the platform itself, which protects against the undue influence of interpersonal trust on news evaluation. This finding is reinforced by **Study 3**, which found that on platforms like Facebook, adolescents relied more on content characteristics than on the trustworthiness of friends who shared the news (unlike, e.g., Sterrett et al., 2019; Tandoc, 2019). However, the study also warns that this reliance on content characteristics can be a significant cognitive burden and potentially lead to news avoidance. Evidence across these two studies shows that adolescents are not naïve consumers of digital content; instead, they employ evaluative heuristics that shield them from undue influence.

The most striking challenges to the digital risk narrative emerge from the studies on sleep and aggression. While much prior research has linked evening smartphone use to poor sleep, **Study 4** presented a counterintuitive finding at the within-person level: on nights when adolescents used their phones more than usual, they went to bed earlier and slept longer. This finding runs counter to many prior (mostly cross-sectional) studies (for review, see Hale & Guan, 2015; Lund et al., 2021), suggesting that the link between smartphone use and adolescent sleep is more complex and not as detrimental as previously claimed. Meanwhile, the two studies on aggression directly

did not support one of the longest-standing fears about digital media. Using both experimental (**Study 7**) and long-term longitudinal (**Study 8**) designs, the work found no causal evidence that exposure to violent video game content, aggressive streamer commentary, or long-term violent gameplay increases aggression or decreases empathy in adolescents (contrary to GAM expectations; 2018; Bushman & Anderson, 2001; but in line with recent longitudinal evidence, for review see Drummond et al., 2020).

Taken together, these findings suggest the need to rethink prevailing digital risk narratives. Rather than being passive victims of harmful technologies, adolescents appear as active agents who evaluate, adapt, and sometimes even benefit from digital engagement. The evidence across studies indicates that alarmist claims about advertising manipulation, news credibility erosion, sleep loss, or gaming-induced aggression are overstated when not carefully contextualized. A more accurate picture is that risks are conditional, modest in size, and often offset by adaptive uses. This reframing calls for theories that better capture resilience, contextual variability, and the possibility of positive outcomes alongside risks.

5.2.2 Variability of Effects: Individual, Age, and Environmental Factors

The evidence across the studies highlights the substantial role of individual differences and environmental factors in shaping how adolescents engage with and are affected by digital technologies. Rather than acting as a single, deterministic force, digital media functions as a complex environment where individual dispositions, motivations, and coping strategies are expressed and sometimes amplified. The studies collectively highlight that an adolescent's inherent traits and context often dictate how they engage with technology, a process described as a "selection effect." This perspective aligns with recent calls in the literature to examine the heterogeneity of digital media effects, recognizing that adolescents do not experience media uniformly (Beyens et al., 2020; Valkenburg et al., 2024).

This dynamic is clearly demonstrated in the study of online engagement. **Study 1** found that individual psychological traits were significant predictors of how adolescents use the internet. For instance, sensation-seeking was positively associated with all types of online activities, while emotional problems were linked most strongly to informational uses. This suggests a pre-existing "fit" between the adolescent's disposition and their choice of digital activity. An adolescent with emotional problems may turn to the internet to seek information or support, framing media use not as a cause of their distress but as a coping resource. This perspective inverts the traditional causal arrow, emphasizing that the individual's psychological state often precedes and directs their digital behavior. Study also highlighted the role of parental mediation and socioeconomic status (SES), showing that enabling parental strategies foster informational and social online activities, while restrictive mediation limits adolescents' engagement to more narrowly defined uses (in line with Livingstone et al., 2017).

The influence of personal dispositions also proved central in **Study 7**, where trait-level empathy and aggression were far stronger predictors of state aggression than the content of the streamer's commentary they were exposed to. In particular, trait sympathy emerged as a protective factor, showing a strong negative association with both state hostility and normative beliefs about aggression (in line with Vossen & Fikkers, 2021). In contrast, trait affective empathy unexpectedly predicted higher state aggression, a finding that challenges the conventional assumption of empathy as a uniformly protective mechanism. This pattern may reflect the target of empathic engagement: sympathy was likely directed toward the in-game victims, reducing aggressive responses, whereas affective empathy was directed toward the main character or streamer, heightening identification with survival-oriented aggression. This evidence powerfully argues that who a person is, their stable dispositional traits, might be more influential than brief, situational exposure to digital content.

This theme culminates in **Study 8,** which provides a methodological distinction between selection effects and desensitization effects. At the between-person level, the study found that adolescents with higher overall aggression were more likely to play violent video games. This finding, often misinterpreted or overstated in cross-sectional research as evidence that violent games cause aggression, is re-evaluated in the longitudinal context. The study's within-person analysis found no evidence for a desensitization effect (i.e., that playing VVG increases aggression over time) but did find mixed and inconsistent selection effects (i.e., that changes in aggression can predict changes in VVG engagement). This compelling evidence demonstrates that the correlation between aggression and VVG is likely driven by stable, pre-existing personality differences (selection) rather than by a causal effect of the game itself. This selection effect, where aggression leads to greater VVG engagement, might be pertinent primarily to younger adolescents, while being non-existent for older adolescents (Breuer et al., 2015).

The role of age in shaping adolescents' digital experiences and outcomes emerged as a nuanced but important theme across the studies. **Study 1** demonstrated that older adolescents use the internet in a more diversified manner, engaging in information-seeking, communication, and entertainment activities more extensively than younger peers, which supports the developmental perspective that digital engagement broadens with age (Livingstone et al., 2019). However, not all digital competencies followed this age trajectory. **Study 2** found no evidence that younger adolescents were less capable of recognizing native advertising, challenging assumptions that adolescents' ability to recognize persuasive content is not fully developed until later adolescence (cf. van Dam & van Reijmersdal, 2019; Van Reijmersdal & van Dam, 2020). Similarly, **Study 7** observed no association between age and state aggression, suggesting that situational responses to aggressive stimuli may be more influenced by contextual or individual difference factors than by age. More fine-grained age effects were identified in social gaming in **Study 6**, which revealed that depressive mood predicted

different gaming behaviors across developmental stages: early adolescents tended to cope with increase depressive mood by engaging in games with higher social interaction potential, while mid-adolescents shifted toward less socially interactive games. This may reflect a developmental shift in how adolescents meet their relatedness needs, with older adolescents seeking more emotionally intimate social interactions than social gaming provides (Burke et al., 2024).

Study 4 adds a critical nuance to these findings by challenging assumptions about differential susceptibility (in contrary to some prior findings, e.g., Kalmbach et al., 2018; Lange et al., 2017; Tashjian et al., 2019). Within-person associations between nightly smartphone use and sleep outcomes were not significantly moderated by age, gender, insomnia symptoms, or baseline levels of smartphone use. Adolescents with insomnia consistently reported poorer sleep, yet they were not more vulnerable to nightly increases in smartphone use. Similarly, heavy smartphone users did not exhibit greater susceptibility than moderate or light users. These results suggest that the impact of smartphone use on sleep is modest and largely independent of stable individual characteristics, highlighting that situational and contextual factors may play a larger role than trait-level vulnerabilities in shaping some short-term digital effects.

Finally, the role of environmental exposure was further emphasized in **Study 7**, where long-term experiences with violence—not short-term exposure to aggressive commentary—were linked to higher retaliation beliefs. Importantly, frequent exposure to violent online or offline content was associated with greater state aggression (e.g., Chaux & Castellanos, 2015), while long-term engagement with violent video games or aggressive streaming content showed no such relationship. The implication is that environmental violence operates as a developmental context in which digital media use is embedded, shaping adolescent outcomes in more profound ways than discrete media exposures. **Study 8** underscored this context-dependency in another way by highlighting that inconsistent findings in the relationship between aggression and VVG play might be influenced by unmeasured situational variables, such as the COVID-19 pandemic during data collection. This global crisis led to significant changes in behavior, notably among isolated children and adolescents, who reported increased gaming hours, especially in multiplayer games, as a coping mechanism for psychological distress and to mitigate social isolation (Han et al., 2022; Pallavicini et al., 2022).

Taken together, these findings underscore that adolescents' responses to digital technology are neither uniform nor purely determined by the media itself, but are deeply shaped by their dispositional traits and stable individual characteristics. Emotional problems, sensation-seeking, empathy, and aggression emerge as meaningful predictors of how digital contexts are used and experienced, yet their effects are not always intuitive or unidirectional. The evidence further distinguishes between-person associations, which often reflect pre-existing predispositions, and within-person fluctuations, which capture more immediate and contextually bound processes. This distinction emphasizes the importance of disentangling trait-like vulnerabilities from

dynamic, situational effects—a task that multilevel modeling can address in greater depth. Moreover, these findings highlight that digital experiences are embedded within broader environmental contexts: parenting styles, socioeconomic conditions, exposure to real-world violence, and societal disruptions all shape how adolescents engage with and interpret digital content. Far from neutral backdrops, these contextual factors actively moderate opportunities for digital learning, risks of harm, and pathways of resilience. Collectively, this body of evidence points to the necessity of ecological and multilevel perspectives in future research, integrating technological, social, and cultural contexts to more fully understand adolescent development in the digital age.

5.2.3 Gendered Effects

The studies within this thesis consistently reveal that gender is not a simple demographic variable but a fundamental, organizing force that shapes how adolescents engage with, perceive, and are affected by digital environments. The gendered differences are not marginal; they are pervasive and often lead to dramatically divergent outcomes, highlighting the need for a gender-specific lens in media effects research.

Early differences in digital engagement are evident in **Study 1**, which found that girls were more inclined towards social online activities, whereas boys favored entertainment activities like gaming. This early divergence in media preferences risks reinforcing long-term digital inequalities, as different activity types foster distinct skill sets and social opportunities (Sey & Hafkin, 2019). The gendered patterns extend to media literacy and persuasion, as demonstrated in **Study 2**. This study found that boys rated native advertising as more reliable and reported higher purchase intentions than girls. This difference may not be an inherent trait but rather a second-order effect of parenting: if boys experience more restrictive parental mediation, they may have fewer opportunities to develop the critical media literacy skills needed to identify and resist persuasive appeals (Clark, 2011; Lee, 2013).

The role of gender becomes even more critical in the context of body image and mental health. **Study 5,** a psychometric validation study, found exploratory evidence that the protective associations of body appreciation with body satisfaction, media-ideal internalization, and depression were stronger for girls than for boys. This highlights a gender-specific vulnerability to body image concerns (a topic often influenced by social media) and identifies a crucial psychological resource that may be particularly important for girls' well-being.

The most profound evidence of gender as a fundamental moderator comes from **Study 6**, which examined the effects of social gaming on loneliness and depressive mood. The within-person effects were completely reversed for boys and girls: while an increase in social gaming reduced loneliness and depressive symptoms for boys, it increased both outcomes for girls. This striking finding cannot be explained by a single-level theory. Instead, it points to deep-seated differences in gendered friendship

norms—with boys' friendships often centered on shared activities and girls' on emotional intimacy and one-on-one communication (Perry & Pauletti, 2011; Rose & Rudolph, 2006). For girls, the activity-focused, sometimes toxic, nature of online gaming may fail to meet their expectations for emotional connection, turning a potential coping mechanism into a source of frustration and distress. For boys, social gaming may act as a protective factor, while for girls, it may serve as an ineffective coping mechanism, reinforcing depressive tendencies. Moreover, toxic communication and hostile gaming environments disproportionately affect female players (Fox & Tang, 2017; Tang et al., 2020), undermining their sense of relatedness and exacerbating emotional distress.

Finally, gender differences were also evident in aggression and violent gaming patterns. **Study 7** showed that boys expressed higher retaliation normative beliefs than girls, consistent with prior research (e.g., Huesmann & Guerra, 1997). **Study 8** confirmed that boys engaged more in violent video game use than girls, in line with previous literature (e.g., Kasumovic et al., 2015).

Taken together, these findings demonstrate that gender is not just a background characteristic but a decisive contextual factor shaping digital engagement, interpretations, and psychosocial outcomes. They underscore that interventions in digital literacy, parental mediation, and well-being support must explicitly address gendered experiences. Ignoring these differences risks reinforcing existing inequalities and overlooking vulnerabilities unique to boys and girls in the digital sphere.

5.2.4 Within- versus Between-Person Effects

A significant methodological contribution of this thesis is its systematic use of designs and statistical analyses that differentiate between within-person and between-person effects—a distinction that is helpful for robust causal inference (Hamaker et al., 2015), even though it alone may not be sufficient to establish causality. Between-person analyses capture stable, trait-like differences between individuals (e.g., whether a person who is generally more aggressive also tends to play more violent games). In contrast, within-person analyses examine dynamic, day-to-day fluctuations within a single individual (e.g., whether playing a violent game more than usual on a given day leads to a subsequent increase in aggression). The findings across multiple studies demonstrate that these two levels of analysis can yield dramatically different (sometimes referred to as “Simpson’s paradox”; see Kievit et al., 2013), and sometimes paradoxical, results, challenging the validity of much of the previous literature that relied on simpler designs.

The distinction is most clearly demonstrated in the **Study 6.** At the between-person level, adolescents who generally played more social games also reported higher levels of loneliness, reflecting a stable association between these variables across individuals. In other words, some adolescents are simply more inclined to play social

games than others. In contrast, the within-person analysis revealed potential mood-regulatory effects: when an adolescent played more social games than usual during a given six-month window, their feelings of loneliness decreased. By separating within-person and between-person effects, this methodological approach provides a more precise and nuanced understanding of the relationship, moving beyond simplistic interpretations of correlation as causation.

Finally, this methodological precision is central to the thesis's refutation of the aggression narrative. In **Study 8,** the work concludes there is no causal desensitization effect (VVG leading to increased aggression or decreased empathy) because the within-person analysis of dynamic changes over four waves found all such effects to be statistically insignificant. The observed correlation between a preference for violent gaming and higher aggression is therefore attributed to a stable, between-person selection effect—a pre-existing disposition—rather than a causal influence of the game itself.

In summary, these findings demonstrate the critical importance of distinguishing within- from between-person processes when studying adolescents' digital behaviors in media effects, and especially for video games effects (Ballou, 2023). While between-person associations capture stable predispositions, within-person analyses reveal how digital media use relates to temporal changes in psychosocial functioning. The divergent findings across **Studies 4, 6, and 8** suggest that previous literature, often relying on single-level or cross-sectional approaches, may have overlooked key temporal and contextual dynamics. Future research should therefore prioritize designs capable of disentangling these levels of analysis—such as intensive longitudinal or ecological momentary assessment methods—to more accurately capture the causal and contextualized effects of digital media use on adolescent well-being.

5.3 Limitations and Future Directions

Across the studies included in this habilitation thesis, several methodological and conceptual limitations should be acknowledged. A central issue concerns the reliance on self-report instruments and proxy indicators, which may not always adequately capture the behaviors of interest. For example, in social gaming, the SIPA measure assigns a social potential score to games rather than directly measuring actual in-game interactions, meaning solitary play in multiplayer-capable games could be misclassified as "social." Similarly, digital skills questionnaires may overestimate competencies compared to actual performance. Furthermore, a common challenge concerns issues of measurement validity and reliability. Several studies relied on shortened, adapted, or self-report instruments (e.g., digital skills, body image, sleep, or gaming measures), which may limit the precision of the findings. Future research should therefore strive for validated, full-length, and multi-method assessments, including objective behavioral measures such as trace logs, in-game interaction data, actigraphy, or physiological

indicators, to enhance construct validity and provide a clearer understanding of how digital engagement unfolds in everyday life.

Another recurring challenge lies in ecological validity. While controlled experimental manipulations (e.g., streamer commentary, credibility cues) provide valuable causal insights under standardized conditions, they often fail to approximate the complexity of adolescents' digital environments, which are multi-layered, personalized, and socially embedded. Moreover, although several studies relied on general adolescent or student populations, they often did not focus on specific high-exposure subgroups such as heavy gamers, active social media users, or content creators, who may experience digital effects more strongly or differently. Future work should therefore adopt comparative approaches that capture both diversity and the populations most relevant to the studied phenomena.

Statistical and design-related limitations should also be acknowledged. In particular, a priori power analyses were not always conducted, especially for more complex longitudinal studies, and sample sizes might not have been sufficient to support the complexity of advanced longitudinal models, raising concerns about statistical power and the robustness of parameter estimates. In addition, the studies highlight the importance of temporal dynamics and causal inference. Although designs such as RI-CLPM strengthened causal inference, several studies relied on cross-sectional data or long measurement intervals, limiting the ability to capture short-term dynamics and reciprocal influences. Future research should combine adequately powered longitudinal designs with intensive methods such as ecological momentary assessment, daily diaries, or experimental interventions to more precisely trace how digital engagement and credibility perceptions relate to well-being over time.

Finally, while the studies addressed outcomes such as sleep, body image, aggression, empathy, loneliness, and depression, there was sometimes a lack of measured explanatory mechanisms that could clarify how and why digital environments influence these outcomes. For instance, studies on advertising effects did not always measure persuasive processes, and work on gaming sometimes lacked indicators of motivational or relational mechanisms. Future research should therefore prioritize the inclusion of mediating variables grounded in psychological theory, such as need satisfaction, social comparison, or identity processes, to move beyond documenting effects and toward understanding underlying pathways.

Taken together, these limitations highlight clear avenues for further work. Building on the strengths of this thesis, future studies should aim to integrate objective behavioral measures, ecologically valid designs, sufficiently powered longitudinal approaches, theoretically grounded mechanisms, and targeted high-risk or high-engagement subgroups. Such efforts would allow for stronger causal inferences, richer explanatory insights, and greater applicability of findings to both scientific debates and applied interventions.

6 Conclusions

The research presented in this habilitation thesis offers a new conceptual and methodological roadmap for understanding the complex relationship between adolescents and their digital environments. The eight studies collectively articulate a unified argument: the impact of digital media is not a matter of whether it is "good" or "bad," but rather a function of intricate interactions between the individual, the technology, and the context. The thesis decisively moves the field beyond simplistic, a-theoretical models that have often fueled public panic and misinformed policy debates.

At the conceptual core of this work lies the integrative Model of Engagement and Well-being (iMEW), which provides a comprehensive theoretical framework for understanding how digital activities and well-being are jointly shaped by personal and contextual susceptibility factors. This habilitation does not merely apply the iMEW but systematically extends and refines it in several ways. First, it broadens the model by incorporating new susceptibility variables—such as body image, credibility perception, and other individual dispositions—that were not part of its original formulation or empirical foundations. Second, it strengthens the model's transactional and reciprocal dimension, demonstrating through longitudinal and experimental designs that digital engagement and well-being mutually influence one another over time. Third, it advances the iMEW's explanatory precision by systematically testing moderating effects on reciprocal relationships, identifying when, how, and for whom digital engagement yields beneficial or detrimental outcomes.

The habilitation further extends the iMEW by integrating theoretical insights from the General Aggression Model (GAM) and Self-Determination Theory (SDT). This integration enriches the iMEW's capacity to account for motivational and affective mechanisms underlying digital behavior and its consequences. Specifically, GAM provides a framework for understanding affective and cognitive routes of aggression and empathy in response to media exposure, while SDT elucidates the motivational processes through which digital engagement can either support or frustrate basic psychological needs. Together, these extensions situate the iMEW as a broader, multi-level meta-framework capable of explaining diverse ICT-related phenomena across both individual and contextual domains.

A central contribution of this work is its success in opening the "black box" of media use, showing that the specific behaviors, motivations, and susceptibilities behind engagement are far more consequential than time spent online. The findings consistently demonstrate that digital technologies function as amplifiers of existing predispositions rather than as primary causal drivers. For instance, adolescents with pre-existing emotional vulnerabilities may use digital media as a coping mechanism, whereas those high in trait aggression may be drawn to violent content, reflecting selective exposure and reciprocal influence processes modeled within the extended iMEW. This nuanced

framework enables a shift from viewing adolescents as passive recipients of digital influence to understanding them as active participants whose media use both shapes and is shaped by their psychological characteristics and developmental contexts.

Methodologically, the thesis introduces innovative analytical distinctions that further refine the iMEW's explanatory power. In particular, the systematic separation of within-person and between-person effects provides a more accurate representation of dynamic, intra-individual changes and reciprocal pathways over time. The divergent findings across these analytical levels—illustrated in studies on sleep, body image, and social gaming—challenge the validity of causal inferences derived from cross-sectional or between-person designs. This methodological innovation establishes a higher standard for empirical research on digital engagement and well-being, emphasizing the importance of longitudinal, multilevel, and process-oriented designs.

Ultimately, this body of work advances both theory and method in the study of adolescents' digital lives. Conceptually, it extends the iMEW into a dynamic, multi-theoretical model integrating motivational, affective, and cognitive mechanisms. Empirically, it demonstrates that media effects are contingent, bidirectional, and context-dependent. Methodologically, it sets new standards for causal inference and model testing. Collectively, these contributions provide a more comprehensive and empirically grounded understanding of how adolescents' digital experiences shape—and are shaped by—their well-being, resilience, and developmental trajectories.

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