NAVARRO, JESSICA L. Ph.D. Laying the Foundation for Protective Digital Parenting: The Development of a Theoretical Framework, a Validated Measure of Digital Parenting Attitudes, and a Person-Centered Analysis of Digital Parenting Styles. (2022)
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Over the past thirty years, the advent and proliferation of digital and social technologies has expanded the contexts in which children and families play, learn, communicate, and grow. Although burgeoning, developmental and family science research exploring the intersection of technology, development, and the family system has lagged behind the pace of technological adoption and innovation. The current studies were developed and conducted to aid researchers in considering how digital and social technologies may influence diverse areas of inquiry. Study 1 delineates an adaptation of Bronfenbrenner's bioecological theory for the digital age, entitled neo-ecological theory. The microsystem is expanded to include virtual and physical microsystems, which impacts the conceptualization of proximal processes, person characteristics, contextual influences, and time. In addition, neo-ecological theory re-emphasizes the importance of macrosystemic influences on proximal processes in the digital age. Study 2 explicates the development and validation of the Digital Parental Mediation Scale (DPMS), a quantitative measure of parents' attitudes about digital-specific parenting practices. Utilizing the DPMS, Study 3 used latent profile analysis (LPA) to identify four profiles of digital parental mediation styles. The results of Studies 2 and 3 showed that parents' attitudes about the four dimensions of digital mediation, as well as parents' digital mediation styles, were differentially related to parent and household characteristics (including parent gender and race/ethnicity, socioeconomic status, child age, and parents' technology-related confidence), suggesting great heterogeneity in how parents approach parenting in the digital age. Directions for future research and limitations to generalizability across temporal, cultural, and developmental contexts are discussed.

LAYING THE FOUNDATION FOR PROTECTIVE DIGITAL PARENTING: THE DEVELOPMENT OF A THEORETICAL FRAMEWORK, A MEASURE OF DIGITAL PARENTING ATTITUDES, AND A PERSON-CENTERED ANALYSIS OF DIGITAL PARENTING STYLES

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Dr. Jonathan Tudge
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DEDICATION

In loving memory, this dissertation is dedicated to my mother, Laraine Kingsborough, and my grandmother, Iva Jeanne Kingsborough, both of whom continue to inspire me daily with their curiosity, perseverance, and grace. This dissertation is also dedicated to all the remarkable women in my family, including my own daughter, Annabel Jeanne Navarro; may we continue to make our foremothers proud.

APPROVAL PAGE

This dissertation written by Jessica L. Navarro has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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CHAPTER I: INTRODUCTORY CHAPTER

The intersection of digital technology and the family is an emerging field of inquiry in family studies. In 2012, an entire issue of Family Relations was devoted to media and family, but most of this issue focused on research about television and little space was devoted to digital and social technologies. However, in the last 10 years, more scholars have recognized the centrality of technology within the modern family system, as it has changed how families interact, communicate, work, learn, process information, and spend their leisure time (Sharaievska, 2017). However, technology remains on the periphery of the field and is most often approached from a pathological or deficit-based lens (Ferguson, 2020; Hertlein, 2018).

Digital technology is a broad term, encompassing both the hardware and software used for a wide array of purposes—communication, work, education, play, leisure, shopping, and countless others. There are also a plethora of words and phrases used in day-to-day life to describe digital technology (e.g., social, virtual, cyber, online, internet, media); disentangling the function and applicability of these terms is difficult given the dynamic and quickly evolving nature of technology. This lexical variety can intimidate scholars, acting as a barrier to the consideration and inclusion of issues related to digital technology in research. Further, defining and operationalizing how children, adolescents, and parents use digital technology (and its role within the family system) is similarly difficult. For both good and bad, scholars have approached technology from myriad perspectives (e.g., online behavior, online identity experiments, attitudes/motivations, content analysis, frequency/duration) (Barry et al., 2017; Ehrenreich & Underwood, 2016; Frison & Eggermont, 2020; Hunt et al., 2018; Primack et al., 2017; Teppers et al., 2014; Toth-Kiraly et al., 2021; Valkenburg & Peter, 2008; Wang et al., 2018). From a strengths-based perspective, these varied approaches highlight the multidimensionality of digital

technology, the myriad mechanisms at work, and how different facets of technology can be protective and/or deleterious depending on person characteristics and context. However, this breadth can also make it difficult for scholars to identify simple and evidence-based strategies for incorporating the impact of digital technology into their research.

Digital Technology and the Family

Digital technology has transformed the way Americans communicate and socialize. In the past 15 years, mobile phone ownership has grown considerably (from 62% in 2002, to 97% in 2018) and smartphone ownership has more than doubled in the past 10 years (from 35% in 2011 to 85% in 2021) (Perrin, 2021). These numbers are even higher among youth: 100% of young American adults own a cell phone, 96% of those owning smartphones (Perrin, 2021). Despite this ubiquity, access to digital devices and high-speed internet connectivity varies significantly by socioeconomic status and geography (Perrin, 2021) and this heterogeneity among families differentially impacts the well-being of children and youth. In a study of Mexican-heritage parents and their children, Katz (2017) found that while most children had access to digital technology, slow internet service, shared time on devices, data limits, and service disconnections impaired the extent to which they could use technology for information, school, and leisure. Some children had access to the internet only through mobile devices (i.e., mobile-only connectivity) which further limited the affordances (e.g., word processing) available to them (Katz, 2017). The digital divide has only widened during the COVID-19 pandemic; sufficient access to digital technology and the internet was unattainable for many low-income and rural families, furthering educational inequalities (Lai & Widmar, 2021).

Digital technology is neither a panacea nor a plague; it presents both risks and benefits for families. The risks associated with technology for children, youth, and families include

mental health problems, decreases in the quantity and quality of family time, and increased conflict between parents and children. In the absence of longitudinal studies, the long-term impact on children is largely unknown. A plethora of mostly cross-sectional research in the last twenty years has explored the interrelation between technology and internalizing symptomatology but, overall, findings have been mixed and difficult to synthesize. Some scholars hypothesize that the use of digital devices may impair or delay the development of self-soothing and coping mechanisms, as parents and children may use technology as a distraction from boring, uncomfortable, or anxiety-inducing situations (Nathanson, 2018). However, systematic reviews of this literature (e.g., Odgers & Jensen, 2020) suggest that concerns about the deleterious effects of technology on the mental health of youth may have been overblown.

The small screens of digital devices encourage solo use which can reduce time families spend actively engaging with one another (Nathanson, 2018; Williams & Merten, 2011). For example, middle-school students reported that while Facebook usage strengthened friendships, extensive use reduced face-to-face contact with parents (Liu et al., 2013). Online gaming can have similar effects; although it can provide an escape from reality and is a source of leisure, extensive online gaming can be isolating for some youth (Sharaievska, 2017). Further, for some families, extensive adolescent use of digital and social media was related to lower familial intimacy (Carvalho et al., 2015). However, these associations varied by child age and activity, underscoring the complexity and heterogeneity of this influence within developmental processes.

Digital technology can also be a source of conflict between parents and children. Communication over digital media has different affordances (e.g., lack of non-verbal signals) than face-to-face communication, which can lead to more misunderstandings in some family contexts (Carvalho et al., 2015). Parents and adolescents can also disagree over the perceived

risks of digital and social media. Adolescents report more conflict when their perceptions of online risks did not match those of their parents and when they felt their parents used overly intrusive parenting practices (Borca et al., 2015; Racz et al., 2017). Many adolescents felt that their cell phone was an "electronic tether;" simply another way for their parents to check on them and ask them to run errands for them (Racz et al., 2017). Moreover, it appears that the more restrictive the parental strategies, the more conflict and duplicitous behavior occur (Dwokin, 2018; Hessel & Dwokin, 2017).

Although there are risks associated with digital technology for families, there are also considerable advantages, including benefits for emotional health, social well-being, family cohesion, and participatory learning. Youth report myriad socioemotional benefits of using digital and social media: 81% of youth said that their online activities strengthen their real-world friendships, 68% reported finding it easier to reach out to others during hard times, and 69% reported socializing with a more diverse group of friends (Anderson & Jiang, 2018). Qualitative interviews with youth also suggested that Facebook and other online social interactions help to strengthen existing social relationships (Liu et al., 2013). For adolescents who may feel isolated in their community (e.g., transgender teens), online interactions can help support identity and social development (Primack et al., 2018; Sharaievska, 2017). Further, digital and social media provide an avenue for children and adolescents to research and develop their own opinions and interests (Clark, 2011). Children and adolescents are often more fluent with and knowledgeable of technology than are their parents. This presents a unique opportunity for participatory learning, where parents can learn from their children and encourage their children to be coaches and leaders (Clark, 2011). This dynamic offers opportunities for positive interactions, thus strengthening parent–child bonds (Dworkin, 2018; Nathanson, 2018).

A multitude of studies have found positive associations between family satisfaction and frequency of parent–child communication using technology (Carvalho et al., 2015; Hessel & Dworkin, 2017; Stein et al., 2016; Williams & Merten, 2011). Technology may support family connectedness through several different mechanisms: co-use, ease of instant communication, added flexibility to parental employment (Williams & Merten, 2011). Interacting over social media and playing online games are opportunities for parents and children to interact more frequently and build connections, both online and in person (Carvalho et al., 2015). Social media interactions between parents and their adolescent children are associated with both reduced conflict and higher levels of connection in real life (Coyne et al., 2014; Sharaievska, 2017). Digital and social media also offer practical advantages for families. Activities and schedules can be managed in real time, reducing confusion and miscommunication (Fletcher et al., 2018). For co-parenting families, it offers a two-fold advantage: ease of parent–child contact and communication between co-parents (Carvalho et al., 2015). Digital technology also adds flexibility to parental employment; some parents can use technology to work from home, creating more opportunities for family time and connection (Carvalho et al., 2015; Williams & Merten, 2011). For low-income parents working multiple jobs, technology can help them stay in frequent contact with their adolescent children (Racz et al., 2017). For families separated by distance (e.g., transnational and immigrant families, families in different states, family members in long-term care settings), technology offers opportunities for instant connection, including face-to-face interactions over video chatting applications. These forms of communication are also less expensive than traditional landline phone calls, especially to other countries (Carvalho et al., 2015; Nathanson, 2018; Sharaievska, 2017; Williams & Merten, 2011). Hard-of-hearing

individuals and their families also benefit; video-chatting, text messaging, social media, and email offer instantaneous and easy communication, far superior to the telephone.

The literature examining digital technology and children, youth, and families demonstrates that technology and the internet, for both good and bad, are omnipresent for modern families—they are inextricably woven into the fabric of everyday life. For family and developmental scientists, this means that all areas of inquiry are influenced by (and influence) the quotidian activities and interactions occurring in these virtual contexts.

Aim and Current Studies

My goal for this dissertation is to develop tools to encourage researchers to consider how technology influences their own areas of inquiry. More specifically, in this dissertation, I present: (a) a theoretical framework to help scholars conceptualize how digital interactions and activities influence the family ecology, (b) a newly developed measure of parental attitudes towards the mediation of digital and social media, and (c) an integration of these two tools in a person-centered analysis of digital parenting styles. In addition, I hope that this dissertation will encourage scholars to engage in temporal self-reflexivity. We are often encouraged to think critically about how our identity, experiences, and positionality impact our research, but it can be more challenging to incorporate the hidden aspect of historical time. To avoid making implicit generalizations equating the experiences of today's children, youth, and families with those of the last year, decade, or century, we must reflect on the influences of the current epoch——the digital age.

Study 1: Neo-Ecological Theory

The first study in this dissertation presents an adaptation of Bronfenbrenner's bioecological theory (Bronfenbrenner & Morris, 2006) for the digital age; this novel adaptation is entitled neo-ecological theory, with the prefix "neo-" reflecting that this theory is a modified form of an older framework. As Bronfenbrenner's theory was conceptualized and delineated prior to the advent of the digital and social media, bioecological theory fails to account for the activities and interactions taking place in digital spaces, which have unique affordances, given that temporal and spatial restrictions are lifted in digital contexts. In this theoretical paper, I delineated two forms of the microsystem: the physical and virtual. Physical microsystems are face-to-face settings (e.g., home or school), while virtual microsystems are digital platforms (e.g., social media, Zoom, online games, text messaging). This adaptation has cascading impacts across the rest of the theory and the Process-Person-Context-Time (PPCT) research model, which was Bronfenbrenner's approved research design for bioecological theory. Neo-ecological theory is intended to provide family and developmental scientists with a theoretical framework inclusive of virtual and digital contexts, therefore facilitating easier consideration (and inclusion) of digital and social media as synergistic influences within the family system over time.

Study 2: The Digital Parental Mediation Scale (DPMS)

The second study of this dissertation delineates the development and validation of a quantitative measure of parental mediation of digital mediation. Contemporary parents are using parenting practices specific to digital and social media, but little is known about the efficacy of these strategies. I developed the Digital Parental Mediation Scale (DPMS) in response to a lacuna of validated measures of parents' attitudes about digital parenting skills and strategies. The DPMS has a bifactor structure, with four sub-scales of digital-specific parenting attitudes:

discursive mediation, restrictive mediation and monitoring, participatory mediation, and mediation by modelling. The DPMS is a tool to assist developmental and family scientists to incorporate digital parental mediation into studies of parents and families, even if technology is not the focus of their research.

Study 3: Styles of Digital Parental Mediation

The third paper of this dissertation presents a research study using neo-ecological theory, parental mediation, and parenting styles as theoretical frames and the Digital Parental Mediation Scale (DPMS) as a measure of parental attitudes about digital mediation. For contemporary parents, virtual contexts influence parenting in a multitude of ways, including: (a) as a context in which their child is developing through everyday interactions and activities, and (b) as a context in which they themselves are interacting with (and parenting) their child (e.g., text messaging, social media). As a context in which children develop, parents must consider the unique affordances of virtual spaces in their parenting practices and many use technology itself as a mechanism for communication and connection. Are there patterns in how parents approach digital parenting?

Studies of parenting styles and patterns are ubiquitous throughout the child development and family studies literature, but few studies have investigated digital-specific parenting styles. Person-centered statistical approaches allow researchers to identify heterogenous subgroups by disaggregating multivariate distributions into different underlying (or latent) distributions. Using latent profile analysis (LPA), this study explores whether there are heterogenous sub-groups of parents who have similar patterns of attitudes about digital-specific parenting (i.e., digital parenting styles). In addition, a multiple-group LPA is estimated to examine whether these profiles are similar for mothers and fathers. Multinomial regression models are used to explore

whether parent characteristics, household composition, and parent technology use and attitudes are differentially related to membership in these profiles.

CHAPTER II: STUDY 1. TECHNOLOGIZING BRONFENBRENNER: NEO-ECOLOGICAL THEORY

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Abstract

We propose an adaptation of Urie Bronfenbrenner's bioecological theory, *neo-ecological theory*. As bioecological theory was developed in the 20th century, it requires significant modifications to reflect some of the most ubiquitous contexts in which adolescents learn, play, and grow—the technological and virtual ones. While several scholars have developed laudable theories related to youth development in virtual contexts, the field lacks an overarching theory to address the intersection of development and technology. In developing neo-ecological theory, we hold true to the tenets of bioecological theory, but suggest key modifications to reflect our technologized world. We delineate a key alteration to the microsystem, namely the existence of two types of microsystems—physical and virtual. In addition, we emphasize the importance of macrosystemic influences (i.e., the influences of culture and within-society subcultural variation) in understanding development in the digital age. The implications of these modifications cascade across the Process-Person-Context-Time (PPCT) model; proximal processes, person characteristics, context, and time are all reexamined. In the digital age, virtual microsystems are central contexts in which youth engage in proximal processes. As such, we believe that all scholars of development, regardless of their specific research interests, should consider the ways

digital contexts influence their outcomes of interest. Without it, practitioners, policy makers, parents, and technologists will be in the dark about how best to support adolescents.

Keywords: Bronfenbrenner's bioecological theory, neo-ecological theory, adolescent development, technology.

Introduction

Urie Bronfenbrenner developed his ecological theory of human development in response to what he described as "…the science of children in strange situations" (1977, p. 513). We argue this critique is applicable today, as developmental and family sciences frequently overlook some of the ubiquitous contexts in which youth learn, play, and grow—the technological and virtual ones. Bronfenbrenner's theory, being fully developed by the turn of the century (Rosa & Tudge, 2013), did not consider the impact of developing in the digital age. Building upon bioecological theory, this paper proposes an innovative conceptual lens for understanding development in the digital age: *neo-ecological theory*. This adaptation is particularly applicable to researchers focused on the influences of technology in the lives of adolescents, but we contend that all scholars studying children, youth, and families should consider the extent to which digital contexts impact their outcomes of interest. Further, although the focus of this paper is primarily on youth, the influence of technology on human development arguably spans the life course.

Although the digital revolution may have begun with the advent of the personal computer, the introduction of smartphones (e.g., the iPhone in 2007) demarcated a new technological period particularly relevant to social scientists. In a prophetic 1991 paper, Weiser introduced the idea of ubiquitous technology, and stated that "the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" (p. 94). Since 2007, this prophecy has been realized; digital technology is inextricably woven "into the fabric of everyday life." As digital technology has miniaturized, the boundaries between the virtual and physical realms are no longer clear (Uzelac, 2008). In addition to our phones, computers, and tablets, silicone chips exist in our cars, refrigerators, thermostats, light bulbs, vacuums, alarm clocks, and countless other devices. Smart home

products listen to the cadence and content of our lives and their algorithms provide us with individualized information, products, and services. Computing has become ambient, such that the boundaries between what is or what is not technology are no longer readily apparent (Plowman, 2019). Further, interactions with technology are no longer individual and unidirectional, but complex, bidirectional, and dynamic.

In response to this digital revolution, a moral panic has ensued among parents, policy makers, practitioners, and researchers alike. Pathological and deficit-based approaches have proliferated, and media narratives and policy decisions have been made based on small effect sizes from cross-sectional studies (Ferguson, 2020). This moral panic constitutes a moral imperative for scholars of child and adolescent development, as the "true cost lies in the enormous loss of scientific knowledge and understanding of the role media play in development and developmental processes" (Vandewater, 2013, p. 50). We contend that a cohesive theoretical framework is essential to the development of high-quality and strengths-based research designs, where technology can be incorporated regardless of the specific field of inquiry.

The language of the digital age is messy; words like digital, media, online, virtual, technological, digital, the Internet, and social have permeated our lexicon and become so ubiquitous that it often becomes difficult to ascertain their intended meaning. While this plethora of words is likely not a significant issue in day-to-day life, clearly defining these terms and constructs is necessary to advance scholarship in this area of research. Platforms are "mechanisms or technological vehicles for connecting people and information" (McFarland & Ployhart, 2015, p. 1654), and the basis for all digital software and their related communications, interactions, and activities. Platforms range from simple (e.g., text messaging) to complex (e.g., social media). Social media platforms are unique in that they "facilitate information sharing,

user-created content, and collaboration across people" (p. 1653). Across these different platforms, the content is the text, images, video, and audio shared by its users. Subsequently, the ability to share, distribute, access, and interact with information is shaped both by the features of the digital platform and the content it is designed to promulgate. McFarland and Ployhart (2015) delineated a valuable taxonomy for organizing and understanding social interactions (and their related technologies) in the digital age—the omnibus context continuum. This continuum ranges from face-to-face (i.e., physical) interactions on one pole, through 'Web 1.0' (e.g., read and write only applications like text messaging and email) to 'Web 2.0' (e.g., interactive applications with programming features like social media) on the other. This continuum highlights how material, spatial, and temporal differences impact the affordances of these environments. The non-digital end of the continuum exists in the physical world, where matter is made from atoms and interactions occur in the same spatial–temporal location (McFarland & Ployhart, 2015; Nesi et al., 2018a). The social media end of the continuum exists in the virtual world, comprised of intangible bits of data where spatial and temporal restrictions are freed. Although not outlined in McFarland and Ployhart's paper, as their focus was on social media, we contend that most online gaming contexts lie closer to the Web 2.0 pole. Like social media platforms, multiplayer online games allow for interactions and activities with both other people and objects and symbols in the environment.

Bronfenbrenner's contributions to the field of child development spanned four decades (Tudge, 2017). Bronfenbrenner initially termed his theory "the ecology of human development" before revising it to "ecological systems theory" and finally to "bioecological theory." These iterations were developed across three distinct phases: (a) 1973-1979, (b) 1983-1993, and (c) 1993-2006 (Rosa & Tudge, 2013). Rather than describing the theory's development across these

three phases (see also Tudge et al., in press), our "technologizing" adaptation is based on the final iteration of this theorizing, with one exception—the inclusion of the macrosystem from phase two. Of particular importance to our purpose are his writings on the role of cultures and sub-cultures, although they are not to be found in the final phase. In the second phase, Bronfenbrenner wrote:

> …human-beings are not only a culture-producing species, they are also culture produced; that is, the psychological characteristics of the species are a joint, interactive function of…an active organism…and…of the forms of psychological functioning and possible courses of development existing in a given culture at a particular point in history. (Bronfenbrenner, 1989, p. 204)

This point is relevant to our adaptation of bioecological theory because of the unprecedented (and rapidly evolving) cultural and historical era in which today's young people are developing. We argue that without acknowledgement and incorporation of these technological influences on development, developmental science will again become "the science of children in strange situations." In the third phase, bioecological theory added a fundamental concept—proximal processes—termed "the engines of development" (Bronfenbrenner & Morris, 2006, p. 798), and outlined the Process-Person-Context-Time (PPCT) research model. Bronfenbrenner and Morris (2006) elaborated on the synergistic and dynamic nature of the theory: "The combination of Person and Context exhibit a mutually reinforcing, multiplicative, indirect effect on the power of proximal processes as the engines of development" (p. 801).

This theoretical paper proposes a conceptual framework for understanding and researching development in the digital age. Our ideas have drawn both from bioecological theory

and from conceptual work about technology and youth (e.g., Granic et al., 2020; McHale & Ployhart, 2015; Nesi et al., 2018a; Subrahmanyam & Šmahel, 2011). Subrahmanyam and Šmahel proposed the co-construction model of adolescents' online behavior. This model centers on adolescents as the agentic co-creators of their own virtual environments. In addition, these scholars described virtual contexts as "cultural spaces, where norms are created, shared and passed on to other users. Online culture is not static, but is a cyclical dynamic entity, and users are constantly generating and passing on new norms" (2011, p. 34). This model recognizes the important role digital sub-cultures play in the lives of adolescents. Nesi and colleagues (2018a, 2018b) challenged preconceptions that online interactions mirror offline ones and proposed that "the social media context transforms adolescents' peer experiences" (2018a, p. 268). Their "transformation framework" identifies key features and affordances of social media platforms that alter peer interactions and relationships in adolescence. Granic and colleagues (2020) explored adolescent identity development in the digital age. They proposed moving beyond how much time is spent online (i.e., screen time) to look at how and why digital interactions and activities impact identity development. Granic et al. proposed that by focusing on identity-formation processes, researchers "…can help pinpoint the digital experiences that will contribute to both healthy normative development as well as the emergence of serious mental health concerns" (p. 196).

Neo-Ecological Theory

Although we view proximal processes as constituting the "engines of development" (Bronfenbrenner & Morris, 2006 p. 798), our discussion of neo-ecological theory begins with context to accommodate profound alterations related to the microsystem, which have cascading

impacts throughout the other elements of the model. We will then consider the remaining three constructs of the PPCT model, namely person characteristics, time, and proximal processes.

Context

Despite the fact that, from the outset, Bronfenbrenner's theory was explicitly ecological, dealing with the synergistic interdependence of individuals and the contexts in which they lived, it has largely been treated as a theory of context. Portrayals of his theory as the individual surrounded by concentric rings of context are ubiquitous both in academic texts and on the web. Our concern with this portrayal (see Tudge, 2008; Tudge et al., 2009; 2016) should not be treated as signifying that context was not an important part of his model. It is a very important part, especially in exploring how the spatial and temporal freedoms of the digital era impact development. It is simply not the *most* important, let alone the preeminent, part of the model.

Microsystem

Bronfenbrenner defined the microsystem as:

> …a pattern of activities, social roles, and interpersonal relations experienced by the developing person in a given *face-to-face* setting with particular physical, social, and symbolic features that invite, permit, or inhibit, engagement in sustained, progressively more complex interaction with, and activity in, the immediate environment. (Bronfenbrenner, 1994, p. 1645, italics added)

In other words, microsystems were considered to be physical locations where "face-to-face" proximal processes took place (e.g., home, school, or work). Many of the attempts to apply ecological theory to the intersection of technology, children, youth, and families continue to have conceptualized the use of information communication technology as an activity or interaction

within a face-to-face microsystem (e.g., Arnott, 2016; Edwards et al., 2017; Jordan, 2004; McHale et al., 2009; Vandewater, 2013; William & Merten, 2011). Other scholars (e.g., Johnson & Puplampu, 2008; Plowman, 2016; Wang et al., 2010) have chafed at this limitation and attempted to find ways to explain the complexity digital technology adds to the microsystem—namely that many of the interactions and activities in which youth currently engage are not occurring face-to-face.

Johnson and Puplampu (2008) acknowledged how virtual spaces complicate Bronfenbrenner's model by lifting geographical limitations on interactions. They proposed the "techno-subsystem, a dimension of the microsystem," which includes "child interaction[s] with both living and nonliving elements of communication, information, and recreation technologies in immediate or direct environments" (p. 5). They proposed that this subsystem acts as a conduit for interactions or activities in the microsystem. However, such a sub-system could be accounted for within Bronfenbrenner's existing theory—namely the features of the microsystem (i.e., "particular physical, social, and symbolic features that invite, permit, or inhibit, engagement…" (Bronfenbrenner, 1994, p. 1645)). Plowman (2016) discussed the ways in which technological interactions can reach beyond the microsystem and argued that the "concepts of context influenced by Bronfenbrenner imply boundaries that may no longer exist" (p. 194). Instead, building on Dourish (2004) and Heritage and Clayman (2010), Plowman suggested that contexts may be more relational than spatial, but did not specify further how such a concept might relate to the rest of the model or be operationalized.

Digital technology has created a conceptual and methodological quandary for Bronfenbrenner's microsystem: If virtual interactions and activities are not happening in the microsystem, where are they happening? Neither the solutions proposed by Johnson and

Puplampu (2008) nor Plowman (2016) adequately answer this question. In our view, virtual interactions and activities are occurring in contexts unforeseen by Bronfenbrenner—in bits of data travelling at the speed of light—and his theory must be fundamentally altered to incorporate modern "…activities, social roles, and interpersonal relations" (Bronfenbrenner, 1994, p. 1645). As such, we propose the first of three modifications to the microsystem:

1. *There exist two types of microsystems: virtual and physical*.
    a. A *virtual* microsystem is a pattern of activities, social roles, and interpersonal relations experienced by the developing person on a given *digital platform* with particular relational and symbolic features that invite, permit, or inhibit, engagement in proximal processes within that environment.
    b. A *physical* microsystem is a pattern of activities, social roles, and interpersonal relations experienced by the developing person in a *face-to-face* setting with particular physical, social, and symbolic features that invite, permit, or inhibit, engagement in proximal processes within that environment.

Although some may argue that such a proposition is unnecessary and the simple removal of the phrase "face-to-face" from the definition would be sufficient to resolve the problem, we believe it is crucial to make a distinction between these two types of microsystems because virtual and physical microsystems each have unique "physical, social, and symbolic features" that differentially impact the synergistic interrelation of proximal processes, person characteristics, and time. We also conceptualize two types of microsystems because spatial constraints have been lifted, allowing for the second of our three modifications:

2. *The developing individual can exist in more than one microsystem at once.*

Whereas Bronfenbrenner conceptualized microsystems as discrete physical locations, like the home, school, or workplace, the flexibility of digital platforms enables individuals to participate in interactions within two microsystems simultaneously. Take as examples a child attending classes remotely from their home, college students playing online games with friends from their dorm room, a parent sharing a photo on a social media platform with their child while at work, or an older adult in an assisted-living facility video conferencing with their family who live in another country. All of these individuals are participating in two microsystems—the virtual one (e.g., an online classroom) and the physical one (e.g., their home). Further, we specify more than one microsystem to reflect ubiquitous media multitasking (i.e., the use of more than one digital platform simultaneously, Rideout et al., 2010). As such, developing individuals can participate in two or more virtual microsystems (e.g., attending a online meeting while scrolling through a social media feed) in addition to their physical microsystem (e.g., the home).

As spatial and temporal constraints have been lifted in virtual microsystems, the ways in which individuals move in and out of them is different than in physical microsystems. Traditionally imagined, one enters a physical microsystem (e.g., the home) through a door and exits the same way. This is different from a child's or adolescent's virtual microsystem, such as an online multiplayer game. The child's presence in this virtual microsystem is defined by the interactions and activities in which the child is engaged—playing a game with their peers. As elucidated by Dourish (2004), "context isn't just 'there,' but is actively produced, maintained and enacted in the course of the activity at hand" (p. 22). Virtual microsystems are phenomenological; persons appear to 'open' and 'close' virtual microsystems through the

interactions and activities in which they engage, regardless of the software itself being loaded on their gaming console. The same principle applies to virtual microsystems on social media platforms; a teenager opens a virtual microsystem when they scroll through social media and closes this microsystem when they move to a different platform or put down their device. In summary, this third modification can be stated as:

3. *The opening and closing of virtual microsystems are defined by the interactions and activities in which the developing individual engages.*

Unique Features of the Virtual Microsystem. The features outlined below are not shared by all virtual microsystems, nor inapplicable to physical microsystems. Instead, in line with the omnibus continuum framework proposed by McFarland and Ployhart (2015), we propose that these features be viewed on a continuum, both in terms of their applicability and degree of pertinence to the microsystem in question. Given the breadth and pace of technological innovation (not to mention the corresponding youth-led cultural innovation in digital spaces), scholars must be flexible and dynamic in their approach to describing virtual microsystems. We suggest these features as a starting place for incorporating elements of virtual microsystems into research, not as a definitive list.

Synchronicity and Asychnronicity. Interactions and activities in virtual microsystems can take place both synchronously (e.g., in real time) and asynchronously (e.g., with a time lag) (Best et al., 2014; McFarland & Ployhart, 2015). Some activities and interactions in physical microsystems are asynchronous (e.g., letter writing). Nonetheless, this feature is more pronounced in virtual microsystems, although the degree of asychnronicity varies depending on the digital platform (Nesi et al., 2018a). Some virtual microsystems are highly synchronous (e.g., video conferencing, online gaming) whereas email is asynchronous. Other platforms incorporate

elements of both, allowing individuals to engage with content and in communication in real time (e.g., instant messaging and watching live video streams) and with previously posted content or communications (e.g., social media feeds). The asychnronicity of virtual microsystems can create more opportunities for adolescents to engage on their terms (Granic et al., 2020).

Availability. Inherently, in flouting the spatial and temporal restraints of physical microsystems, individuals in virtual microsystems can interact with others at great distances, both synchronously and asynchronously (McFarland & Ployhart, 2015). Availability is a key affordance when considering proximal processes occurring in virtual microsystems, as it allows people to connect with others who may otherwise be unavailable to them (boyd, 2010; Nesi et al., 2018a). The relevance of availability to child development cannot be understated; it is central to the lives of young people in the digital age. For example, young people can connect with others who may have similar interests or be experiencing similar challenges (e.g., adolescents playing online games with friends who have moved away, LGBTQ youth seeking support on coming out to their family and community, etc.). During the COVID-19 epidemic, availability has become central to the functioning of society: children and youth attended school remotely, doctors ministered to their patients via online portals, and work meetings took place virtually.

Publicness. Few physical microsystems allow young people to interact with large numbers of people. Even in a school or sports setting, "visual and auditory information is limited by physics; walls and other obstacles further restrain visibility" (boyd, 2008, p. 125). Larger venues, like concert halls or sports stadiums, are not microsystems (unless one happens to be a performer or play sports) because they do not allow for "sustained, progressively more complex interaction" (Bronfenbrenner, 1994, p. 1645) on a regular basis. In virtual microsystems, group interactions are not limited to a geographical location and individuals can communicate and

interact with a much wider audience (Nesi et al., 2018a). Termed networked publics by boyd (2008), social media and interactive platforms "allow people to gather for social, cultural, and civic purposes and they help people connect with a world beyond their close friends and family" (boyd, 2010, p. 39). The feature of publicness is particularly relevant to scholars examining civic engagement among youth (Granic et al., 2020). In networked publics (e.g., social media platforms like Twitter), individuals are interacting with an invisible audience (boyd, 2008); individuals cannot know with certainty who or when others will read, view, or share the content they posted. As a result, how individuals imagine their 'audience' impacts their self-presentation (i.e., demand characteristics) in virtual microsystems.

Permanence. Also termed persistence (boyd, 2008; 2010), this feature reflects the degree to which virtual interactions and activities remain accessible after the interaction is completed (Nesi et al., 2018a). Regardless of the synchronicity of the initial interaction or activity, their content can be accessed for an indefinite period of time. Permanence plays out differently depending on the digital platform and presents both opportunities and risks to development. Comments on social media platforms, websites, and blogs can remain indefinitely, and although some can be removed by the individual, others cannot, depending on who posted them and the affordances of the platform. Even platforms eschewing permanency face the conundrum of screenshots; content can be recorded and reshared, sometimes to the detriment of the original poster. As such, while an individual's "…attitudes and opinions may change over time, prior expressions of these attitudes and opinions that are expressed over social media still exist" (McFarland & Ployhart, 2015, p. 1659).

In conjunction with searchability (i.e., the ease with which people can find and verify information online; boyd, 2008; McFarland & Ployhart, 2015) this side of permanence can be

detrimental and burdens today's youth in ways unexperienced by previous generations (Granic et al., 2020). Today's adolescents do not have the luxury of a 'fresh slate' when they change locations, schools, or workplaces; as virtual microsystems are not bound by geography or time, their digital past is omnipresent. News media reports of these incidents abound. For example, there have been reports of college acceptances and job offers rescinded because of comments or photos posted years earlier, adolescents devastated by intimate photographs and videos posted by angry former partners, and transgender youth outed by others who locate and repost digital evidence of their transition. The scalability (i.e., the ease with which content can be shared and disseminated to a wider audience; boyd, 2010) of online content can magnify how permanence impacts proximal processes. However, the permanence of digital platforms can confer benefits as well; reminiscing and nostalgia are encouraged by looking back over photographs, videos, and interactions from the past, and may assist youth in developing their narrative identity (Granic et al., 2020).

Cue Absence. Building upon cues-filtered-out theory (Culnan & Markus, 1987), Nesi and colleagues (2018a) elucidated cue absence as a transformative feature of social media contexts. Unlike in physical microsystems, where typically a combination of verbal and non-verbal cues informs interactions, interpersonal cues in virtual microsystems may be more limited. Interpersonal cues in virtual microsystems are on a continuum, dependent on the design of the digital platform. Most video chatting platforms allow participants to read voice and visual cues. Messaging platforms are text and image based, and content must be interpreted without tonal or visual cueing. In addition to audiovisual clues, identity is also a cue in interpersonal interactions (Nesi et al., 2018a), ranging from interactions with known persons, to source anonymity (i.e., personal identity is totally obscured; Valkenburg & Peter, 2011).

Additional Features. In addition to these more prominent features of the virtual microsystem, there are additional features that may be relevant for some lines of research. In virtual microsystems, content (text, images, video, or audio) can be copied exactly as it was originally expressed. Termed replicability (boyd, 2008), this feature presents a striking contrast to physical microsystems, given that content (including photos and videos) can be shared verbatim instantly across wide distances (Nesi et al., 2018a). In a home or school microsystem, a story or information must be interpreted and then written down or remembered by a person before being re-told. However, in virtual microsystems individuals can share content verbatim with or without attribution. Content may also be altered and misattributed. In addition, virtual microsystems may possess a greater degree of visualness (i.e., the extent to which photographs and videos are emphasized on a digital platform; Nesi et al., 2019) than physical microsystems. Virtual microsystems also allow for interactions and activities to be quantified into metrics (e.g., numbers of likes, share, retweets). The quantifiability available on many digital platforms influences when, what, and how frequently adolescents engage in proximal processes in digital microsystems (Nesi et al., 2019).

Finally, we encourage researchers and practitioners to consider how machine learning and algorithms shape virtual microsystems. Algorithms on digital platforms are designed to gather and interpret data about all aspects of our lives (e.g., our skills, likes, routines, challenges, habits, geographical location) and subsequently tailor our experiences in accordance with goals determined by individuals in the exosystem (e.g., software developers, marketers, and investors). As such, virtual microsystems are a dynamic, individualized, and co-constructed context: "…information and communication processing hardware and software, alongside humans and other agents, collaboratively produce space and culture" (Taffel, 2016, p. 332). In this way, exo-

and macrosystemic forces exert considerable influence on the virtual microsystems of youth, often circumventing parents and educators.

Mesosystem

Unlike the microsystem, to which we made two key modifications, we contend that Bronfenbrenner's conceptualization of the mesosystem needs no adaptation to fit into neo-ecological theory. Bronfenbrenner defined the mesosystem "…as comprising the relationships existing between two or more settings; in short, it is a system of two or more microsystems" (Bronfenbrenner & Morris, 2006, p. 817). In some ways mesosystemic influences are even more important in neo-ecological theory, as "adolescents' physical, social, and digital worlds are intertwined and interconnected and have a transactional or bidirectional relationship with each other" (Subrahmanyam & Šmahel, 2011, p. 35).

From a strengths-based perspective, mesosystemic-level research may illuminate whether skills learned in virtual microsystems translate into gains in physical contexts. Granic et al. (2020) elucidated examples of ways in which video games can help adolescents develop a sense of agency: intermittent reward schedules, micro-successes, the "hero's journey," and redemptive narratives. Although not explicitly utilizing an ecological perspective, a number of studies have examined mesosystemic influences between positive proximal processes in virtual and health outcomes in physical microsystems. In a study of African American and Latinx youth, Stevens et al. (2017) found that participants saw social media as an important and credible source of sexual health information. Participants' exposure to sexual health information on social media was significantly associated with reductions in sexual risk-taking behaviors offline. Huang et al. (2013) and Suffoletto et al. (2015) found that web- and text-based drinking interventions reduced the incidence of binge drinking among adolescents. Bliuc and colleagues (2020) found that, for

adults who suffer from alcohol and drug addiction, participation in online support groups on a regular basis for an extended period of time predicted positive recovery outcomes. They hypothesized that the participants' participation in an online recovery community (a virtual microsystem) helped individuals to build "recovery capital" (a person characteristic), which translated into lower rates of relapse in the physical microsystems they inhabited.

There are numerous studies of deleterious influences of virtual microsystems (see Nesi et al., in press, for a comprehensive overview); we will provide two examples of longitudinal mesosystemic studies. In their 2018 study, Nesi and Prinstein delineated a novel proximal process—digital status-seeking (i.e., "attempts to obtain social-media-based indicators of peer status (e.g., likes, comments)" (p. 1)—and differentiated it from its physical microsystem counterpart, popularity. They found that adolescents who engaged in more digital status-seeking at baseline were more likely to engage in higher levels of substance abuse and have more sexual partners one year later. In their longitudinal study of Norwegian youth, Erevik and colleagues (2017) found that more frequent posting of and exposure to alcohol-related content on social media was predictive of later alcohol use, but this effect was weakened considerably when baseline alcohol use was taken into account. While these studies did not measure proximal processes in both microsystems (as a true mesosystemic study would), they demonstrate complex interrelations between virtual and physical microsystems, and how important this system of systems is to a neo-ecological approach.

In addition to studies of the interrelation between virtual and physical microsystems, researchers should consider the mesosystemic relation between two or more virtual microsystems. Marwick and boyd (2011) described the phenomenon of context collapse, whereby multiple audiences (as imagined by the developing individual) converge on a single

digital platform. For example, social groups that inhabit separate physical microsystems (e.g., colleagues in a workplace microsystem and family members in a home microsystem) may all be present in a single virtual microsystem (e.g., a social media platform). Alternately, social connections originating from different virtual microsystems (e.g., friends from an online support group and a romantic partner on a dating app) may each find the developing individual on a social media platform. These collisions of social interactions and activities from different microsystems presents challenges for how individuals represent themselves and their relationships with others. Without distinction between virtual and physical microsystems, mesosystem-level analyses will be ineffectual and obscure the bidirectional and interrelated nature of these microsystems.

Exosystem

Similar to the mesosystem, the exosystem in neo-ecological theory remains largely unchanged from Bronfenbrenner's conceptualization. Bronfenbrenner (1993) defined the exosystem as

> …the linkages and processes taking place between two or more *settings*, at least one of which does not contain the developing person, but in which events occur that indirectly influence processes within the *immediate setting* in which the developing person lives. (Bronfenbrenner, 1993, p. 24, italics added).

However, we propose the wording of his definition be changed to reflect the duality of virtual and physical microsystems:

> *An exosystem represents the linkages and processes taking place between two or more microsystems, at least one of which does not contain the*

> *developing person, but in which events occur that indirectly influence proximal processes within one or more of the microsystems in which the developing person engages.*

More simply, exosystemic forces parallel those of the mesosystem; it is a system of systems, one of which does not contain the developing individual. In the digital age, exosystemic forces are likely a more significant force in the lives of youth than in previous generations. Rather than influencing youth through their home or school microsystems, where parents and teachers can potentially buffer (or at least discuss) deleterious exosystemic forces (e.g., the loss of a job, changes in school policies), exosystemic forces may impact youth participating in virtual microsystems more directly. For example, conflicts between software developers and hardware companies about pricing and revenue streams can indirectly impact adolescents' ability to engage in interactions and activities in virtual microsystems (e.g., #FreeFortnite, when Fortnite was removed from the Apple app store).

This is an especially important level of context for developmental and social scientists to consider—our power to promote positive youth outcomes must now expand beyond our partnerships with parents, educators, and other practitioners to include developers of digital platforms. This a crucial exosystemic influence in the lives of youth and, as Granic et al. (2020) eloquently argued:

> If psychological scientists begin to partner and participate more in the development of digital tools of all kinds, they will have a better chance to provide young people with safe, enriching, identity-relevant online environments that feel authentic and relevant to their core needs and values. (p. 215)

Macrosystem

In his phase III writings, Bronfenbrenner and his colleagues (e.g., Bronfenbrenner et al., 1996) discussed at length the "growing chaos" in the United States, the result of a "major breakdown specifically in the domain of social development" (Bronfenbrenner & Evans, 2000, p. 121). Writing from a largely deficit-based perspective, Bronfenbrenner delineated this chaos as evident in two trends: (a) increasing time spent alone by children and adolescents, and (b) a "progressive decline in measures of competence and character" (p. 120). Bronfenbrenner saw these societal changes as deleterious, the fault of corrupting influences of single parenthood and disengaged youth. Rereading these paragraphs today underscores Bronfenbrenner's own positionality and calls into question whether his earlier conceptualization of the macrosystem, as a "societal blueprint for a particular culture, subculture or other broader social context" (Bronfenbrenner, 1989, p. 228), was an enduring or transient element of his theory. Was this blueprint intended to be malleable and reflect changes in social norms? Or was this blueprint merely a mechanism for reinforcing the status quo? His later writings favor the latter, and in publications about bioecological theory and the PPCT model, the macrosystem is almost entirely absent.[1] Perhaps his own positionality and focus on social policy obscured him from viewing some of these changes (e.g., what he called "chaos" and a "teenage syndrome" (Bronfenbrenner & Morris, 2006, p. 824)) as being normative within a new cultural era (i.e., a time of shifting gender roles and less restrictive sexual mores).

[1] The term *macrosystem* is mentioned once in Bronfenbrenner and Morris (2006) on page 796, in reference to his 1979 book, despite references elsewhere to racial and ethnic differences within the United States. It is not mentioned at all in his 2000 publication with Evans, entitled, ironically, "Developmental Science in the 21st Century." Further, in a 1999 chapter, in which the term *macrosystem* also fails to appear, he concluded the section on micro-, meso-, and exosystem effects as follows: "So much for environmental process and context as shapers of development" (p. 20).

As developmental and social scientists in the digital age, we would be wise to not follow suit. To understand and support today's young people, we must be prepared to examine the diverse cultures and subcultures within which they live, play, and grow. Only through incorporating the dynamic influences of the macrosystem can our research stay relevant to parents, educators, practitioners, and industry. To reflect the importance of the macrosystem to neo-ecological theory, we instead utilize Bronfenbrenner's earlier phase II writings in our interpretation of the macrosystem. In 1989, Bronfenbrenner defined the macrosystem as:

> …the overarching pattern of micro-, meso-, and exosystems characteristic of a given culture, subculture, or other broader social context, with particular reference to the developmentally-instigative [sic] belief systems, resources, hazards, life styles, opportunity structures, life course options, and patterns of social interchange that are embedded in each of these systems. (p. 228)

Further, we incorporate Tudge's cultural-ecological theory (2008) into our conceptualization of the macrosystem and its role within neo-ecological theory. Competence, which Bronfenbrenner delineated as "the demonstrated acquisition and further development of knowledge, skill, or ability to conduct and direct one's own behavior across situations and developmental domains" (Bronfenbrenner & Morris, 2006, p. 803), must be viewed as a culturally defined construct (Tudge, 2008). Tudge defined culture as:

> A group of people who share a set of values, beliefs, and practices; who have access to the same institutions, resources, and technologies; who have a sense of identity of themselves as constituting a group; and who

attempt to communicate those values, beliefs, and practices to the following generation. (pp. 3–4)

This definition does not specify the type of group—it can refer to an entire society or to any group within that society that fits the definition. Obviously, this view of culture does not permit a single way in which to measure either competence or dysfunction, which can only be related to the cultural group's values and practices.

The ubiquity of digital technology is a global phenomenon; five billion people, roughly three-quarters of the world's population, own smartphones. Smartphone ownership in emerging economies has skyrocketed in recent years, with youth being the most rapid adopters (Taylor & Silver, 2019). This rapid adoption of digital technology likely differentially impacts the development of adolescents depending upon the values and beliefs, resources, and social structure of their society. For example, Borzekowski et al. (2006) found that Ghanaian youth from lower socioeconomic backgrounds were more likely to use the internet for health information. Such a finding may run contrary to expectations based on higher rates of digital device ownership among higher socioeconomic youth, but when viewed within cultural norms of privacy related to sexual activity and health, this finding reveals that the internet is an important tool for providing health education to youth who leave school early to support their families and cannot access school-based health information.

Of additional consideration to social scientists is governmental censorship of the internet. The internet is sometimes viewed as a tool of liberation, and yet "The world's authoritarians have shown just as much aptitude for technology as their discontented citizens'' (Lake, 2009). For example, the Great Firewall (Yang, 2020) of China exerts considerable restrictions on the form and content of digital technologies Chinese citizens can access. This censorship impacts the

features of the virtual microsystems in China (e.g., anonymity is low), and as such, indirectly influences proximal processes. How might such restrictions and oversight impact identity development for Chinese adolescents? Iran, where all telecommunications are centralized by state-run agencies, maintains stringent controls over internet usage, prohibiting access to non-Islamic content (Iran, 2020). Such macro-level "hazards" (Bronfenbrenner, 1989, p. 228) may limit digital participation, but when viewed from the perspective of the culture itself, censorship may be viewed as a different formulation of cyberspace (Jiang, 2012) rather than a hazard.

In addition to these societal-level variations, macro-level contexts also include within-society cultural groups. In the United States, the oppression and marginalization of people of color influences proximal processes in both physical and virtual microsystems and in the mesosystemic relations between them. In a qualitative study with African American and Latinx youth living in disadvantaged neighborhoods, Stephens and colleagues (2017) explored the myriad ways in which interactions and activities in virtual microsystems, like Facebook, can be both positive and negative. The "misuse of platforms can prove detrimental, leaving youth at the margins with another closed avenue to building community…youth are strategically migrating to social media sites with more restrictions as a way to limit their exposure to drama" (p. 964). Brock (2012) explored discourse on Black Twitter, which he described as a "public group of specific Twitter users" (p. 545). Twitter's rapid adoption as a vehicle for cultural communication and connection reflects the availability and publicness of the platform: "…transcending the size limitations and conversational incoherence of chat rooms, [Black Twitter allows] users to participate in open-ended community building discourses in near real-time" (p. 545). Virtual microsystems are not homogenous; macrosystemic influences extend into digital spaces,

synergistically interacting with time, person characteristics, and features of the micro-, meso-, and exosystems.

Access to digital technology and broadband internet access is also influenced by macrosystemic influences. At the macrosystem level, this digital divide reflects class inequalities and disparities between urban and rural areas in the United States. The ramifications of the digital divide were amplified during the COVID-19 pandemic, as youth with limited access to digital devices and high-speed broadband were further disenfranchised when schooling went online (Beaunoyer et al., 2020). In addition to social isolation, health information about COVID prevention, testing, and vaccines was primarily transmitted through digital media, making lower socioeconomic and rural youth more vulnerable to the virus itself (Beaunoyer et al., 2020). Recent research suggests that the digital divide may not be as relevant to adolescents as to other populations (e.g., older adults), as access to smartphones is high across class groups (George et al., 2020). However, George and colleagues (2020) found that youth from more economically disadvantaged backgrounds were more likely to experience negative spillover between virtual and physical microsystems.

Person Characteristics

Person characteristics feature twice in bioecological theory, initially as one of the forces impacting proximal processes and again as a developmental outcome. Person characteristics are both "an indirect producer and…a product of development" in the spiral of development (Bronfenbrenner & Morris, 2006, p. 798). Bronfenbrenner and Morris (1998, 2006) reformulated developmentally relevant person characteristics into three categories: force, resource, and demand. In our adaptation of bioecological theory to neo-ecological theory, these constructs remain largely unchanged but can be applied in new ways.

Force

Force characteristics are "active behavioral dispositions" (Bronfenbrenner & Morris, 2006, p. 810) that promote or impede proximal processes. As such, force characteristics can be broken down further into developmentally generative (e.g., curiosity, agency, ability to delay gratification) and developmentally disruptive (e.g., impulsiveness, distractibility, inability to delay gratification) characteristics. Research has shown that behavioral dispositions can influence individuals' selection and use of digital platforms. For example, persons with more extroverted tendencies prefer to use platforms with more cue presence and eschew anonymity (Best et al., 2014).

Resource

Resource characteristics are "biopsychosocial liabilities and assets" (Bronfenbrenner & Morris, 2006, p. 812) that influence the capacity to engage in proximal processes—both positive and inverse (Merçon-Vargas et al., 2020). "Assets" include skills, knowledge, and abilities that promote competence and buffer against disruption, whereas "liabilities" describe characteristics like illness, social impairments, and physical disabilities. Adolescents may utilize skills and knowledge they gain from virtual microsystems in interactions with parents, teachers, and others in their physical microsystems. Youth are often the experts when it comes to information technology, and this can upend traditional hierarchies in homes and schools—providing opportunities for parents and teachers to learn from adolescents and further support their development as agentic and capable individuals (Barron et al., 2009; Bond, 2014, Nesi et al., 2018a). While this may change as future generations of parents will have grown up with social and digital media, it is likely that technological innovation will introduce new challenges for parents of the future. Digital literacy (i.e., the ability to find and evaluate online information) is

also a resource characteristic, but the digital divide may impair the development of this skillset, furthering disenfranchisement and isolation, and thus reinforcing the "digital vicious cycle" (Beaunoyer et al., 2002, p. 2).

Demand

Demand characteristics describe more phenotypic or observable features that "invite or discourage reactions" (Bronfenbrenner & Morris, 2006, p. 812) from the environment (e.g., gender, skin color, age, attractiveness, shyness, and happiness). Of all three types of characteristics, demand characteristics are possibly the most impacted by the advent and utilization of digital media. In virtual microsystems, developing individuals have tools (e.g., visualness, anonymity), time (e.g., asychnronicity), and space (e.g., availability) to regulate their online demand characteristics and, as a result, may have a greater degree of control in how they are perceived than in physical microsystems. Marwick and boyd (2011) posited that digital social performances are based on an individual's "imagined audience" (p. 115). Social performances can be curated using photographs, text, videos, design, social connections, and quantifiable metrics (e.g., likes, shares). These performances also vary based on the digital platform. For example, profiles on dating sites and applications allow for highly curated self-presentations under optimal conditions (Marwick & boyd, 2011). However, social media platforms (e.g., Twitter, Snapchat) allow for a more "dynamic, interactive identity presentation" (Marwick & boyd, 2011. p. 116). The visualness of some digital platforms (e.g., Instagram) may encourage more visual representations of self, as opposed to more narrative, text-based contexts. Although virtual microsystems allow for more curation of demand characteristics, these presentations can be limited by mesosystemic forces, as friends, family, and colleagues can be audience members in both virtual and physical microsystems (boyd, 2008).

Time

Although Bronfenbrenner had written about the importance of historical time in the first two phases of the theory, only during the third phase was time formally added to his Process-Person-Context-Time model. He described three types of time that impact development: micro-, meso-, and macrotime (previously termed the chronosystem).

Microtime

Microtime is defined as "continuity versus discontinuity in ongoing episodes of proximal process" (Bronfenbrenner & Morris, 2006, p. 796), and refers to what is happening within a proximal process. Microtime parallels the construct of mindfulness: Is the developing individual able to stay present or 'in the moment' during a proximal process? Or is the proximal process being interrupted repeatedly? When framed from this perspective, microtime becomes an incredibly important component of neo-ecological theory. As discussed previously, digital technology facilitates media multitasking, defined as the use of more than one digital device or platform simultaneously. Further, in our model, we propose that developing individuals can be in more than one microsystem at a time. Consequently, the ability of youth to stay present and engaged in proximal processes may be interrupted frequently. Digital platforms are designed to engage us; we receive messages and notifications when we get an email, a 'like' on social media, an upcoming event on our calendar, and when the refrigerator door is left ajar. The impact of some of these digital interruptions, also termed technoference, has been studied in both spousal and parent–child interactions. Using the actor–partner interdependence model to assess bidirectionality between parents, McDaniel and Radesky (2018) found that maternal (but not paternal) technoference in parent–child interactions significantly predicted higher levels of externalizing and internalizing child behaviors. Kushlev and colleagues (2016) found that adult

participants assigned to a week-long experimental condition to maximize their phone's notifications reported significantly higher levels of inattention.

Mesotime

Mesotime refers to the repetition of proximal processes, over days, weeks, and years. While not typically a focus in writings about the ecological model, mesotime is the only sub-element of the PPCT model to be explicitly described within the definition of proximal processes, which states: "To be effective, the interaction must occur on a *fairly regular basis* over extended periods of time" (Bronfenbrenner & Morris, 2006, p. 797, italics added). In future research utilizing neo-ecological theory, scholars should not consider time primarily in terms of interruptions to proximal processes, but rather examine how digital technology may both encourage and disrupt engagement in proximal processes on a regular basis. Some of the features of virtual microsystem may make it more possible for proximal processes to happen regularly, and over an extended period of time. For example, a young child may be able to read books each night on a video chatting platform with her grandparents who live far away. During COVID-19, students were able to attend school daily, avoiding severe disruptions in educational proximal processes because of digital classroom platforms.

However, paralleling technoference at the microtime level, digital technology may also impair the ability of individuals to engage in proximal processes on a regular basis. Virtual microsystems likely have an opportunity cost; youth may be missing out on proximal processes (e.g., learning a new sport) that occur in physical microsystems by engaging in e-sports. Alternatively, this opportunity cost may also be positive; fewer adolescents are engaging in sexual risk-taking behaviors than previous generations (Twenge et al., 2017).

Mesotime is also relevant to research about screen time. Although a full review of this expansive and contested literature is not within the scope of this paper (see Odgers & Jensen, 2020 for a recent review), we feel it is imperative to note that screen time is but one sub-element of the synergistic and interrelated influences on development in the digital age. Rather than focus solely on the length of time or frequency that adolescents spend in virtual microsystems, we recommend that scholars instead examine the frequency and durations of proximal processes occurring within virtual microsystems. Screen time is not a proxy for the pattern of proximal processes in which youth engage in online and is too simplistic to account for developmental outcomes. Bronfenbrenner eschewed focusing on direct effects, and instead suggested that "in ecological research, the principal main effects are likely to be interactions" (1979, p. 38). A singular focus on screen time as a main effect obscures proximal processes and the underlying mechanisms of development. Granic et al. (2020) suggested: "Instead of simple frequency counts on different devices and application, what we need to examine is how the function of digital media relates to mental health" (p. 198).

Macrotime

Macrotime represents "the changing expectations and events in larger society, both within and across generations, as they affect and are affected by, processes and outcomes of human development over the life course" (Bronfenbrenner & Morris, 2006, p. 796). A such, macrotime and the macrosystem are two sides of the cultural coin. The bidirectionality between the macrosystem and developing individuals is more fluid now than at any time in history.

The advent of the internet and networked publics (boyd, 2008) has magnified and accelerated cultural change. Building upon Vygotsky (as did Bronfenbrenner), Greenfield and Zan (2006) wrote: "The internet is cultural because it is shared, norms are developed, and these

norms are transmitted to new generations of users, even as the new users, greater access, and technological innovation create new norms" (pp. 392–393). Further, boyd (2008) argued that the internet has allowed adolescents to take back control of youth culture. For decades, decisions in the exosystem (by adults in positions of authority) have co-constructed a paradoxical youth culture where "the contradictions run deep—we sell sex to teens but prohibit them from having it; we tell teens to grow up but restrict them from the vices and freedoms of adult society" (boyd, 2008, p. 135). The advent of the internet freed adolescents and "decentralized publics" (p. 135), allowing them to participate more fully in co-constructing elements of the macrosystem.

In addition, the rapid advent and adoption of digital technologies has created digital cohorts, demarcated by the adoption of particular digital hardware and software. In one of the few studies to examine digital cohorts, Bohnert and Gracia (2020) wrote: "…recent rapid transformations in digitalization suggest that today's youth do not form a single coherent digital generation, with children's 'new' digital contexts differing remarkably from those of children in previous cohorts" (p. 1). These shorter cohorts may have differential effects on development and these temporal effects are a direction for future research.

Proximal Processes

Bronfenbrenner delineated proximal processes as the driving force behind human development in the third phase of the development of bioecological theory. Bronfenbrenner and Morris (2006) wrote:

> …human development takes place through processes of progressively more complex reciprocal interaction between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment. To be effective, the interaction

must occur on a fairly regular basis over extended periods of time. Such enduring forms of interaction in the immediate environment are referred to as proximal processes. (p. 797)

Proximal processes are at the forefront of bioecological theory because they serve as the conduit for synergistic interrelations between the characteristics of the person and their environments across time. Operationally, as part of the PPCT model, proximal processes can be systematically investigated as a function of person characteristics, context, and time. Bronfenbrenner almost exclusively wrote about proximal processes as being positive (i.e., leading to competence and buffering against disfunction), but Merçon-Vargas and colleagues (2020) delineated the term inverse proximal processes to describe "detrimental interactions in the immediate environment that take place over extended periods of time on a fairly regular basis, becoming increasingly complex" (p. 329). In this adaptation of ecological theory, we embrace this more expansive notion of proximal processes, as these two types of proximal processes offer a more realistic framework for understanding youth and their families. However, as iterated previously, competence and dysfunction are culturally defined constructs; what is deemed a successful developmental outcome varies by culture and sub-culture. Similarly, whether a proximal process is positive or inverse should be defined by the cultural group of the developing child or adolescent.

The unique features of virtual microsystems impact the forms proximal processes take within them. The third modification of our neo-ecological theory stated

The opening and closing of virtual microsystems is defined by the interactions and activities in which the developing individual engages.

More simply, digital interactions and activities define the existence of the virtual microsystem.

And yet, not all interactions taking place in virtual microsystems are proximal processes; digital platforms are simply another place in which we live, work, and play (e.g., watching TikTok videos, checking the weather, online shopping). These activities are not (typically) proximal processes because they are not usually reciprocal and do not increase in complexity over time. In the physical world, examples of these everyday interactions and activities abound (e.g., eating breakfast, taking a shower, having a cigarette break, riding on the bus, or driving to work). However, physical microsystems continue to exist, even when proximal processes are not occurring within them. By contrast, virtual microsystems arise and are sustained by interactions and activities, some of which are proximal processes.

Bronfenbrenner originally conceived of two forms of proximal processes: (a) those with other persons and (b) those with objects and symbols. As objects and symbols have technologized significantly since the original delineation of proximal processes, we propose modification four:

4. *Proximal processes can take three forms: symbolic, relational, and complex.*
    a. *Symbolic proximal processes are reciprocal, increasingly complex interactions between the developing individual and objects and/or symbols within a microsystem over extended periods on a regular basis.*
    b. *Relational proximal processes are reciprocal, increasingly complex interactions between the developing individual and*

persons within a microsystem over extended periods on a regular basis.

c. *Complex proximal processes are reciprocal, increasingly complex interactions between the developing individual and both persons and objects and/or symbols within a microsystem over extended periods on a regular basis.*

This modification is necessary to describe the forms of proximal processes that can occur within virtual and physical microsystems. Obviously, all three forms take place regularly in physical microsystems. For example, within a home microsystem a child may read books of increasing complexity on a regular basis (symbolic), engage frequently in racial socialization practices with their father (relational), and play chess every week with their grandmother (complex). In virtual microsystems, only relational and complex proximal processes can occur. Symbolic proximal processes, even if they utilize technology, will always take place within the physical microsystem of the developing individual. For example, imagine a child at home creating and playing in a solo Minecraft world. While Minecraft is linked to an online server that modifies game conditions in response to the child's actions, this activity parallels other proximal processes possible in the child's home microsystem, like building with Lego, laying out train tracks, or playing a video game unconnected to the internet. All of these objects and symbols invite "attention, exploration, manipulation, elaboration, and imagination" (Bronfenbrenner & Morris, 2006, p. 798) without interaction with other persons. In a study of Scottish pre-school children, Arnott (2016) found that the children interacted with tablets as they did other objects and symbols in the classroom. Whereas adults view technology as being distinct from other play, children see technological tools as an inherent part of their worlds.

Relational and complex proximal processes in virtual microsystems reflect the unique features inherent in these co-constructed contexts. While some virtual microsystems may be relational (i.e., mostly Web 1.0 platforms like video chatting, text messaging, email), the most pertinent to child and adolescent development are complex proximal processes, mostly occurring on Web 2.0 platforms (e.g., social media platforms, online multiplayer games). Granic and her colleagues (2020) discussed numerous interpersonal and intrapersonal processes that can occur online during adolescence. While Granic et al. did not describe these processes as proximal processes (nor them occurring within virtual microsystems), we believe that their paper provides an excellent starting point for scholars interested in examining positive proximal processes happening in virtual microsystems.

Positive Proximal Processes

According to Granic et al. (2020), adolescents are finding communion with their peers in virtual microsystems. By making social connections with like-minded persons on social media platforms and online games, adolescents can find socioemotional support and strengthen their mental health. Opportunities for such proximal processes are not monolithic, and positive outcomes are the results of an interrelation of person characteristics and the online environment. In addition, virtual microsystems offer opportunities for proximal processes that promote the development of agency and independence. For example, the Hero's journey, a common genre of online games, can help build confidence through overcoming obstacles and developing resiliency to failure (Granic, 2020). Some online games (e.g., Fortnite) are also designed to dynamically adjust to the skill level of the player, helping to ensure that the game play is meeting and pushing the developmental needs of the player (Navarro, 2020). Granic and colleagues also provided illustrative examples of numerous games that encourage the development of positive coping

strategies. Social media platforms provide opportunities for storytelling and sharing of narrative identity with peers, which can play an important role in developing self-esteem and developing social skills. Granic et al. (2020) wrote: "Trusted and supportive peers who can bear narrative contradictions are essential for young people to eventually settle on narrative identities that feel authentic, honest, and generative" (p. 207). Further, for adolescents who may feel marginalized or isolated (e.g., LGBTQ youth, youth of color) in their physical microsystems, virtual microsystems offer opportunities for connections with like-minded individuals and socioemotional support (Odgers & Jensen, 2020).

Inverse Proximal Processes

Research suggesting deleterious impacts of inverse proximal processes in virtual microsystems is copious. Although some of these effects are likely overblown (or erroneous), the unique features of virtual microsystems present a multitude of opportunities for adolescents to engage in proximal processes that can lead to dysfunction. The publicness, permanence, availability, visualness, and cue absence of digital contexts allow for unique opportunities to bully and intimidate others (Nesi et al., 2018b). The availability of social media means that bullying and victimization are no longer temporally or spatially bound; bullies can reach their victims at any time, day or night, and microsystems that were safe in previous generations (i.e., home) no longer offer respite. Further, because cyber victimization is happening in virtual microsystems, it may be less visible to parents and teachers. The moral panic about technology (at the macrosystemic level) may influence some parents to respond harshly or punitively to cyber victimization, and consequently, some youth may be less likely to report being cyber victimized. The publicness and permanence of virtual microsystems may compound the fear and humiliation victims feel because it can be witnessed by many people over and over, extending

the duration and frequency (i.e., meso-temporal impact) of the inverse proximal processes. The mesosystemic links between the virtual and physical microsystems (e.g., school) may lead to further deleterious outcomes and also raises concerns related to jurisdictional responsibility.

In addition to cyber victimization, the unique features of virtual microsystems may encourage inverse proximal processes, like social comparison, that can lead to feelings of insecurity and anxiety, body image concerns, and disordered eating (Holland & Tiggemann, 2016). The accessibility, asychnronicity, and visualness of social media platforms (e.g., Instagram) are conducive to comparisons; adolescents can effortlessly access millions of images, many of which have been carefully staged and edited to look perfect (i.e., carefully curated demand characteristics). Prevailing cultural beliefs about beauty (i.e., macrosystemic and macrotemporal influences) are internalized, and can intensify inverse proximal process. From a micro-temporal and meso-temporal perspective, the intensity, duration, and frequency of these inverse proximal processes can lead to poorer body image and increased disordered eating (Holland & Tiggemann, 2016).

Synergy

In the sections above, we explored neo-ecological theory through each component of Bronfenbrenner's Process-Person-Context-Time model (albeit in a different order). For heuristic purposes we explored these elements separately, but development is the result of the multidirectional interrelations, or synergy, between these constituent elements. Person characteristics, context, and time are interdependent; all three forces synergistically shape "…the form, power, content, and direction of the proximal process" (Bronfenbrenner & Morris, 2006, p. 798), which in turn influence elements of the person, context, and time. As such, operationalizing neo-ecological theory requires scholars to embrace longitudinal designs, and to

gather data not only about people and their environments, but also about the interactions and activities going on within them. Instead of studying each of these elements in isolation, "it is best to eschew main effect explanations in lieu of the complex interplay of internal and external forces reciprocally influencing each other at every moment" (Hollenstein & Colasante, 2020, p. 255).

Applying Neo-Ecological Theory

As we have discussed at length in other publications (e.g., Navarro, Stephens et al., under review; Tudge et al., 2009; 2016), most applications of Bronfenbrenner's bioecological theory and corresponding PPCT research model have struggled to operationalize his ideas with fidelity. This is likely due to a multitude of factors, including that many scholars use earlier iterations of Bronfenbrenner's theory, the proliferation of the notion that bioecological theory is solely related to context (e.g., textbook diagrams depicting nested rings of context), and the fact that Bronfenbrenner did not undertake research using his model and rather used the work of other scholars to illustrate his ideas. Combined with the sheer expansivity of the theory, scholars may feel overwhelmed when trying to apply Bronfenbrenner's ideas to their own research and teaching. After reading this paper, delineating an adaptation of his model with even more complexity, applying neo-ecological theory to your research or teaching may seem daunting.

To avoid this dilemma, we recommend applying and teaching neo-ecological theory in a simple and stepwise fashion, using the Process-Person-Context-Time model as a guide (see Navarro, Stephens, et al., under review, for more detail). This is outlined briefly below, utilizing a fabricated research question (*How might the type of digital interactions in which youth engage impact their substance use?*) and corresponding research and teaching examples. At a *minimum*, a study utilizing neo-ecological theory should address the following four requirements:

1. *Proximal Processes.* The selected proximal process should be an interaction or activity that is increasingly complex (positive or deleterious), reciprocal between the focal individual and other person(s)/object(s), and occurs regularly for an extended period. The selected process should be measured at a time point between baseline and when the outcome is measured.
    a. *Research example:* Utilizing a survey measure, youth reported on the interactions in which they typically engaged in on their most frequently used social media platforms. This information was utilized to determine if they predominantly engaged in active (i.e., commenting/liking friends' posts, posting content themselves) or passive (i.e., scrolling but not commenting, liking, or posting) interactions online.
    b. *Teaching example:* Ask students to brainstorm the different types of interactions and activities taking place in virtual microsystems that they think might relate to substance use. Probe into why they think these activities might relate to the outcome, and if these interactions and activities constitute proximal processes in terms of complexity, reciprocity, and regularity.
2. *Person Characteristics.* Person characteristics feature twice—as both an antecedent and an outcome. The antecedent variable

should be measured (or analyzed) categorically, with a minimum of two levels, and selected for its empirical and theoretical relevance. The outcome variable should be measured after the proximal process has taken place.

   a. *Research example:* In a baseline survey, youth reported on their propensity to compare themselves to others online (i.e., social comparison orientation (SCO)). After separating the sample into terciles based on this measure, the top and bottom terciles comprised the person characteristic in two-levels: high propensity for SCO and low propensity for SCO. Externalizing behaviors, as reported at the third time point, served as the outcome variable.
   b. *Teaching example:* Ask students to generate a list of possible person characteristics that they think may influence the chosen proximal process selected earlier. Urge students to think about person characteristics beyond the focal child/adolescent, like parents or caregivers, siblings, and peers. Also ask student to generate a list of possible ways of measuring substance use for the outcome variable.

3. *Context*. At a minimum, only *one* level of context need be included in the study design. Like person characteristics, the chosen

contextual influence must also be operationalized categorically with two levels.

a. *Research example (only* one *need be addressed):*
    i. *Microsystem:* At baseline, participants submitted screenshots of their time spent on digital media platforms over the course of the preceding week. Based on this information and coding scheme, youth were assigned to one of two virtual microsystems: (a) high visualness and (b) low visualness.
    ii. *Macrosystem:* At baseline, participants reported on their parents' occupation and income and were assigned to one of three socioeconomic groups (i.e., high, middle, low).
b. *Teaching example:* One level of context at a time, ask students to think through contextual influences at the microsystem, mesosystem, exosystem, and macrosystem. How might features of the home microsystem influence the active or passive nature of youth's interactions online? How might unique features of virtual microsystems influence these interactions? What about home–school relations (i.e., mesosystem)? How might decisions made by software developers (i.e., exosystem) influence these

interactions? What about socioeconomic status or systemic inequalities (i.e., macrosystem)?

4. *Time.* A longitudinal study design is necessary to examine the influence of proximal processes over time. In addition, macrotemporal influences must also be considered.
    a. *Research example:* Data for the study was collected at three time points: (a) baseline at which antecedent person characteristics and contextual influences were measured (e.g., SCO, externalizing behaviors, platform visualness, socioeconomic status), a second time point when proximal processes were measured (e.g., social media interactions), and a final time point when the outcome was measured (e.g., externalizing behaviors adjusted for externalizing behaviors at baseline).
    b. *Teaching example:* Ask students to think about how the selected person characteristics, contextual influences, and proximal process may interact with each other over time. Brainstorm how the proximal process may mediate relations between a social comparison orientation and substance abuse among adolescents. Finally, ask students to consider the temporal conditions. How might recent events or cultural change influence the proximal process, person characteristics, and contextual influences?

While this example places interactions occurring virtual microsystem at the forefront, the theory can also be applied to research where digital technology may be not be as central. In today's technologized world, there are likely very few phenomena in which digital technology is not an influence in some way.

Conclusion

Bronfenbrenner's ecological (and later, bioecological) model of human development has been a backbone of developmental science since its inception in the 1970s and offered an overarching theoretical framework for understanding the multitude of influences on development across time. However, as it was written in the 20th century, Bronfenbrenner's bioecological model requires significant modifications to reflect the virtual and technological contexts in which we currently communicate, learn, play, and work. In delineating neo-ecological theory, we hold true to the tenets of bioecological theory, but suggest key modifications to reflect our changed world. We delineated a fundamental modification of the microsystem, namely the existence of two forms of microsystems—physical and virtual. In addition, at odds with bioecological theory, we emphasized the role of the macrosystem (i.e., the influences of culture and within-society subcultural variation) in understanding development. These seismic changes ripple across the PPCT model, opening new avenues of inquiry into development in the digital age. For example, future research should explore mesosystemic relations across physical and virtual microsystems, and the varied functions and features of different types of virtual microsystems within the PPCT model.

In our technologized world, virtual microsystems are central contexts in the lives of youth, and are thus critically important to researchers, practitioners, and policy makers. In addition, without research incorporating the influences of proximal processes in virtual

microsystems, software developers will be in the dark about how best to design their platforms to promote positive outcomes for adolescents, and families. Further, we believe that all scholars studying children, youth, and families, regardless of their specific field on inquiry, should consider the ways digital contexts may influence their outcomes of interest.

CHAPTER III: STUDY 2. A MEASURE OF PARENTAL ATTITUDES REGARDING MEDIATION FOR THE DIGITAL AGE: DEVELOPMENT AND VALIDATION OF A BIFACTOR MODEL

Abstract

Given the ubiquity of digital technology in their children's and adolescents' lives, parents are using digital-specific strategies to mitigate online risks and augment online benefits. The goal of this study was to develop and validate a measure of parents' attitudes about the mediation of digital technology. An internet-based survey was administered to 460 parents of children and adolescents in the United States. Exploratory bifactor analysis revealed one general factor and four digital-specific factors: discursive mediation, restrictive mediation and monitoring, participatory mediation, and mediation by modeling. Confirmatory factor analysis supported a bifactor model of the Digital Parental Mediation Scale (DPMS); the general factor explained shared variance related to parenting style and skills in general, while the mediation factors represented digital-specific attitudes. Construct validity was evidenced in differential associations between mediation factors and parenting efficacy, influence, child age, and parent and child technology use patterns.

Keywords: parental mediation, adolescent, child, digital technology, bifactor, internet, social media, parenting.

Introduction

In the past 15 years, cell phone ownership in the United States has grown considerably (from 62% in 2002 to 95% in 2018; Anderson & Jiang, 2018). Sixty-nine percent of 12-year-olds and 89% of 16-year-olds own a smartphone (Rideout & Robb, 2019). While the current generation of children and adolescents were born into the technological era, their parents were born and raised prior to the advent of the smartphone and social media. Compared to television, digital media (including social media and online gaming) is more interactive, immersive, social, and portable (Jiow et al., 2011). Sixty-six percent of parents feel that parenting is harder today than it was 20 years ago, with 26% citing technology as the primary source of this additional difficulty (Auxier et al., 2020). Some parents do not feel they have the knowledge or skills to be able to effectively mediate digital technology, and that their children or adolescents typically have higher digital literacy and skills than they do (Krcmar & Cingel, 2016). Today's parents must attempt to guide children of all ages through quickly evolving virtual contexts which parents themselves are learning to manage.

The term "parental mediation" (i.e., the skills and practices parents use to manage the relation between children and media; Livingstone & Helsper, 2008) has been used since the 1960s and originally referenced parents' roles in regulating children's exposure to television. However, television and current digital technologies have different affordances (boyd, 2011) and require unique skills and strategies to manage their impact on children and youth. Within the literature on digital parenting skills and strategies, digital parental mediation is not conceptualized or measured consistently. The aim of the present study is to develop and validate a quantitative measure of digital parental mediation for parents of both children and adolescents who utilize digital and social technologies.

Parental Mediation Theory and Measurement

Nathanson (1999) developed a theoretical model of parental mediation related to television content with three dimensions: (a) active mediation, (b) restrictive mediation, and (c) co-viewing (see also Jennings, 2017). Active mediation involves parents teaching children about media and its content. Active mediation can be protective against negative behaviors (e.g., aggression) and can facilitate the development of critical thinking skills and moral reasoning (Clark, 2011). Restrictive mediation refers to the establishment and implementation of rules and limits on both content and duration of exposure. While developmentally appropriate boundary setting is beneficial, too much restriction by parents can increase parent-adolescent conflict and encourage adolescents to find alternate means of watching forbidden or limited content (Clark, 2011; Katz et al., 2019; Krcmar & Cignel, 2016). Co-viewing refers to parental presence while the child or adolescent is using media. Jiow and colleagues (2017) developed an updated framework of parental mediation featuring four components: (a) gatekeeping (i.e., rules and limits on time, content, access), (b) discursive (i.e., active discussions between parents and children about decision making and value priorities), (c) investigative (i.e., parents seeking out information to inform their mediation strategies, using ICT to gather more information for use in gatekeeping and discursive strategies), and (d) diversionary (i.e., parents' redirection to alternate activities).

Using these theoretical models, researchers have developed quantitative strategies to determine the prevalence, dimensionality, and impact of parental mediation of digital technologies. Livingstone and Helsper (2008) asked British parents questions about their co-use, active mediation, and restrictive mediation. An exploratory factor analysis (EFA) suggested four types of mediation: (a) active co-use, (b) interaction restrictions (limits on who the

child/adolescent can interact with), (c) technical restrictions (limits on content and time), and (d) monitoring. However, the strength and pattern of factor loadings were inconsistent, suggesting that parental mediation in 2004 had yet to coalesce around a set of digital-specific skills. Sonck and colleagues (2013) examined patterns of internet mediation in a sample of parent-child dyads in Holland. Building on the questions posed by Livingston and Helsper (2008), they asked both parents and their children questions about mediation across four subdimensions: active mediation, restrictive mediation, co-use, and monitoring. However, results from a principal components analysis indicated a different pattern of factors than those of Livingston and Helsper (i.e., restrictive content mediation, active safety mediation, restrictive technical mediation, and monitoring), and co-use did not load cleanly onto a separate factor. In 2014, Nikken and Jansz developed a measure of internet mediation for parents of children aged 2-12 years. Similar to Sonck et al. (2013), a factor analysis supported subdimensions of active and restrictive mediation; different from Sonck et al., co-use emerged as a coherent factor. Their analyses supported two additional factors: supervision and technical safety guidance. Glatz et al. (2018) examined internet-specific parental efficacy and internet-specific parenting practices. Using a 10-item scale (adapted from items used by Livingstone and Helsper (2008) and Sonck et al. (2013)), across three dimensions—active mediation, restrictive mediation, and monitoring—Glatz and colleagues found that monitoring and restrictive parenting practices loaded onto the same factor, thus indicating a two-factor solution.

The lack of consistency across these studies in identifying coherent and consistent dimensions of digital parental mediation strategies suggests a need for a more comprehensive effort to identify the dimensions of parental mediation of ICT and the behaviors that represent such dimensions. In addition, these studies did not incorporate more recently described aspects

of digital parenting, including participatory mediation (Clark, 2011), investigatory mediation (Jiow et al., 2017), and modelling (Vaala & Bleakely, 2015). Participatory mediation parallels co-use but also involves parents and children using technological platforms together to (a) strengthen parent-child relationships, (b) learn about the virtual activities and interactions in which children engage, (c) monitor online social networks and interactions, (d) learn about how technologies work, and (e) learn about new technologies from children/adolescents (Clark, 2011). As a result of shifts in parental norms to be more child-centered and less defined by hierarchical parent-child power structures, and the ubiquity of digital technology, participatory mediation is now a commonplace practice for parents (Clark, 2011). Co-use and participatory mediation are related to parent characteristics. Connell et al. (2015) found that mothers engaged in less video game co-play than fathers, suggesting that fathers may be more willing to engage in participatory mediation strategies to learn about new games or applications than mothers. Connell and colleagues (2015) also found that the more time parents spent on their own devices, the more likely they were to co-engage on video game platforms and tablets. In sum, the more comfortable and confident parents feel with technology, the more likely they are to engage in participatory strategies. This is a double bind for parents who feel less technologically capable, as they will be less likely to engage in participatory strategies to increase technological competence and self-efficacy.

A critique of the existing parental mediation literature has been a lack of attention to the knowledge and skills parents need to have to engage in mediation strategies. Parents must have the necessary information and skills to know what to talk about when engaging in active mediation and co-use, and to be able to set effective and appropriate boundaries that are developmentally appropriate (Jiow et al., 2017). Investigative mediation consists of “information

seeking and skill acquisition" practices (Jiow et al.; p. 319). This may involve visually assessing digital content, seeking out information from other sources, playing video games or developing social media platforms to better understand them, or asking others for help. Investigative mediation augments the effectiveness of all other forms of parental mediation and helps parents to differentiate their strategies based on the technology and their child's characteristics, including developmental age. Given the rapid pace of technological innovation, investigative and participatory mediation are strategies that help parents keep pace with their children and their changing needs.

Modelling is another tool parents employ to help them mitigate risks associated with digital technology (e.g., Hefner et al., 2019; Vaala & Bleakely, 2015). Parents themselves are heavy users of social media and ICT, and parent technology use is correlated with that of their children and adolescents (Vaala & Bleakely, 2015). Parents' problematic mobile phone involvement (PMPI) is a significant predictor of child PMPI (Hefner et al., 2019). How parents utilize their devices and platforms sets an example for their child(ren)/adolescent(s) and is an important aspect to be considered in the digital mediation toolkit. These two shortcomings (i.e., (a) the lack of consistent dimensions in previous measurement studies and (b) the omission of newly delineated dimensions of digital mediation) limit the extent to which scholars, policy makers, and parents can draw overarching conclusions about the efficacy of digital parental mediation strategies.

Digital Parental Mediation and General Parenting Style

Some researchers have explored the intersections between digital-specific parenting practices and parenting in general, and how these constructs similarly or differentially relate to antecedents and outcomes of interest. Livingstone and Helsper (2008) adopted an ecological

perspective: “parental mediation strategies represent ways in which the family reproduces its values in the face of external meaning systems” (p. 582). In essence, Livingston and Helsper argued that digital mediation is a tool parents use, consistent with their general parenting style and goals. This supposition is supported by positive correlations and similar directions of effects demonstrating a strong link between general and digital-specific constructs.

Parents of children under the age of 12 who say they are doing a good job as a parent are more likely to be confident in knowing how much screen time is appropriate (Auxier et al., 2020). In other words, parents who feel more efficacious in general also experience more digital-specific parenting self-efficacy, a finding supported by the convergent validity between Gatz et al.’s (2018) measure of internet-specific parenting self-efficacy and general parenting self-efficacy. Warren (2017) reported that those parents who used more restrictive, active, and co-use mediation strategies across devices also reported more general parental involvement and parent-child communication. Most studies have found differences of magnitude and direction in how restrictive mediation, active mediation, monitoring, and co-use are associated with general parenting constructs. For example, Hefner et al. (2019) found that parents who reported higher parent-child attachment also reported engaging in more active mediation and monitoring, but not restrictive mediation. In addition, they found that those with secure parent-child attachments and more active/co-use mediation had children with less problematic mobile phone involvement (PMPI), but those parents who used the most restrictive mediation had children with higher PMPI, suggesting different directions of effects than found by Warren (2017). Vaala and Bleakley (2015) reported that adolescent-reported general parental monitoring was more strongly related to adolescents’ internet behavior than internet tracking, internet restrictive practices, and co-use. Their findings suggest that monitoring in general is central to parents’ influence on

adolescents' digital lives and that internet tracking, restrictions, and co-use are not substitutes for general parental monitoring. Vaala and Bleakely (2015) suggested that child disclosure is a large component of digital monitoring; it is likely that close parent-child relationships are central to navigating the balance between minimizing online risks and maximizing the benefits of digital technology (Jeffrey, 2020). In a cluster analysis of parent's digitally mediated and in-person parental monitoring, Rudi and Dworkin (2018) found a high in-person/high digital monitoring group and high in-person/low digital monitoring group but did not find a low in-person/high digital monitoring cluster. They hypothesized that this combination was not found because digitally mediated monitoring is a distinct construct supplemental to general parental monitoring.

General and digital-specific parenting are interrelated. Padilla-Walker et al. (2012) included general parenting constructs (i.e., maternal autonomy granting, maternal connection, and maternal regulation) as time invariant predictors of the slope and intercept of latent growth curves of restrictive mediation, active mediation, and deference (i.e., the choice not to intervene). They found that the negative slope of restrictive monitoring was significantly steeper for mothers who had higher autonomy granting style. In addition, maternal autonomy granting was positively related to the intercept of deference. These findings suggest that mothers high in autonomy granting may understand their adolescent's need for autonomy and grant their child more freedom over their media use at the start of adolescence and relax restrictions earlier than parents who are lower in autonomy granting style. Padilla-Walker et al. also reported that maternal regulation was predictive of the active mediation intercept; mothers who had strong relationships with their children and engaged in frequent discussions with their children were more likely to engage in digital mediation practices.

This poses a quandary for researchers of digital parental mediation: How to disentangle general and digital-specific parenting attitudes, strategies, and skills? While we know these constructs operate synergistically within the family system, the development of a measure of digital-specific mediation will facilitate the identification and evaluation of what promotes positive outcomes and mitigates risk within this specific aspect of the parent-child relationship, an aspect that is highly concerning for many parents (Auxier et al., 2020). We hypothesize that a measure of digital mediation with a bifactor internal structure would best reflect this duality. Bifactor models have two components: (a) a general factor that represents shared variance across all the items in the scale, and (b) group factors that represent additional shared variance among clusters of items (Reise, 2012). The general factor reflects a construct common to all the items in the scale, while the group factors represent separate constructs. Reise (2012) argued that this structure is most appropriate when "…the researcher expects a response to primarily reflect a strong common trait, but there is multidimensionality cause by well-defined clusters of items from distinct subdomains" (p. 692). We believe this structure is appropriate for a measure of digital parental mediation, with the general factor representing covariance related to parenting style and the parent-child relationship in *general*, while the group factors represent covariance of *digital-specific* mediation dimensions.

The Digital Parental Mediation Scale

This purpose of this study was to develop and validate a measure of parents' attitudes about mediation strategies related to digital technology and to explore associations between digital parental mediation, pertinent demographic variables, and related parenting constructs to explore construct validity of the digital-specific mediation dimensions. Based on the existing theoretical and empirical work focusing on the conceptualization and measurement of digital

parental mediation, we developed the Digital Parental Mediation Scale (DPMS). We initially hypothesized seven dimensions of digital parental mediation: (a) discursive mediation, (b) restrictive mediation, (c) monitoring, (d) co-use, (e) modelling, (f) technological agency, and (g) developmental appropriateness.

Discursive mediation is when parents engage in discussions with their children and adolescents about digital and social technology (Clark, 2011; Jiow et al., 2017). Existing research suggests that discussions about the benefits and risks associated with digital technology are protective (Nathanson, 2015). *Restrictive mediation* (Nathanson, 1999), also termed gatekeeping (Jiow et al., 2017), reflects the use of age- and context-appropriate restrictions and boundaries on digital content, social connections, and time spent online. In the context of digital mediation, *monitoring* reflects a technologized style of parental monitoring, defined as "a set of correlated parenting behaviors involving attention to and tracking of the child's whereabouts, activities, and adaptations" (Dishion and McMahon, 1998, p. 61). *Co-use* is when parent and child use digital technology together (e.g., playing games, interacting over social media platforms, text messaging) (Nathanson, 2015). *Modelling* reflects parents' recognition of their own digital behavior as a model for their children (Vaala & Bleakley, 2015). *Technological agency* represents parents' choices to learn about and use about the technology and platforms their children are utilizing (Primack, 2018). Finally, *developmental appropriateness* was hypothesized to represent parents' differentiated mediation strategies dependent upon the age and developmental stage of their child(ren) (Jeffrey, 2020; Padilla-Walker, 2012).

Method

Procedure

These seven hypothesized dimensions served as the framework for a semi-structured focus group held with 12 mothers of pre-adolescents and adolescents in November 2019 (M_{age} = 46), recruited through snowball sampling at a local middle school. Sixty-nine potential items for the DPMS were generated based on focus group responses. This survey was then distributed to parents of at least one child ages 5 to 18 online in January 2020. Participants were recruited through CloudResearch (previously known as TurkPrime), an online research platform that recruits participants from PrimePanels (Litman et al., 2017). Participants were financially compensated through CloudResearch for their participation. Institutional review board (IRB) approval was granted for both the focus group and survey studies.

Participants

Using Stata/SE 17.0, data were cleaned and organized. In keeping with online data cleaning procedures, participants who completed less than 80% of the survey (n = 10), who had no children (n = 3), and who took less than 588 seconds (i.e., time it would take to read all 12,000 characters in the online survey for a participant in the 95th percentile of reading speed) (n = 82) were removed from the sample (Buchanan & Scofield, 2018), leaving 460 participants in the current study. Participants in the study were between 20 and 69 years of age (M = 40.67, SD = 7.20), 69.6% were married, and had an average of 2.4 children with a mean age of 12.7 years (SD = 3.69). Of the 460 participants, 61.1% identified as cisgender female and 38.9% identified as male (38.5% cisgender, 2 transgender). The sample self-identified as 75.2% White, 11.3% Black or African American, 7.8% Hispanic or Latino, 2.0% Asian, and 3.7% other. Participants were diverse in terms of education and income (see Table 1).

Table 1. Study 2: Sample Educational Attainment and Household Income

Highest Educational Attainment	*N* (%)	Household Income	*N* (%)
Less than HS degree	11 (2.4)	Less than $10,000	24 (4.3)
HS graduate (or GED)	81 (17.5)	$10,000-29,999	73 (13.2)
Some college but no degree	93 (20.1)	$30,000-49,999	91 (16.4)
Associate degree	60 (13.0)	$50,000-69,999	91 (16.4)
Bachelor's degree	82 (17.7)	$70,000-89,999	62 (11.2)
Master's degree	105 (22.7)	$90,000-149,999	114 (20.5)
Doctoral degree	18 (3.9)	$150,00 or more	100 (18.0)
Professional degree (e.g., JD, MD)	13 (2.8)		

Measures

Digital Parental Mediation Scale.

Participants completed the 69-item Digital Parental Mediation Scale (DPMS). Parents rated the perceived importance of each item ("How important do you think it is to do the following with your child(ren) or adolescent(s)?") on a 5-point Likert scale (1-*not important*, 5-*very important*).

Perceived Parenting Self-Efficacy and Influence.

The efficacy subscale of the Parental Locus of Control (PLOC) scale (Campis et al., 1986) measured parents' global feelings of confidence with regard to parenting. Participants rated items on a six-point Likert scale (1-*disagree strongly*, 6-*agree strongly*). Higher scores on the parenting efficacy subscale (7 items, $\omega = 0.77$) indicated that parents felt more effective in their parenting skills. The 5-item Perceived Influence Scale (PIS; Freedman-Doan et al., 1993) assesses the extent to which parents feel they can influence their child's behavior with regards to school, peers, and externalizing behaviors. Participants rated how much influence they felt that

had on a seven-point Likert scale (1-*very little*, 7-*a great deal*), with higher scores indicating greater perceived influence ($\omega = 0.89$). Both constructs were modeled as latent variables (see supplemental materials).

Digital Technology Usage and Experiences.

Participants indicated the extent to which they and their child(ren) used different types of digital devices (e.g., desktop, laptop, smartphone, mobile phone, tablet, smartwatch, gaming console, kindle, other). The total of all items used served as index scores of: (a) number of parent devices ($M = 4.26$, $SD = 1.85$) and (b) number of child devices ($M = 3.60$, $SD = 1.62$). Participants indicated the extent to which they and their child(ren) or adolescent(s) use a variety of software application types for different purposes (e.g., photo and video sharing, texting and messaging, gaming, reading and education, music and podcasts, entertainment (e.g., Netflix), news, and other) to yield (a) number of parent applications ($M = 4.92$, $SD = 1.63$) and (b) number of child applications ($M = 4.34$, $SD = 1.66$). Participants estimated their own average screen time per day in hours ($M = 7.32$, $SD = 3.09$) and their child(ren)'s average screen time per day in hours ($M = 5.77$, $SD = 2.99$). Participants rated their confidence in using digital technology ("How confident do you feel in your ability to use digital technology (e.g., smartphones, tablets, gaming systems, computers, etc.)?") on a 13-point scale ($M = 8.41$, $SD = 1.65$), their worry about their child(ren)'s use of digital technology ("Overall, how worried are you about your child(ren)'s or adolescent(s)'s use of digital devices?") on a five-point Likert scale (1-*not at all worried*, 5-*extremely worried*) ($M= 3.69$, $SD = 4.27$), and their frequency of conflict about digital technology ("Overall, how often do you experience conflict with your child(ren) or adolescent(s) over their use of digital devices?") on a five-point Likert scale (1-*never*, 5-*always*) ($M = 2.64$, $SD = 0.97$).

Parent and Child Characteristics.

Parents self-reported all parent and child characteristics. Parent age was treated as a continuous variable (range from 20 to 69). Parent gender reflects self-identified gender identity, regardless of sex-assigned at birth (0 = *male*, 1 = *female*). Educational attainment was recoded to be dichotomous (0 = *some college or less,* 1 = *college graduate or more*), as was marital status (0 = *not currently married*, 1 = *currently married*). Income was treated as a continuous variable (1 = *less than $10,000 per year* to 7 = *more than $150,000 per year*), as was the number of children in the family. Race/ethnicity was recoded into two dummy variables, one representing participants who self-identified as Black (1 = *Black,* 0 = *all others*) and one representing participants who self-identified as Hispanic (1 = *Hispanic,* 0 = *all others*), with White and other racial/ethnic identities as the reference group.

The age and gender of children were also included in the current study. We asked participants to report on these two variables for up to six children. To address that participants reported on numerous children and/or youth, we created a variable to reflect the age of the oldest child across all six possible entries. This maximum age variable was then used to create a binary variable to reflect potential developmental differences between how parents mediate digital technology for children and adolescents (0 = *13 years and younger*, 1 = *14 years and older*). Child/adolescent gender was coded into three categories: (a) families that had only female child(ren), (b) families that had only male child(ren), and (c) families that reported having both male and female children. This was operationalized by two dummy variables, one representing female-only families (1 = *female only*, 0 = *all others*) and another representing male-only families (1 = *male only*, 0 = *all others*), leaving parents who reported having a mix of genders as the reference group.

Analytic Strategy

We used Stata/SE (version 17.0) to examine the distributions of the DPMS indicators for skewness (cutoff values of < -2 and > 2) and kurtosis (cutoff value of > 4; Bowen & Guo, 2011). Only one DPMS item ("Avoid texting and driving") fell outside the cutoff values for skewness (-2.286) and kurtosis (5.347) and was subsequently removed from analyses.

Focal analyses were conducted using structural equation modelling (SEM) using MPlus 8.6 (Muthén & Muthén, 2017). All analyses utilized a maximum likelihood robust (MLR) estimator and missing data were handled by full-information maximum likelihood estimation (FIML). We used the following fit indices to evaluate and compare the acceptability of the models: (a) χ^2 values and associated *p* values, (b) root mean square error of approximation (RMSEA) ≤ 0.06 and its 90% confidence interval upper-bound ≤ 0.08, (c) comparative fit index (CFI) ≥ 0.95 for good fit and ≥ 0.90 for acceptable fit, and (d) standardized root mean square residual (SRMR) ≤ 0.08 (Brown, 2015; Hu and Bentler, 1999). In addition to comparing nested models using chi-square difference tests (which are sensitive to sample size), we also utilized change in CFI (≤ -0.01) as a marker of negligible difference between models (Cheung & Rensvold, 2002). As we used the MLR estimator, we employed the Satorra-Bentler (2010) adjusted chi-square difference to calculate if the differences between nested models were significant.

Data from the full sample (N = 460) were randomly separated into two sub-samples for exploratory and confirmatory factor analyses (completed using the *splitsample* function in Stata). First, using sub-sample A, exploratory bi-factor analyses (EBFA) were completed using a bi-geomin (oblique) rotation (Jennrich & Bentler, 2012; Reise, 2012). EBFA extracts all hypothesized subscale factors plus an additional general factor. In this instance, we hypothesized

that this general factor may represent general parenting skills and practices, removing shared "parenting" variance, leaving the sub-scale factors to represent attitudes about digital-specific parenting. The number of factors to extract was selected by examining the Kaiser criterion (eigenvalues > 1.0), the scree test, parallel analysis, comparing model fit (Δ CFI, Δ χ^2), and substantive evaluation (Brown, 2015). Subscale factors were examined for small factor loadings and low factor determinacy, and individual items were evaluated for low communality (i.e., low loadings on all factors besides the general factor) and significant cross-loadings on more than one subscale.

Utilizing sub-sample B, confirmatory factor analyses (CFA) were then conducted to compare alternative model structures: one-factor model (wherein all items would load onto a single factor), correlated-factors model (wherein items would load onto separate but related factors), second order model (wherein items would load onto separate factors, which in turn would load onto a higher order parental mediation factor), and a bifactor model (replicating the EBFA above with one general factor and digital-specific factors). Following these initial models, the bifactor model was respecified based on examination of residual variance, modification indices, factor loadings, and substantive issues (Brown, 2015). Finally, this respecified model was completed using the full sample.

We then completed measurement invariance testing of the bifactor model across mothers and fathers in the full sample using a stepwise, forward approach: configural invariance (i.e., equal factor structure), metric invariance (i.e., equal factor loadings), scalar invariance (i.e., equal intercepts) (Sass, 2011). When needed (i.e., the Δ χ^2 was significant), we tested a partial scalar invariance model by freeing the most non-invariant item intercept until the partial scalar model was not significantly different from the metric model (Dimitrov, 2010). We also analyzed

internal consistency reliability of the bifactor model as specified by Hammer and Tolland (2016). Omega and omega hierarchical were computed using a the Bifactor Indices Calculator (Duebner, 2017), a Microsoft Excel-based tool for calculating bifactor-specific internal consistency reliability statistics, including omega (ω), omega hierarchical (ω_h), and explained common variance (ECV), which estimate the ratio of true score variance to observed score variance taking into account the bifactor structure of the model (McNeish, 2018). Following testing for measurement invariance and internal consistency reliability.

Results

Exploratory Bifactor Analyses (EBFA)

The EBFA, completed using sub-sample A, indicated that 10 factors had eigenvalues greater than 1, while the parallel analysis and scree plot suggested extracting four factors. Fit indices for the 2-factor to 8-factor models are displayed in Table 2. One-factor models are not applicable to EBFA analyses because there are a minimum of two factors—the general factor and an additional dimension. The RMSEA was lowest, and the CFI was highest, for the 7-factor solution (i.e., one general factor, six subscale factors). In addition, the 7-factor solution had a significantly lower χ^2 value than the 8-factor solution and the 8-factor solution was not significantly better than the 7-factor solution. However, closer examination of the loadings in the 7-factor and 6-factor solutions revealed that the 7th and 6th factors in these solutions had low factor determinacy, suggesting that these factors likely represented measurement artifacts and the 6- and 7-factor model was not a viable solution.

Table 2. Study 2: Fit Indices for EFA Models (Sample A)

Model	*N*	χ^2	*df*	*p*	AIC	RMSEA	Upper-bound	SRMR	CFI	Δ CFI	Δ χ^2	Δ $\chi^2 p$	Comparison
2-factor	221	4522.16	2209	<.001	37609.64	0.069	0.072	0.056	0.757				
3-factor	221	4019.98	2142	<.001	37091.80	0.063	0.066	0.046	0.803	0.046	371.77	<.001	2-factor
4-factor	221	3634.71	2076	<.001	36747.36	0.058	0.061	0.040	0.836	0.033	316.04	<.001	3-factor
5-factor	221	3466.23	2011	<.001	36604.95	0.057	0.060	0.036	0.847	0.011	145.57	<.001	4-factor
6-factor	221	3374.41	1947	<.001	36480.94	0.057	0.061	0.034	0.850	0.003	102.48	.0017	5-factor
7-factor	221	3133.63	1884	<.001	36354.93	0.055	0.058	0.031	0.869	0.019	239.53	<.001	6-factor
8-factor	221	3192.37	1822	<.001	36313.13	0.058	0.062	0.029	0.856	-0.013	52.93	0.787	

As a result, we decided to utilize the 5-factor solution. This decision was supported by (a) equal RMSEA values in both models and (b) that the 6-factor solution had a Δ CFI of 0.003 from the 5-factor model, suggesting that the 6-factor solution was negligibly better than the 5-factor solution. Further, the 5-factor model made substantive sense; the hypothesized subscales (discursive mediation, restrictive mediation, monitoring, co-use, education, developmental appropriateness, and modelling) collapsed into four theoretically coherent dimensions:

1. Fifteen *Discursive Mediation* (DM) items were estimated, but only eight loaded strongly onto the factor. The remaining items were dropped due to low communality (six items) and cross-loading onto two subscale factors (one item*)*, resulting in 8 items for this factor.
2. Items from the originally separate hypothesized dimensions of restrictive mediation and monitoring dimensions loaded onto a single factor, termed henceforth *Restrictive Mediation and Monitoring* (RMM). Substantively, both hypothesized dimensions reflect rule-setting and rule-enforcing parenting practices. Of the initial 18 items (11 restrictive monitoring, seven monitoring), six items from each of the restrictive and monitoring dimensions loaded significantly onto the RMM factor. The other six items did not load significantly onto any

subscale factor and were subsequently dropped. In addition, two boundary-related items from the developmental appropriateness dimension loaded significantly onto RMM ("Set time limits based on their age and maturity" and "Set content limits based on their age and maturity"). Similarly, one discursive item ("Discuss limits on content viewed online") also loaded onto the RMM factor, resulting in a total of 15 items for this factor.

3. Items from the originally separate hypothesized co-use and parental education dimensions loaded onto a single factor, termed henceforth *Participatory Mediation* (PM). Both dimensions were intended to reflect parents' active engagement with technology as a form of connection and communication with their child(ren) or adolescent(s). All 10 original co-use items loaded onto this factor, as well as three of the parental education items. The other four parental education items did not load significantly onto any subscale factor and were dropped, resulting in a total of 13 items for this factor.
4. Nine (of 10) items from the originally hypothesized modelling dimension loaded significantly onto the *Mediation by Modelling* (MM) factor. One item ("Talk with your partner and/or family members about modelling appropriate digital behavior") did not load significantly onto any subscale factor and was dropped from subsequent analyses, leaving 9 items for this factor.

Confirmatory Factor Analyses (CFA) and Measurement Invariance

Following the EBFA, we used sub-sample B to examine how well these factors and items fit measurement models (i.e., CFAs) with different internal structures (one factor model, correlated 4-factor model, second-order model, and bifactor model; see Table 3). Boomsma (2000) recommended comparing multiple models to ensure the selected model is the best fit to

the data, which was necessary to ensure that the bifactor model explained more variance than the models without a general factor.

Table 3. Study 2: Comparison of CFA Measurement Models

Model	*N*	Parameters	χ^2	*df*	*p*	AIC	RMSEA	RMSEA Upper-bound	SRMR	CFI
One factor	224	132	3022.96	902	<.001	25874.73	0.102	0.106	0.113	0.616
4-correlated factors	224	138	1846.22	896	<.001	24832.95	0.069	0.073	0.079	0.828
Second order	224	140	1848.44	898	<.001	24382.05	0.069	0.073	0.080	0.828
Initial Bifactor	224	182	1600.07	852	<.001	24098.00	0.063	0.067	0.053	0.865
Revised Bifactor	224	186	1485.66	848	<.001	23969.65	0.058	0.063	0.051	0.895
Bifactor (Whole Sample)	441	186	1494.62	848	<.001	46931.12	0.042	0.045	0.040	0.934

The bifactor model (i.e., a general factor and four subscale factors) had the best fit to the data, with the RMSEA, RMSEA upper-bound, and SRMR having good fit and the CFI acceptable fit. Analysis of the modification indices and residual variances indicated that three items from the hypothesized developmental appropriateness dimension had poor fit; one item ("Allow them more privacy as they grow in age and maturity") had a high residual variance (0.859) and two items ("Set time limits based on their age and maturity" and "Set content limits based on their age and maturity") did not load significantly onto the restrictive mediation and monitoring (RMM) subscale. In addition, the modification indices and residual variances indicated that the model would fit the data better if the uniqueness of items specific to social media (items 20, 21, and 22) and gaming (item 23 and 24) were correlated. With these respecifications (i.e., dropping three items and correlating the uniqueness of five items), the bifactor model fit the data well; all model fit indices suggested good fit. In addition, the Akaike information criteria (AIC) was lowest for the respecified bifactor model. We also ran this model on data from the whole sample; comparison to pre-specified goodness-of-fit cutoff values

($\chi^2(848) = 1494.62$, $p < .001$, RMSEA = 0.042 [Upper-bound 90% CI = 0.045], SRMR = 0.040, CFI = 0.934) suggested that the model fit the data well. The factor loading for each item from this model are displayed in Appendix I, with the MPlus code for the model in Appendix II. The findings from the EBFA and CFA models suggest that a significant portion of the variance among the digital-specific subfactors can be explained by a general factor, which may reflect that digital parenting attitudes are shared with parenting attitudes in general, but also have digital-specific unique variance.

Table 4 displays fit indices for the measurement invariance models of the DPMS bifactor model with respect to mothers ($N = 280$) and fathers ($N = 180$). A full explanation of these analyses can be found in the supplemental materials; we found that the partial scalar invariance model did not significantly worsen model fit when compared to the metric invariance model ($\Delta\chi^2(41) = 43.633$, $p = 0.210$ Δ CFI < 0.001). This suggests that the DPMS works similarly for mothers and fathers; the same construct is being measured by the DPMS in both groups and any differences between these groups will be because of different factor-level intercepts (i.e., means) and variances.

Table 4. Study 2: Fit Indices for Measurement Invariance Testing (Mothers/Fathers)

	Configural	Metric	Scalar	Partial Scalar [b]
N	440	440	440	440
Parameters	371	289	250	252
χ^2	2693.71	2748.22	2803.19	2794.19
df	1697	1779	1818	1816
p	<.001	<.001	<.001	<.001
$\Delta\chi^2$ [a]	-	81.78	53.85	43.633
Δ *df*	-	82	39	41
$\Delta\chi^2$ *p*	-	0.486	0.057	0.210
Comparison	-	Configural	Metric	Metric
AIC	46722.62	46721.24	46687.18	46681.18
RMSEA	0.052	0.050	0.050	0.049
Upper-bound	0.055	0.053	0.053	0.053
SRMR	0.082	0.087	0.088	0.088
CFI	0.906	0.909	0.908	0.908
Δ CFI		0.003	0.001	0.000

[a] Satorra-Bentler $\Delta\chi^2$.

[b] Two item intercepts freed in partial scalar model. Both items were specific to online gaming.

Dimensionality and Internal Consistency

Paralleling the theoretical development of the DPMS, quantitative findings support the multidimensional bifactor structure of the measure. Hammer and Toland (2016) suggest three signs that bifactor models are appropriate: (a) subscale intercorrelation > 0.3, (b) first order factors loading onto second order factor at > 0.5, and (c) the ratio of the first to second eigenvalue is > 3. The DPMS met all three signs: (a) intercorrelations of the subscale factors were greater than 0.5 in the four-correlated factor model, (b) first order factor loadings were 0.650 in the second-order factor model, and (c) the eigenvalue ratio was 5.74. In addition, the

explained common variance (ECV) of the general factor was 0.558, less than suggested 0.85 cutoff for a unidimensional model, suggesting that these data were not best represented by a one-factor model (Stucky et al., 2014).

Table 5 summarizes the internal consistency of the DPMS; the omega of the general factor (0.973), discursive mediation (0.896), restrictive mediation (0.952), participatory mediation (0.935), and modelling (0.933) were high. However, when we used the omega hierarchical to account for the variance explained by the general factor, the reliabilities of digital-specific dimensions were lower, with three falling below the 0.5 cutoff for independent use (Hammer & Toland, 2016). This finding is substantively coherent; we expected digital parenting skills and strategies to largely mirror parenting practices in general (i.e., for a general parenting factor to explain a large proportion of the variance) and for the remaining variance to reflect digital-specific attitudes. We recommend caution in utilizing the DPMS subscales separately from the latent bifactor model or using a sum-score approach (McNeish & Wolf, 2020). Instead, we recommend using a latent variable bi-factor measurement model (in an SEM framework) to estimate the optimal-weighting and variance/covariances of the general parenting factor and four sub-factors (McNeish & Wolf, 2020). Within the structural model, the digital-specific subfactors can then specified in regression equations without the general parenting factor because it is still part of the overall model. Alternatively, in the interests of parsimony, factor scores for each of the sub-factors can be saved and used in subsequent analyses, although this approach is inferior at estimating error than using a latent variable approach.

Table 5. Study 2: Internal Consistency of the Bifactor Model

	ω	ω_h	ECV
General parenting factor	.973	.786	.558
Discursive mediation	.896	.147	.211
Restrictive mediation & monitoring	.952	.243	.325
Participatory mediation	.935	.803	.842
Modelling	.933	.288	.325

Note. ω = omega; ω_h = omega hierarchical; ECV = explained common variance.

Structural Models

To examine construct validity, we extended the bifactor measurement model to examine associations between the DPMS subscales and relevant demographic and parenting variables. We sought to describe who was endorsing higher/lower levels on the DPMS subscales; we regressed the DPMS subscales onto demographic characteristics, technology usage and attitudes), and two general parenting scales. These structural models all had good fit to the data, with fit indices within acceptable ranges (RMSEA ranged from 0.040-0.048, SRMR ranged from 0.040-0.073 and CFI ranged from 0.916-0.934). Results for these structural models are summarized in Table 6 and delineated in detail in the supplemental materials. As expected, the DPMS general factor and subscales were differentially associated with theoretically relevant independent variables in the model.

Table 6. Study 2: Structural Model Regression Coefficients of Person Characteristics and Perceived Parenting Influences on DPMS Subscales

			GPF		DM		RMM		PM		MM	
	M	*SD*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Demographic Predictors												
Mother	0.64	0.48	**0.134****	**0.050**	-0.077	0.046	-0.035	0.054	**-0.248*****	**0.047**	**-0.102***	**0.050**
Parent age	40.69	7.17	-0.059	0.048	0.038	0.044	-0.072	0.051	0.084	0.045	0.029	0.052
College educated	0.47	0.50	-0.043	0.052	**0.092***	**0.045**	-0.049	0.051	**0.226*****	**0.044**	**0.114***	**0.048**
Married	0.69	0.46	-0.038	0.058	**0.119***	**0.047**	**-0.134***	**0.053**	**0.188*****	**0.044**	**0.201*****	**0.052**
Income	4.43	1.84	-0.057	0.057	**0.142****	**0.052**	**0.134****	**0.052**	**0.283*****	**0.043**	**0.240*****	**0.049**
Race/ethnicity: Black	0.11	0.32	-0.014	0.055	0.080	0.051	-0.053	0.052	0.076	0.101	0.006	0.908
Race/ethnicity: Hispanic	0.08	0.27	-0.041	0.050	0.068	0.036	0.055	0.039	0.058	0.034	0.065	0.043
# Children	2.41	1.29	-0.015	0.059	0.062	0.042	**0.131****	**0.046**	0.032	0.052	0.074	0.046
Child age ≥ 14	0.66	0.47	-0.177	0.105	**0.240***	**0.097**	**-0.137***	**0.106**	**0.458*****	**0.107**	**0.316****	**0.120**
Child gender: girls only	0.49	0.50	0.070	0.068	-0.038	0.047	-0.068	0.061	-0.005	0.058	-0.019	0.055
Child gender: boys only	0.34	0.47	0.016	0.069	-0.065	0.051	-0.070	0.060	-0.071	0.059	-0.088	0.059
Technology Usage & Attitudes												
Parent # devices	4.26	1.85	0.095	0.057	0.099	0.053	0.093	0.060	**0.217*****	**0.044**	**0.177*****	**0.051**
Parent # applications	4.92	1.63	0.091	0.032	0.043	0.026	-0.008	0.033	**0.107*****	**0.029**	0.035	0.033
Parent screen time	7.32	3.09	0.040	0.050	**0.130****	**0.046**	**0.127***	**0.050**	**0.279*****	**0.044**	**0.118***	**0.052**
Child # devices	3.60	1.62	0.007	0.058	**0.131****	**0.049**	0.093	0.055	**0.205*****	**0.044**	**0.163*****	**0.050**
Child # applications	4.34	1.66	0.001	0.051	**0.115****	**0.045**	0.011	0.050	**0.208*****	**0.046**	**0.106***	**0.048**
Child screen time	5.77	2.99	**-0.147****	**0.048**	**0.159*****	**0.040**	0.013	0.050	**0.294*****	**0.043**	**0.127****	**0.046**
Parent tech confidence	8.41	1.65	**-0.269*****	**0.043**	-0.020	0.034	-0.044	0.063	**0.116***	**0.055**	0.091	0.076
Parent tech worry	3.69	4.27	0.097	0.060	0.087	0.066	-0.086	0.057	0.095	0.050	0.053	0.064
Parent-child tech conflict	2.64	0.97	**0.179*****	**0.050**	-0.046	0.049	0.062	0.053	-0.002	0.052	-0.042	0.055
General Parenting Attitudes												
PLOC: Efficacy			**0.453*****	**0.069**	-0.103	0.084	**-0.231***	**0.093**	**-0.201***	**0.079**	**-0.179****	**0.085**
PIS: Influence			0.173	0.091	**0.196****	**0.076**	**0.212*****	**0.065**	**0.361*****	**0.054**	**0.184***	**0.080**

Note. All independent variables were modeled in separate structural models. GPF = general parenting factor, DM = discursive mediation, RMM = restrictive mediation and monitoring, PM = participatory mediation, MM = mediation by modelling, PLOC = Parental Locus of Control scale, PIS = Parental Influence Scale.

* $p \leq .05$, ** $p \leq .01$, ***$p \leq .001$.

Discussion

Our findings indicate that a bifactor model best represents the nature of parental digital mediation. Parental GPF and mediation subscale scores were associated differentially, by both pattern and direction, with demographics, technology-related attitudes, and parenting efficacy. Mothers scored higher on the GPF (but not digital mediation subscales) than fathers, consistent with a literature suggesting that mothers have greater availability and engage in more child caregiving overall than fathers (Connelly, 2015; Warren, 2017). Parents who reported higher conflict with their child or adolescent related to technology had higher levels of the GPF, a pattern not found with any of the digital mediation factors. It could be that parents who do not place as much importance upon digital-specific mediation practices (and thus more of their variance was explained by the GPF) have more conflict related to technology *because* they do not see these practices as necessary or important. Parents with higher tech-related confidence had significantly lower GPF scores; this suggests that parents who feel technologically confident are more apt to use digital-specific mediation practices (and thus less of their variance was explained by the GPF), because they have the knowledge and skills to help their child navigate activities and interactions in virtual contexts.

The GPF also had a different pattern of associations with general parenting attitudes (i.e., parenting efficacy and influence). Parents with higher global beliefs in their competence as parents had higher GPF, supporting our assertion that this factor represents variance related to parenting in general (i.e., parents who have high scores on the GPF are also more likely to feel that they parent well in general). However, we did not find significant associations between parents' feelings of influence and their GPF scores, although influence was significantly associated with the digital mediation factors. It appears that GPS represents general parenting-

related variance, while subscale factors are more reflective of attitudes about digital-specific practices. This has implications for how the measure should be employed in future research. We propose that researchers use a bifactor latent variable modelling technique when employing the DPMS, either by including the measurement model within SEM, or using saved factor scores of the subscales in subsequent analyses.

Parental endorsement of the distinct DPMS subscales varied based on several parental characteristics. As regressions were run in separate models, it is likely that parents' education, income, and technology use (i.e., number of parent and child devices and applications, and screen time) each reflect socioeconomic status (SES) to some extent. That each of these predictors were significantly related to all four of the digital mediation factors likely reflects that higher SES parents have more fiscal resources and availability to engage in mediation behaviors.

The subscale discursive mediation represents discussions between parents and their children/adolescents about digital technology. This subscale had the weakest loadings of the four subscales and the individual items had the highest loadings onto the general factor, reflective of the significant overlap between digital-specific discursive strategies and parenting in general. This is likely because most parents use discussion to support their children and mitigate risks across all facets of family life (Warren, 2017). Parents who felt they had more influence over their child's behavior placed more emphasis on discursive strategies, paralleling previous research (Krcmar & Cingel, 2016). This suggests that parents in this study who endorsed more digital-specific discursive strategies also felt they were better able to guide their child(ren)'s behavior in general. This could be because discursive mediation strategies provide opportunities for parent involvement, parent–child communication, and parent connection (Padilla-Walker at al., 2012; Warren, 2017). We know that parental mediation is but one component of the complex,

bidirectional, and ongoing negotiations between parents and their children about technology (Jeffrey, 2020), and it is therefore likely that discursive strategies work in both ways—as a way to exert influence and as a source of concern (through increased parental knowledge of online risks). Discursive strategies are a likely a powerful tool for parents to develop open lines of communication about online experiences, exert influence, and gain information about their child's activities and interactions online.

In contrast to Livingstone and Helsper (2008) and Sonck et al. (2013), but in keeping with Glatz et al. (2018), we did not find monitoring and restrictive mediation to be separate factors; items for both a priori dimensions loaded strongly onto one factor. This makes sense, given the blurring of boundaries between these two constructs in the digital realm. Parents can now set *and* enforce limits using technology (e.g., parents can set time and content limits using a software application or feature, and the same software can automatically monitor content and restrict access). Parents use rule setting, enforcement, and monitoring to mitigate their child's exposure to risks (Clark, 2011; Elsaesser et al., 2017; Jeffrey, 2020). Parents attitudes about restrictive mediation and monitoring (RMM) were not associated with demographics, technology usage and attitudes, or general parenting attitudes in the same pattern as DM, PM, and MM, suggesting that this factor is tapping into a dimension relatively distinct from the other dimensions (which substantively align more closely with positive parenting strategies). Parents with more children in their household were more likely to endorse RMM practices, suggesting that parents of larger families rely more on restrictive and monitoring practices, perhaps due to the higher total volume of their children's digital activity – or because they have learned more restrictive and monitoring practices given their increased digital mediation experience across children. RMM was less endorsed as a strategy by parents who had an adolescent child,

consistent with previous findings that restrictive practices decrease during adolescence (Glatz et al., 2018; Nikken & Jansz, 2014; Padilla-Walker et al., 2012; Sonck et al., 2013; Vaala and Bleakely, 2015; Warren, 2017). This body of literature suggests that restrictive mediation is likely curvilinear, peaking in late childhood, when youth begin to use digital devices and platforms independently, and reducing in adolescence as youth develop enhanced digital skills, autonomy, and self-regulation. RMM was also related to the numbers of hours parents reported that they spent using digital technology. Parents who see themselves as heavier users of technology might not want the same outcome for their children and so use more restrictive strategies. Alternately, more intense users may have less time to engage in other types of mediation and rely more heavily on RMM.

Participatory mediation was suggested by items from the hypothesized co-use and technological agency dimensions loading onto the same factor, suggesting that indicators for this factor assess the degree to which parents believe in engaging deeply with technology to connect with and learn from their children. In our study, parents of adolescents placed greater importance on participatory mediation strategies. This parallels findings of Rudi and colleagues (2015) and likely reflects patterns of more technological ownership and use by older adolescents. Fathers were more likely to see participatory strategies as important, in line with previous research suggesting that fathers may be more willing to engage in participatory mediation strategies to learn about new games or applications than mothers (Connell, 2015). Parents who used screens more intensely themselves also placed greater emphasis on participatory mediation, replicating the findings of Connell et al. (2015) who found that the more time parents spent on their own devices, the more likely they were to co-engage on video game platforms. This may be because of both availability (i.e., the more parents use their own device, the more opportunities they have

to connect with their child on social media, over text message, or on a gaming platform) and because these parents likely have increased comfort and skills with technology. This is a double bind for parents who have limited access to digital technology or high-speed internet, as they may feel less technologically capable and less likely to engage in participatory strategies to increase technological competence and self-efficacy. Supporting previous findings (e.g., Krcmar & Cingel, 2016), we found parent's higher feelings of influence were positively associated with PM, possibly because participatory mediation offers opportunities for parents to increase parental knowledge into their child's digital activities and interactions and to strengthen parent-child communication (Clark, 2011). However, our findings suggest that participants with higher general parenting efficacy did not value participatory mediation as strongly. As our study was cross-sectional, we cannot ascertain the directionality of this association; it could be that parents who do not feel efficacious use participatory strategies to increase their knowledge of their child's behavior, opportunities for connection, and to augment the influence/control they have in online contexts. Alternately, it could be that parents who feel globally efficacious do not feel it is necessary to engage in participatory mediation.

Our study is the first to incorporate parents' own modeling of technology engagement in measurement of parental mediation of digital technologies. Building upon the work of Vaala and Bleakley (2015) and Hefner et al. (2019), we modeled a subscale of the DPMS designed to assess the extent to which parents saw their own digital behavior as a tool in their approach to digital mediation. This factor had strong loadings and changed little from our initially hypothesized dimension when modeled in the bifactor structure. We found that parents who strongly endorsed modelling items had at least one adolescent in their household. Perhaps because adolescents use digital technology more intensely than younger children and parents feel

it is most important to model appropriate digital behavior to help them establish healthy habits. Our results related to parent's feelings of efficacy and influence parallel the pattern for DM, RMM, and PM; parents who reported higher efficacy placed significantly less emphasis on modelling, but feelings of influence over child behavior predicted more importance on modelling. As with PM, this pattern suggests that parents might view modeling as an avenue of increasing their control over digital-specific behavior, but not as part of more global feelings of parenting efficacy. Future studies should incorporate the construct of internet-specific parenting self-efficacy (Glatz et al., 2018), to determine if mediation strategies relate more closely to this digital-specific construct.

Limitations and Future Directions

The results of this study contribute in important ways to the parental mediation literature and provide scholars with a validated measure to assess different dimensions of this construct. However, parental mediation is not a unidirectional or static phenomenon; parental mediation strategies are "…dynamic, context-driven processes that are flexible, situated, and often negotiated between parents and their children" (Jeffrey, 2020, p. 19). Unfortunately, as our study design was cross-sectional, we were not able to identify causal relations between the DPMS and other observed variables or understand these processes over time. Further, mediation consists of bidirectional interactions between parents and children, but we only collected data from parents, not from children. We could not ascertain the degree which parental and child viewpoints of mediation strategies are congruent. Future studies should examine how children perceive their parents' mediation and how it correlates with parents' perceptions of their own digital mediation. Longitudinal study designs would help to elucidate how these complex processes, person characteristics, and contexts interrelate across developmental time. Another limitation is that our

study was completed using an online sample; parents who are lower-intensity technology users or technophobic were likely underrepresented in our sample; our results may be biased and represent parents who feel more confident in their technological understanding and skills. Our study also relied upon self-report measures which can bias results; this is especially true related to retrospective questions about behavior (e.g., questions about screen time). Previous studies (e.g., Hunt et al., 2018) have reported low correlations between objective and subjective measures of screen time. Future research should incorporate methods to assess these behavioral variables directly, possibly using screen shots of screen time applications or battery usage.

It is important to note that we collected our data at a unique moment in time. We recruited US-based participants and collected data throughout January of 2020, only a few weeks prior to the COVID-19-related shutdowns in the United States. Parental attitudes about digital technology and mediation may be characterized by different priorities post-pandemic. In addition, our sample was comprised of a cohort of parents who did not grow up with digital technology. In the coming years, cohorts for whom social media and smartphones were part of their childhood and adolescence will they themselves become parents; their styles of digital parental mediation will likely differ substantially from previous generations. The sample for our study was recruited in the US, a WEIRD (Western, Educated, Industrialized, Rich, and Democratic) society. As a result, generalizability beyond the US-context is limited; our findings are unique to the temporal and cultural context in which our data were collected.

Conclusion

The results of this study suggest that parental mediation of digital technology is a complex construct, not unlike parenting in general, and that there are digital-specific mediation practices that parents use to help manage their children's digital media use and exposure. By

incorporating an expansive to approach to digital mediation (i.e., dimensions beyond active mediation, restrictive mediation, and co-use) and a bifactor structure, we hope that our measure will be a valuable tool for future research and the development of educational interventions to support children, youth, and families in a dynamic and rapidly evolving technological environment.

CHAPTER IV: STUDY 3. STYLES OF DIGITAL PARENTAL MEDIATION: A MULTI-GROUP PERSON-CENTERED APPROACH

Abstract

Parental mediation of digital technology is influential within the dynamic and bidirectional process of digital socialization in which contemporary parents and children engage. Utilizing a person-centered approach and novel measure of digital parenting mediation strategies, the current identifies four latent profiles of digital parental mediation styles: one "high" and one "average" digital meditation style, and two "low" involvement styles, demarcated by parents' emphasis on mediation by modeling. These profiles were generalizable across mothers and fathers, and differentially associated with relevant covariates (including parent income and race, child age, parent and child screen time, and parents' technology-related confidence and worry). This study demonstrates the heterogeneity of digital parental mediation styles among a representative sample of parents in the United States.

Keywords: parental mediation, digital parenting, parenting styles, digital technology

Introduction

Today's children and adolescents were born into the digital era, but their parents were born and raised prior to the advent of the smartphone and social media. In the space of a generation, the developmental contexts in which children learn, communicate, and play have expanded to include the internet, a context without spatial or temporal restrictions and with affordances distinct from those in face-to-face settings (Navarro & Tudge, 2022). Compared to television, digital technology (including social media and online gaming) is more interactive, immersive, social, and portable (Jiow et al., 2017). Today's parents find themselves in an unprecedented situation as they attempt to guide children and youth through quickly evolving virtual contexts that they themselves are also learning to manage. Two-thirds of parents feel that parenting is harder today than it was 20 years ago, with 26% citing technology as the source of this additional difficulty (Auxier et al., 2020). Some parents do not feel that they have the knowledge or skills to be able to effectively mediate their children's engagement with digital technology, and that their children or adolescents typically have higher digital literacy and skills than they do (Krcmar & Cingel, 2016).

Research on digital-specific parenting has increased rapidly in the last decade, as scholars and practitioners have realized the growing need for evidence-based information for parents, practitioners, and policy makers. However, most of these studies assume homogeneity across parents, treating parents as having similar patterns of knowledge or skills about how to mediate the influence of digital technology (e.g., Connell et al., 2015; Glatz et al., 2018; Hefner et al., 2019; Jiow et al., 2017; Padilla-Walker et al., 2012; Rudi & Dworkin, 2018; Sonck et al., 2013; Vaala & Bleakely, 2015). To date, three studies have explored variability in constellations of parenting related to digital technology, and although these studies offer valuable person-centered

insights into specific aspects of parenting and technology, there is a lack of person-centered research incorporating multiple dimensions of digital-specific parenting (e.g., discussions, rules, modeling). Given that there is likely great diversity in how parents approach parenting related to technology, the identification of substantively and statistically significant subgroups could be a useful mechanism to assist researchers and practitioners in developing and implementing targeted education, interventions, and support. The aim of this study is to test whether distinct profiles of digital mediation styles can be identified, whether these profiles differ between mothers and fathers, and whether parent characteristics, household composition, and parent technology use and attitudes are differentially related to membership in these profiles.

Theoretical Framework

This study seeks to understand parents' digital mediation styles through the lens of the neo-ecological framework (Navarro & Tudge, 2022), integrating parenting style typologies (Baumrind, 1971, 1978, 1991, 2005; Darling & Steinberg, 1993) and parental mediation theory (Clark, 2011; Jennings, 2017; Nathanson, 1999). Neo-ecological theory largely parallels Bronfenbrenner's (2006) bioecological theory of human development but delineates two types of microsystems—physical and virtual—and emphasizes the importance of macrosystemic and macrotemporal influences in understanding development in an increasingly technologized world. Neo-ecological theory offers a theoretical framework in which to integrate the literature on parenting styles and parental mediation into the contemporary socio-temporal milieu (i.e., macrotime) and to explore why and how styles of digital parental mediation may differ from parenting styles in general. In addition, it offers insight into how digital parental mediation is synergistically interrelated with a multitude of ecological influences and highlights the necessity for exploration into the heterogeneity of the bidirectional process of digital socialization.

Bronfenbrenner and Morris (2006) defined macrotime as "the changing expectations and events in larger society, both within and across generations, as they affect and are affected by, processes and outcomes of human development over the life course" (p. 796). The introduction of the iPhone in 2007 demarcated a distinct temporal era, as the miniaturization, interactivity, and ubiquity of digital technology has resulted in a society in which technology is woven "into the fabric of daily life" (Weiser, 1991, p. 94). In some ways, macrotime has accelerated since the advent of digital and social media. Rather than seeing cultural change across generations, the advent of the internet has created virtual microsystems (Navarro & Tudge, 2022) in which "the internet is culture because it is shared, norms are developed, and these norms are transmitted to new generations of users, even as the new users, greater access, and technological innovation create new norms" (Greenfield & Zan, 2006, pp. 392–393). Within-generation cohorts are shorter, demarcated by the popularity of certain devices and platforms (Bohnert & Gracia, 2020). In addition, virtual microsystems are co-created by youth (boyd, 2008), allowing adolescents to have greater control of youth culture than in previous generations. When viewed from the lens of macrotime, it is understandable that the current cohort of parents (who largely did not have digital and social media in their childhoods) report concern or insecurity about how to support and guide their children when it comes to digital technology (Auxier et al., 2020; Krcmar & Cingel, 2016; Nikken & De Haan, 2015). Contemporary parents cannot reflect upon their own childhoods for guidance, feel pressure to keep up with the rapid pace of technological innovation, and may find themselves less knowledgeable and confident than their children. This macrotemporal transition raises questions as to the applicability of pre-digital era parenting theories, including those related to parenting style, socialization, and mediation.

Parenting styles represent different patterns of attitudes and beliefs parents display across domains of child rearing (Darling & Steinberg, 1993), operationalized as parents' person characteristics within a neo-ecological framework (Navarro & Tudge, 2022). Discussions of parenting styles are ubiquitous throughout the child development and family studies literature, with early discussions of the issues by Baumrind (1978, 1991) and Maccoby and Martin (1983). Parenting styles are typically modeled orthogonally on perpendicular axes of warmth/responsiveness and control/demandingness, resulting in four parenting styles: (a) authoritative (high warmth, high control), (b) authoritarian (low warmth, high control), (c) indulgent (high warmth, low control), and (d) neglectful (low warmth, low control) (Baumrind, 1978, 1991; Maccoby & Martin, 1983). In research focusing on the experiences of White, middle-class Americans, the authoritative style has consistently been linked to better academic outcomes (Spera, 2005). Research with families from an array of sociocultural backgrounds suggests that although authoritative parenting can be beneficial across a wide variety of contexts, the efficacy of parenting styles varies by race/ethnicity, culture, and socioeconomic status (Pinquart & Kauser, 2018; Spera, 2005). This raises questions about the efficacy of different parenting styles across *time*: Might optimal parenting styles also vary by temporal context? A recent study of parents in Spain, the United States, Germany, and Brazil found that the children of parents with an indulgent style had the highest scores on self-esteem and the internalization of social values, higher than those of authoritative parents (Garcia et al., 2019). These findings suggest parenting styles and their relation to child development may not be immutable across macrotime, paralleling heterogeneity across sociocultural contexts.

Darling and Steinberg's (1993) contextual model of parenting delineated parenting goals, practices, and styles, such that goals drive the selection of domain-specific practices, whereas

parenting styles represent the emotional environment in which children are raised. This parallels Bronfenbrenner's delineation of person characteristics (i.e., parents' goals, attitudes, and styles) as an influence on proximal processes (i.e., parent–child interactions). Parents utilize a specific set of skills and practices when trying to control, monitor, and support their children's use of media (Nathanson, 1999). These skills and practices, termed parental mediation, also "represent ways in which the family reproduces its values in the face of external meaning systems" (Livingstone & Helsper, 2008, p. 582). Consequently, parental mediation may also be viewed as a form of digital socialization, whereby parents attempt to guide the development of their child's values and beliefs about the internet (Smith et al., 2015). Digital socialization may also be viewed as a proximal process (Bronfenbrenner & Morris, 2006; Navarro & Tudge, 2022), as digital socialization is a bidirectional and synergistic series of parent–child interactions over time, with the goal of increasing children's digital competence.

Building upon the dimensions of digital mediation outlined by Jiow et al. (2017), Sonck et al. (2013) and Vaala and Bleakely (2015), we (Navarro et al., under review) identified four dimensions of digital parental mediation: (a) discursive mediation (i.e., parent–child discussions about online activities and interactions), (b) restrictive mediation and monitoring (i.e., limits on and tracking of child's online activities and interactions), (c) participatory mediation (i.e., use of digital and social technologies to connect and communicate with their child), and (d) mediation by modeling (i.e., setting an example of expectations related to activities and interactions using digital technology). These dimensions reflect distinct strategies and practices contemporary parents engage in to mitigate the risks and amplify the benefits of digital technology and social media. In the same sample of US parents that is used here, we found that participants' preference for these strategies varied by demographics, use of technology, attitudes about technology, and

their general parenting attitudes. Taken together, these findings underscore that parenting related to technology, like parenting in general, is not monolithic; there is great heterogeneity in the skills and practices used by parents.

Within neo-ecological theory and Darling and Steinberg's (1993) framework, parental mediation of digital and social media would constitute digital-specific parenting practices that are moderated by parents' general parenting style. Parents attempt to utilize mediation and socialization strategies in line with their overarching attitudes and beliefs (Livingstone et al., 2015), and yet digital technology introduces wrinkles into this framework by upending parent–child power hierarchies and presenting concerns unknown to previous generations (Nikken & Opree, 2018). Neo-ecological theory suggests numerous ways in which parents' attitudes and behaviors may differ between virtual and physical microsystems (Navarro & Tudge, 2022). As a context in which youth are participating in daily activities, interacting with others, and thus developing, parents must consider the unique features of virtual microsystems in their selection of parenting practices. Virtual microsystems are not bound by the same temporal and spatial restrictions as physical microsystems and, as a result, have unique affordances (e.g., publicness, availability, cue absence, permanence). For example, the 24/7 availability of digital platforms enables youth to communicate and interact at all hours, which can be both an asset (e.g., emotional support) and a liability (e.g., reduced sleep quality and duration). Interactions and activities in virtual microsystems may also have greater permanence than those in physical microsystems; posts, photos, and messages can be accessed indefinitely. In addition, while physical microsystems (e.g., school, home, workplace) are entered through arriving or departing a physical location, virtual microsystems are more flexible and portable—they can be opened and closed through the push of a button. For scholars of parenting, these differences underscore

the complexity contemporary parents face in attempting to mediate the influence of interactions and activities in which their child or adolescent is engaging in online (Navarro & Tudge, 2022). Consequently, research into styles of digital parental mediation (i.e., attitudes and values about parenting related to digital and social media) may offer additional insights, beyond parenting styles in general, into the process of digital socialization and family- and child-level outcomes. This assertion is supported by research into other domain-specific parenting that has found that general parenting styles were unrelated to child outcomes, whereas domain-specific approaches to socialization were significantly related (Vereecken et al., 2009). In light of the unique affordances of virtual microsystems and the sweeping macrotemporal changes contemporary parents are experiencing, the focus of the current study is on *styles of digital parental mediation.*

Neo-ecological theory posits that the proximal processes (i.e., the everyday, reciprocal interactions and activities between children and their environment that drive development) of digital socialization, during which children and parents negotiate values about the use of the internet and digital media across childhood and adolescence (Nelissen et al., 2019; Smith et al., 2015), are synergistically and iteratively influenced by person characteristics (of parent, child, and other relevant persons) and context (at the micro-, meso-, exo-, and macrosystem level) over time (Navarro & Tudge, 2022). As a result, parents' styles of digital parental mediation are likely dynamic across time and vary widely depending on their constellation of person- and context-level influences. To explore this heterogeneity in styles of digital mediation, the current study takes a person-centered approach to modeling parent attitudes about how to mediate the influences of interactions and activities in virtual microsystems.

Person-Centered Approaches to Parenting Styles

Scholars have traditionally explored parenting styles and practices using variable-centered approaches (e.g., regression) based upon cutoff scores on measures or scales of parenting (e.g., the Parenting Styles and Dimensions Questionnaire (PDSQ), Robinson et al., 2001). Such variable-centered approaches examine the associations among variables and assume homogeneity of variance in the sample. Person-centered analyses (e.g., cluster analysis and mixture modeling) offer an alternate perspective—they do not assume homogeneity, but instead identify heterogenous sub-groups of parents who share common attitudes or practices (i.e., there is significant between-class variation). Paralleling neo-ecological theory (Navarro & Tudge, 2022), Bergman and Magnusson (1997) argued that person-centered approaches to studying parenting were more representative of the synergistic family system than a variable-centered approach, as they encompass more dimensionality to understand the complex process of socialization. Most person-centered approaches to parenting have focused on mothers, but an increasing number of scholars are examining the influences of both mother and father parenting styles and their interrelation to model the family system more holistically (Cabrera et al., 2000; Hoeve et al., 2008; Lindsey & Mize, 2000; Winsler et al., 2005).

Cluster analysis is a person-centered analytic approach whereby observations are grouped based on the similarity or difference among variable means as differentiated by a measure of distance (Kaufman & Rousseeuw, 2009). This approach has been used by numerous parenting scholars to identify sub-groups of parents in line with Baumrind's original typologies and their relation to a multitude of child and adolescent outcomes, including adolescents' achievement strategies (Aunola et al., 2000), trajectories of adolescent delinquency (Hoeve et al., 2008) and adolescent adjustment (Lee et al., 2006). With advances in statistical software, many scholars are

now using mixture modeling to identify subgroups of parents (e.g., Borden et al., 2013; Deng et al., 2020, and Padilla-Walker et al., 2021). Mixture modeling techniques (including latent profile analysis, latent class analysis, and growth mixture modeling) allow the identification of heterogenous subgroups by disaggregating multivariate distributions into different underlying (or latent) distributions (Morin & Wang, 2016). Mixture modeling techniques differ from cluster analysis in that they estimate sub-groups based on the pattern of variables and cases are assigned a class probability, as opposed to a class membership, and allow for the inclusion of covariates (Spurk et al., 2020; Weller et al., 2020). Latent profile analysis (LPA) and latent class analysis (LCA) are forms of mixture modeling that assume latent (or unobservable) classes underly the population distribution. LPA utilizes continuous indicators and LCA categorical; both approaches yield a probabilistic assignment of class membership (i.e., a latent categorical variable) (Spurk et al., 2020).

Despite a plethora of person-centered analyses of general parenting, few studies have utilized this approach to examine digital-specific parenting. Two studies from the University of Minnesota used person-centered approaches to estimate subgroups of parents related to their own technology use (Walker et al., 2011), and face-to-face and computer-mediated monitoring strategies (Rudi & Dworkin, 2018). Walker and colleagues (2011) examined different dimensions of parents' technology use, including: (a) the frequency of using technology for communication, information, creative activities, and connectivity, (b) the number and type of devices they used, and (c) their attitudes about technology. Walker et al. divided their sample of parents into three activity groups—active, middle of the road, and limited—and then further subdivided the sample based on parents' attitudes and device ownership, leaving nine subgroups for analysis. Walker and colleagues found demographic differences between these subgroups;

parents in the active group were two years younger on average and had younger children, while parents in the limited group had older children. Their results underscore the heterogeneity in parental attitudes and use of technology, and that parental use of technology is difficult to predict by demographics alone; attitudes and motivation are key to understanding patterns of use.

In line with the seminal work of Stattin and Kerr (2000), Rudi and Dworkin (2018) conceptualized parental monitoring as being comprised of child disclosure, parent solicitation, and parental control, but disaggregated in-person and technology-mediated parental monitoring. Using cluster analysis, Rudi and Dworkin found that a three-cluster solution was the best fit to the data: (a) a moderate–moderate cluster in which parents employed both in-person and online monitoring with moderate frequency, (b) a high–high cluster in which parents employed both approaches with high frequency, and (c) a high–low cluster in which parents used in-person monitoring with high frequency but low frequency use of technology-mediated monitoring. One of the most interesting findings in this study was the lack of a low–high cluster (i.e., low in-person monitoring and high technology-mediated monitoring), which suggests that technology-mediated monitoring did not replace face-to-face monitoring but was a supplemental approach, and that face-to-face and online monitoring are not the same construct and should be treated as separate (although related) concepts.

Wu and colleagues (2020) used latent profile analysis to identify subgroups of parents based on their own usage of technology and technology-related attitudes, support, rules, and self-efficacy. They identified three profiles in their sample: (a) quiescent users, (b) compliant users, and (c) active users. Quiescent parents were characterized by limited use of technology, and little technology-related support and boundaries for their children. Compliant parents were more adept in their own use of technology and provided some support and structure for their children related

to the use of technology. This third profile, active users, was comprised of parents who used technology frequently, had positive technology-related attitudes and self-efficacy, and provided their children with ample support and consistent rules. Overall, these three profiles reflect low, medium, and high sub-groups of parents' digital technology engagement and digital-specific parenting.

These studies illustrate heterogeneity in how parents use technology (Walker et al., 2011; Wu et al., 2020), in-person and digital monitoring (Rudi & Dworkin, 2018), and technology-related parenting attitudes and self-efficacy (Wu et al., 2020). However, there is a lacuna of person-centered studies examining parents' mediation of digital technology in line with parental mediation theory. The current study addresses that gap through a person-centered approach to identifying subgroups of parents based on their attitudes towards four dimensions of digital parental mediation (i.e., discursive mediation, restrictive mediation and monitoring, participatory mediation, and mediation through modelling), offering a more comprehensive approach to identifying styles of digital mediation. As this study examines *attitudes* about digital parenting, as opposed to parenting behavior, these profiles reflect styles of digital parental mediation rather than digital-specific parenting practices (Darling & Steinberg, 1993).

The Current Study

To explore whether there were sub-groups of parents in our sample who shared similar digital-specific parenting styles, we modeled a key person characteristic—participants' attitudes about four dimensions of digital mediation (i.e., active mediation, restrictive mediation and monitoring, participatory mediation, and mediation by modeling)—using the Digital Parental Mediation Scale (DPMS; Navarro et al., under review) and latent profile analysis (LPA). Based upon the extant literature about parenting styles in general, we expected that we might find

digital-specific profiles partially mirroring the typologies first delineated by Baumrind (1978). Previous research examining general and internet-related parenting found internet-specific styles mirroring the four typologies outlined by Baumrind (Konok et al., 2020; Valcke et al., 2010). Although our indicators were drawn from the parental mediation literature (Navarro et al., under review), as opposed to general parenting styles, three of them (i.e., active mediation, restrictive mediation and modeling, and participatory mediation) reflect aspects of responsiveness and demandingness (Benedetto & Ingrassia, 2021). As mediation by modeling is a more recent addition to the parental mediation literature, we were uncertain how this construct might fit within our hypotheses related to general parenting styles.

Active and participatory mediation include discursive and collaborative practices, offering parents opportunities to display warmth and support (paralleling Baumrind's conceptualization of responsiveness) and have been found to protect against externalizing behaviors and facilitate the development of critical thinking skills and moral reasoning (Clark, 2011). Restrictive mediation and monitoring refer to the establishment and implementation of rules and limits on both content and duration of exposure. Research on restrictive mediation suggests that a balanced and fair approach to rule setting and enforcement results in better outcomes (Elsaesser et al., 2017; Hefner et al., 2017; Katz et al., 2019) and that too many restrictions can increase parent–adolescent conflict and adolescents can be reticent to disclose information to their parents (Clark, 2011; Katz et al., 2019; Krcmar & Cignel, 2016). Taken together, this suggests that when restrictive mediation is used in conjunction with active and/or participatory mediation, restrictive mediation and monitoring parallels findings related to demandingness and positive youth outcomes (Maccoby & Martin, 1983; Spera, 2005) found among authoritative parents. Consequently, we anticipated finding a digital-specific profile

mirroring an authoritative style, in which parents would report strongly positive attitudes about active and participatory mediation strategies and strongly positive attitudes about restrictive mediation and monitoring. In addition, we also anticipated that we might find digital analogues to the authoritarian profile (less favorable attitudes towards active and participatory mediation and higher priority placed on restrictive mediation and monitoring), the indulgent profile (low active/participatory, high restrictive), and neglectful profile (low priority on all forms of digital mediation).

To understand digital-specific parenting from a neo-ecological perspective, we tested similarity in profiles between mothers and fathers (i.e., a person characteristic) in our sample, as previous research suggests that mothers and fathers employ different parental mediation strategies around technology. For example, Connell and colleagues (2015) found that fathers in their sample engaged in co-use practices with significantly greater frequency than mothers. Valcke et al. (2010) found that mothers reported using significantly more controlling internet-related parenting practices than fathers. As a result, we anticipated that the configuration and structure of profiles of digital parenting styles might differ significantly between mothers and fathers, hypothesizing that fathers might evidence styles characterized by high participatory mediation whereas mothers might evidence styles characterized by spikes in restrictive mediation and monitoring. In line with this, we chose to investigate profile similarity in a stepwise fashion, as delineated by Morin and colleagues (2016), before moving on to models examining associations between profile membership and other study variables.

In line with neo-ecological theory, we also expected that other relevant person characteristics and contextual influences (e.g., parent age and income, family structure, technology-related attitudes) would be significantly associated with membership in digital

parenting style profiles, as the synergistic interrelation between person- and context-level influences likely differentially impacts parents' digital socialization goals, their attitudes about technology, and the practices in which they engage. We expected that parent age would be a significant predictor of profile membership, as previous research has found that younger parents use information communication technology (ICT) more frequently than do older parents (Rudi et al., 2015) and that younger parents reported using more supportive internet-related parenting practices (Valcke et al., 2010). Consequently, we anticipated that older parents in our sample would be significantly more likely to be members of profiles that placed less importance on digital mediation strategies across all domains and/or that relied heavily on restrictive mediation. We also anticipated that parent education and income would be associated with membership in profiles that placed higher emphasis on digital mediation across all indicators, as previous studies have found that these indicators (as a proxy for social class, a macrosystemic influence) are positively related to ownership and use of digital technology, digital literacy, digital parenting efficacy, and positive technology-related attitudes, thus reflecting a digital divide among parents who may or may not have the resources and time to access digital technology and reflect upon the influence of digital and social media within their family (Livingstone et al., 2015; Nikken & Opree, 2018; Rudi et al., 2015; Valcke et al., 2010). Neo-ecological theory also supports this assertion; socioeconomic status is a central macrosystemic influence across the course of development, as no proximal processes take place outside of context (Bronfenbrenner & Morris, 2006; Navarro & Tudge, 2022).

Similarly, neo-ecological theory encouraged us to investigate whether race/ethnicity, as a macrosystemic influence related to the oppression and marginalization of people of color in the US, was related to digital parental mediation styles. As a result of a dearth of US-based studies

that have explored parent race/ethnicity beyond using it is as a control, there are limited and mixed findings related to parent race/ethnicity and digital parental mediation in the United States (e.g., Chesley & Fox, 2012; Lauricella et al., 2016). Consequently, we were uncertain how parent race/ethnicity status might be related to profile membership in our sample, but felt it was important to explore from a theoretical perspective and as a recent Pew survey (Auxier et al., 2020) found large differences in children's use of platforms by race and ethnicity (e.g., 50% of Black and 40% of Hispanic parents have a child aged 11 years or younger who watches YouTube daily, compared to 29% of White parents).

In addition to parent characteristics, we anticipated that variables related to household composition (microsystemic factors), including the number, age, and gender of children in the family, might significantly relate to digital parenting style profile membership among the parents in our sample. In our previous variable-centered study (Navarro et al., under review), we found that increasing family size was associated with higher emphasis on restrictive mediation and monitoring, replicating previous results (Sonck et al., 2013). Valcke and colleagues (2010) did not find associations between family size and controlling digital parenting behaviors but did find that parents of smaller families were more likely to display warm behaviors (e.g., communication about the risks of the internet), mirroring general parenting research that has suggested increasing family size is associated with a decrease in positive parenting behaviors (Jenkins et al., 2003). From a neoecological perspective, this important microsystemic factor influences all family members, synergistically effecting both parents' digital mediation styles and the bidirectional process of digital socialization (Navarro & Tudge, 2022). Consequently, we anticipated that increases in family size would be associated with digital-specific profiles marked by greater emphasis on restrictive as opposed to active or participatory strategies.

The associations between child age and parental mediation have been widely studied (Glatz et al., 2018; Navarro et al., under review; Nikken & Jansz, 2014; Padilla-Walker et al., 2012; Rudi et al., 2015; Sonck et al., 2013; Vaala & Bleakley, 2015; Valcke et al., 2010; Warren, 2017) and suggest that parents' application of restrictive mediation and monitoring practices may be curvilinear, peaking in late childhood and early adolescence, when youth begin to use digital devices and platforms independently, and then decline in adolescence when digital skills, autonomy, and self-regulation are more developed. However, developmental patterns related to active mediation and co-use are not as consistent as those of restriction mediation and monitoring. Some research has suggested that parents use fewer discursive techniques as children age (Lauricella et al., 2016; Padilla-Walker, 2012; Warren, 2017), although other scholars have found positive (Navarro et al., under review; Nikken & Jansz, 2014) or insignificant associations (Glatz et al., 2018; Sonck et al., 2013). Findings related to co-use are similarly mixed; co-use has been found to be more common among parents of adolescents (Navarro et al., under review; Rudi et al., 2015), negatively related to child age (Connell et al., 2015; Warren, 2017), and not significantly related to child age (Vaala & Bleakley, 2015).

Considering these mixed findings, we felt it was imperative to explore how child age may relate to styles of digital parental mediation in our representative sample of American parents. Further, neo-ecological theory supports this assertion, as child age is a key person characteristic in understanding developmental trajectories (Navarro & Tudge, 2022). As a result, we chose to model child age from a developmental perspective marking the transition to adolescence (i.e., participant indicated that at least one of their children was over the age of 14 or not). We anticipated that parents of adolescents would be more likely to belong to profiles reflecting positive attitudes about digital mediation strategies, regardless of domain, as their child(ren) are

likely heavier users of technology (Mullan & Chatzitheochari, 2019) and they have had more time and experience in which to develop their digital parenting style. We did not expect to find significant associations between child gender and profile membership, as existing research does not indicate significant differences in parental mediation of digital technology by child gender (Nikken & Opree, 2018; Mullan & Chatzitheochari, 2019; Valke et al., 2010; Warren 2017). However, we chose to include child gender as, from a neo-ecological perspective, parents may alter their digital parenting style in response to gender-specific concerns about virtual microsystems (e.g., social comparison and body image).

In addition to parent demographics and household composition, we also anticipated that parents' and children's use of digital technology, as well as parents' technology-related attitudes would be significantly related to profile membership. Previous research suggests that parents who use technology more frequently and who are more confident in their digital skills are more comfortable utilizing digital mediation strategies, including active mediation, restrictive mediation, and co-use (Connell et al., 2015; Glatz et al., 2018; Rudi & Dworkin, 2018; Shin et al., 2017; Valke et al., 2010; Wu et al., 2020). In line with this research, we anticipated that parents in our sample who reported higher utilization of technology and technology-related confidence would have a higher probability of membership in profiles demarcated by more positive attitudes towards all four digital-specific parenting practices, including restrictive mediation and monitoring, as measured by the DPMS (Navarro et al., under review).

Methods

Sample and Procedure

A sample of 555 parents in the United States was recruited through CloudResearch, an online research platform, in January of 2020 to participate in an online survey. To be eligible, participants had to have at least one child between the ages of 5 and 18. Participants in the study were financially recompensed for their participation in the study in accordance with CloudResearch's policies. Institutional review board approval was granted for this survey. The survey was administered through Qualtrics and took approximately 10 to 15 minutes to complete. Data were cleaned to ensure that all participants met eligibility criteria and to remove observations of poor response quality. Participants who did not have children (n = 3), completed less than 80% of the survey (n = 10), and completed the survey more quickly than expected (i.e., participants who completed the survey in less than 588 seconds, the 95th percentile of reading speed for the 12,000-character survey (Buchanan & Scofield, 2018)) (n = 82), were removed from further analysis, leaving 460 parents in the sample. On average, participants were 40.7 years of age and had 2.4 children with a mean age of 12.7 years. Participants in the study were mostly married (69.6%), with the 61.1% identifying as cisgender female, 38.9% identifying as male (38.5% cisgender male, 0.4% transgender male). The sample was largely representative of the racial/ethnic composition of the United States as a whole, with 75.2% White (76.3% U.S.), 11.3% Black or African American (13.4% U.S.), 7.8% Hispanic or Latino (18.5% US), 2.0% Asian (5.9% US), and 3.7% endorsing other race/ethnicities (US Census Bureau, 2021). The sample was also diverse in terms of education and income (see Table 7). The sample for the current study was also used in a previous publication delineating the development and validation

of the Digital Parental Mediation Scale; see Navarro et al. (under review) for more detailed information about the sample, measures, and procedures.

Table 7. Study 3: Sample Educational and Income Attainment

Highest Educational Attainment	*N* (%)	Household Income	*N* (%)
Less than HS degree	11 (2.4)	Less than $10,000	24 (4.3)
HS graduate (or GED)	81 (17.5)	$10,000-29,999	73 (13.2)
Some college but no degree	93 (20.1)	$30,000-49,999	91 (16.4)
Associate degree	60 (13.0)	$50,000-69,999	91 (16.4)
Bachelor's degree	82 (17.7)	$70,000-89,999	62 (11.2)
Master's degree	105 (22.7)	$90,000-149,999	114 (20.5)
Doctoral degree	18 (3.9)	$150,00 or more	100 (18.0)
Professional degree (e.g., JD, MD)	13 (2.8)		

Measures

Descriptive statistics and correlations between all study variables for both mothers and fathers are presented in Table 8.

Profile Indicators

Digital Parental Mediation Scale. Participants completed the 44-item Digital Parental Mediation Scale (DPMS), a measure of parents' attitudes about parenting practices related to digital and social media (Navarro et al., under review). Parents rated the perceived importance of each item ("How important do you think it is to do the following with your child(ren) or adolescent(s)?") on a 5-point Likert scale (1-not important, 5-very important). The DPMS has a bifactor structure, with one general factor and four digital-specific factors (Navarro et al., under review). A bifactor measurement model has two components: (a) a general factor that represents shared variance across all the items in the scale, and (b) subscales that represent additional

shared variance among clusters of items (Reise, 2012). As the goal of the current study was to elucidate digital-specific styles of parenting, the general factor was omitted as Navarro et al. (under review) argued that the general factor represents variance related to parenting in general. The DPMS has four subscales representing types of digital-specific mediation practices: (a) active mediation (8 items, ω = 0.90), (b) restrictive mediation and monitoring (15 items, ω = 0.95), (c) participatory mediation (13 items, ω = 0.94), and (d) mediation by modeling (9 items, ω = 0.93). A confirmatory factor analysis (CFA) was performed and supported the bifactor structure of the DPMS. This bifactor model was an excellent fit to the data ($\chi^2(848) = 1494.62$, $p < .001$, RMSEA = 0.042 [Upper-bound 90% CI = 0.045], SRMR = 0.040, CFI = 0.934) and tests of measurement invariance showed that the measure worked equally well for mothers and fathers at the scalar level (see Navarro et al. (under review) for a more detailed explanation of measure development and validation).

Demographic Variables

Parent Characteristics. Gender reflects self-identified gender identity (0 = *male*, 1 = *female*), regardless of sex assigned at birth. Educational attainment was modeled dichotomously (0 = *some college or less,* 1 = *college graduate or more*), and income was modeled continuously (1 = *less than $10,000 per year* to 7 = *more than $150,000 per year*). Participants' marital status was also modeled dichotomously (0 = *not currently married*, 1 = *currently married*). Race/ethnicity was recoded into three categories of *White* (largest and reference group), *Black*, and *Other* race/ethnicities represented by two dummy codes. Age was modeled continuously (range from 20 to 69, *M* = 40.67, *SD* = 7.20).

Household Composition. Parents reported on the number of children in their family; this variable was modeled as a continuous variable (*M* = 2.41, *SD* = 1.29). As the participants in the

study had varying numbers of children, we felt that a mean-based approach to child age may mask parent's differentiation of mediation strategies by developmental stage. As a result, we modeled child age dichotomously to reflect developmental differences between parent's attitudes towards mediation of digital technology for children and adolescents (0 = all children in household are *13 years and younger*, 1 = at least one child in the household is *14 years and older*). Similarly, we modeled child gender categorically to account for the various combinations of family structures within our sample: (a) families that had only female child(ren) (1 = *female only*, 0 = *all others*), (b) families that had only male child(ren) (1 = *male only*, 0 = *all others*), and (c) families that reported having both male and female children (reference group).

Technology Ownership and Use

Study participants reported which digital devices they and their child(ren) used (e.g., desktop, laptop, smartphone, mobile phone, tablet, smartwatch, gaming console, kindle, other). The total number of these devices was used to create sum scores of (a) number of parent devices (M = 4.26, SD = 1.85) and (b) number of child devices for the first child they reported on (M = 3.60, SD = 1.62). Participants also reported which software applications they and their child (i.e., the first child they reported on) used for different purposes (e.g., photo and video sharing, texting and messaging, gaming, reading and education, music and podcasts, entertainment (e.g., Netflix), news, and other). These applications were summed to yield (a) number of parent platforms (M = 4.92, SD = 1.63) and (b) number of child platforms (M = 4.34, SD = 1.66). Participants also reported on their average screen time per day in number of hours (M = 7.32, SD = 3.09) and their child(ren)'s average screen time per day in number of hours (M = 5.77, SD = 2.99).

Technology-related Attitudes and Interactions

Participants rated their confidence in using digital technology ("How confident do you feel in your ability to use digital technology (e.g., smartphones, tablets, gaming systems, computers, etc.)?") on a 13-point scale (M = 8.41, SD = 1.65). Participants also rated their worry about their child(ren)'s use of digital technology ("Overall, how worried are you about your child(ren)'s or adolescent(s)'s use of digital devices?") on a five-point Likert scale (1-*not at all worried*, 5-*extremely worried*) (M= 3.69, SD = 4.27). Finally, participants reported the frequency with which they experienced conflict with their child related to digital technology ("Overall, how often do you experience conflict with your child(ren) or adolescent(s) over their use of digital devices?") on a five-point Likert scale (1-*never*, 5-*always*) (M = 2.64, SD = 0.97).

Table 8. Study 3: Correlations and Descriptive Statistics for All Study Variables

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	DPMS - AM	-	**0.636****	**0.791****	**0.733****	0.043	0.085	0.055	**0.176****	0.005	**0.145***	**0.149***	0.093	-0.044	**-0.126***	**0.140***	**0.175****	0.085	0.073	0.083	**0.119***	**0.157***	0.114	0.030
2	DPMS - RMM	**0.493****	-	**0.528****	**0.506****	0.011	**0.119***	**0.144***	0.089	-0.073	-0.043	-0.047	**0.149***	-0.006	**-0.150***	**0.122***	-0.026	**0.148***	0.027	0.063	-0.007	**0.129***	**0.122***	0.114
3	DPMS - PM	**0.849****	**0.499****	-	**0.736****	0.078	0.111	0.040	**0.159***	0.029	**0.190****	**0.228****	0.041	-0.061	-0.072	**0.191****	**0.206****	0.077	0.088	0.087	**0.147***	0.094	**0.121***	0.059
4	DPMS - MM	**0.835****	**0.513****	**0.816****	-	0.046	**0.152***	**0.144***	0.081	-0.042	**0.136***	**0.187****	0.088	-0.096	-0.043	0.075	0.074	**0.134***	0.054	0.086	0.082	**0.162***	0.062	0.003
5	Education - College +	**0.256****	**0.141***	**0.321****	**0.253****	-	**0.449****	**0.150***	-0.028	-0.009	0.111	0.002	**-0.141***	**-0.135***	-0.010	0.109	**0.136***	**0.172****	**0.193****	**0.156***	0.114	0.016	0.069	0.084
6	Income	**0.351****	**0.184****	**0.423****	**0.414****	**0.726****	-	**0.428****	**-0.133***	**-0.117***	**0.218****	-0.005	-0.087	**-0.160***	0.019	-0.066	0.014	**0.244****	**0.149***	**0.217****	**0.124***	-0.004	0.034	0.115
7	Married	**0.38****	**0.134***	**0.449****	**0.346****	**0.483****	**0.468****	-	**-0.137***	-0.047	0.104	-0.002	0.077	-0.097	-0.063	-0.072	-0.114	0.039	0.006	0.029	-0.030	-0.026	0.022	0.077
8	Black	-0.030	-0.004	-0.045	-0.107	**-0.304****	**-0.377****	-0.042	-	**-0.146***	0.004	0.008	0.044	-0.015	0.000	**0.166****	**0.187****	0.113	0.105	**0.167****	0.046	0.086	-0.010	-0.080
9	Hispanic/Other	0.004	0.003	-0.028	0.002	0.059	0.02	-0.023	-0.119	-	-0.039	-0.026	**0.154***	0.045	0.045	0.026	0.016	-0.010	-0.044	-0.084	0.030	0.053	0.070	0.116*
10	Parent Age	-0.078	-0.125	-0.073	**-0.130***	**-0.138***	**-0.160***	**0.144***	**0.143**	-0.106	-	**0.329****	-0.094	0.025	-0.006	-0.040	**0.230****	0.101	-0.003	0.050	**0.134***	**-0.169****	-0.065	-0.001
11	Adolescent in HH	**0.214****	-0.043	**0.217****	**0.182***	0.051	**0.187****	0.121	**-0.145**	0.017	0.055	-	**0.207****	-0.071	-0.089	0.063	**0.142***	-0.086	0.032	0.026	**0.178****	-0.041	-0.053	-0.092
12	# Children	0.063	0.101	0.085	0.068	0.098	**0.153***	**0.140***	**0.212****	0.011	0.039	**0.254****	-	**-0.210****	**-0.339****	0.037	-0.040	0.000	0.045	0.022	0.068	0.082	-0.063	0.074
13	All male children in HH	-0.100	-0.062	**-0.117***	-0.098	-0.052	-0.096	**-0.134***	-0.098	0.091	-0.080	-0.128	**-0.266****	-	**-0.339****	-0.034	-0.041	-0.069	**-0.142***	0.003	**-0.205****	-0.076	-0.035	-0.052
14	All female children in HH	0.072	-0.03	-0.003	0.029	**-0.233****	**-0.219****	-0.007	0.063	-0.075	**0.185****	-0.041	**-0.220****	**-0.262****	-	-0.062	0.008	0.002	-0.042	-0.079	-0.029	0.016	0.019	-0.049
15	Parent Screen Time	**0.325****	**0.216****	**0.417****	**0.324****	0.128	**0.250****	0.056	0.017	-0.079	**-0.217****	0.105	**0.176***	-0.042	-0.122	-	**0.313****	**0.118***	0.111	0.080	0.105	**0.312****	0.013	0.070
16	Child Screen Time	**0.248****	0.071	**0.350****	**0.258****	0.110	**0.246****	0.085	**-0.167***	**-0.137***	-0.096	**0.178***	**0.155***	0.010	-0.048	**0.471****	-	0.090	0.082	**0.155***	**0.167****	0.060	0.086	0.053
17	# Parent Devices	**0.25****	0.081	**0.326****	**0.289****	**0.358****	**0.491****	**0.186****	**-0.310****	-0.011	-0.090	**0.205****	**0.197****	0.037	**-0.198****	**0.273****	**0.313****	-	**0.568****	**0.537****	**0.376****	**0.221****	0.064	**0.145***
18	# Parent Platforms	**0.224****	0.084	**0.263****	**0.171***	**0.217****	**0.269****	0.092	**-0.258****	-0.027	**-0.137***	0.069	0.055	-0.013	-0.047	**0.242****	**0.167***	**0.625****	-	**0.418****	**0.569****	**0.315****	0.107	0.103
19	# Child Devices	**0.276****	**0.142***	**0.309****	**0.296****	**0.143***	**0.308****	0.08	**-0.198****	-0.043	**-0.139***	**0.195****	**0.146***	0.012	**-0.193****	**0.345****	**0.319****	**0.686****	**0.516****	-	**0.567****	**0.173****	-0.022	-0.007
20	# Child Platforms	**0.236****	0.071	**0.283****	**0.223****	0.005	**0.178***	0.095	**-0.161***	0.084	-0.064	**0.232****	**0.199****	-0.096	-0.122	**0.237****	**0.204****	**0.486****	**0.608****	**0.666****	-	**0.213****	-0.020	-0.036
21	Tech-related Confidence	**0.272****	0.064	**0.312****	**0.286****	**0.313****	**0.283****	**0.253****	-0.115	-0.018	-0.123	0.033	-0.047	-0.06	-0.117	**0.356****	**0.188****	**0.203****	**0.167***	**0.229****	**0.181***	-	-0.074	-0.077
22	Tech-related Worry	**0.146***	0.079	0.056	0.101	**0.153***	**0.128***	-0.054	-0.086	0.067	-0.069	0.092	**0.128***	**0.165***	-0.064	0.007	0.03	**0.264****	**0.175***	**0.156***	0.103	-0.018	-	**0.583****
23	Tech-related Conflict	-0.065	0.049	-0.062	-0.024	0.078	**0.149***	-0.101	**-0.146***	0.085	-0.082	0.020	**0.178***	-0.055	**-0.160***	0.009	-0.008	**0.201****	**0.310****	**0.195****	**0.194****	-0.031	**0.353****	-
	Parent Gender (Mother)	**-0.142***	-0.049	**-0.264****	**-0.139***	**-0.429****	**-0.434****	**-0.251****	0.028	0.040	0.012	-0.057	-0.060	0.006	0.084	**-0.193****	**-0.291****	**-0.303****	**-0.217****	**-0.212****	**-0.169****	**-0.154****	-0.076	0.048
	M (Fathers)	0.12	0.05	0.28	0.14	0.76	5.52	0.86	0.10	0.11	40.61	0.70	2.31	0.33	0.13	8.10	6.88	5.01	5.39	4.06	4.73	8.74	4.13	2.57
	SD (Fathers)	0.69	0.85	0.75	0.71	0.43	1.67	0.35	0.30	0.32	7.31	0.46	1.12	0.47	0.33	2.95	3.01	2.02	1.56	1.89	1.63	1.41	4.62	0.87
	M (Mothers)	-0.07	-0.03	-0.17	-0.08	0.32	3.88	0.62	0.12	0.14	40.76	0.65	2.47	0.33	0.19	6.85	5.07	3.86	4.66	3.35	4.14	8.21	3.46	2.66
	SD (Mothers)	0.62	0.78	0.81	0.77	0.47	1.62	0.48	0.32	0.35	7.14	0.48	1.37	0.47	0.39	3.05	2.77	1.55	1.61	1.33	1.63	1.75	4.02	1.00

Note. All correlations above the diagonal are for mothers and below the diagonal are for fathers.

* $p < .05$; ** $p < .01$.

Analytic Strategy

The first goal of this study was to identify subgroups of parenting styles related to digital and social media. Latent profile analyses (LPA), a form of mixture modeling using continuous indicators where variances are assumed to be equal across classes, were estimated in stepwise fashion; we increased the numbers of profiles until the models had issues converging (Spurk et al., 2020). Factor scores from the four digital-specific subscales of the DPMS (Navarro et al., under review) were used as profile indicators. Factor scores reflect participants' optimally weighted scores on each subscale, and although factor scores do not account for error as well as latent variables, they are superior to unit-weighted scoring approaches (e.g., sum scoring) as they reflect the factor loadings of the measurement model (McNeish & Wolf, 2020).

LPA with one to five profiles were estimated for both mothers and fathers using MPlus 8.6 (Muthén & Muthén, 2017) with the robust maximum likelihood (MLR) estimator. Missing data were handled using full information maximum likelihood (FIML) and to avoid local maxima or local solutions, we used 10,000 random sets of start values, 500 iterations, and retained 250 solutions for final stage optimizations (Gillet et al., 2018; Spurk et al., 2020). Both statistical and substantive criteria were used to identify the optimal number of profiles of digital mediation style. Statistical criteria included: the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the consistent AIC (CAIC), the sample-size adjusted BIC (ABIC), the Parametric Bootstrapped Likelihood Ratio Test (BLRT), and the Adjusted Lo, Mendell and Rubin's Likelihood Ratio Test (aLMR) (Gillet et al., 2018; Morin & Wang, 2016). Lower AIC, BIC, CAIC, and ABIC values suggest a better fit to the data and were plotted graphically to identify the elbow of the plot (i.e., the number of profiles after which the plotted fit indices flatten out) (Morin, 2016). Likelihood ratio tests compare a model with *k* profiles to a

model with k -1 profiles to determine if the k profile has significantly better fit (i.e., $p \leq .05$). We also examined entropy to assess the classification accuracy of the model; higher entropy values are better, with 0.6 and 0.8 for the cutoffs for moderate and high classification accuracy, respectively (Moirin & Wang, 2016; Spurk et al., 2020). In addition, we considered the substantive and theoretical meaning, interpretability, and size of the profiles in deciding how many profiles were optimal.

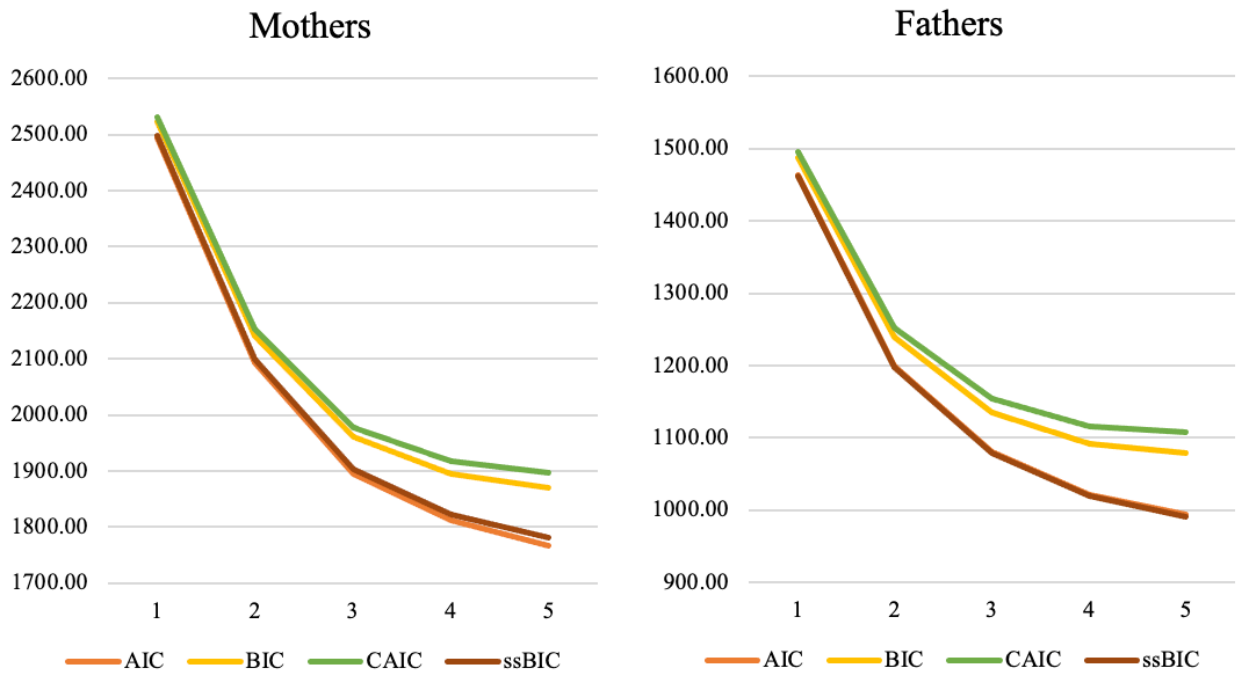
Following the identification of the optimal profile enumeration for both mothers and fathers (separately), we combined these two models into a multi-group LPA model (Morin et al., 2016). Tests for profile similarity between mothers and fathers were conducted in line with the stepwise approached outlined by Morin et al. (2016). This series of tests parallels measurement invariance testing but seeks to establish that profiles are not significantly different across samples. The first step is to establish *configural similarity* (i.e., the same number of profiles is optimal for both mothers and fathers). The second step evaluates if the profiles have *structural similarity* (i.e., means are constrained). The third step assesses the extent to which there is *dispersional similarity* between mothers and fathers (i.e., means and variances constrained). The fourth step (*distributional similarity*) ascertains whether the size of the profiles remains the same across the samples (i.e., means, variances, and class probabilities are constrained). We then extended to tests of predictive similarity to assess the extent to which the associations between the profiles and covariates were statistically invariant across mothers and fathers. To evaluate if each subsequent and more constrained model is supported, Morin et al. (2016) recommended that at least two fit indices out of the BIC, CAIC, and ABIC should have lower values than the less constrained model.

Following tests of profile similarity, multiple-group multinomial logistic regressions were estimated to examine whether demographics (including parent characteristics and household composition), technology ownership and use, and technology-related attitudes and interactions were significantly related to profile membership (Spurk et al., 2020). We used Vermunt's three-step procedure (Asparouhov & Muthén, 2013) to estimate these models, as this procedure avoids altering the size or structure of the profiles when covariates are entered into the mixture model (Moirin & Wang, 2016). We first estimated a model with demographic covariates and included statistically significant covariates in subsequent models estimating the associations between profile membership and (a) technology ownership and usage, and (b) technology-related confidence, worry, and conflict.

Results

The fit indices for models with 1- to 5-profile solutions are presented in Table 9. For both mothers and fathers, we accepted the 4-profile solution because: (a) the plot of fit indices flattened around four profiles (see Figure 1), (b) the a-LMR likelihood ratio tests indicated that the 4-profile solution was a better fit than the 3-profile solution and that the 5-profile solution was not significantly better, and (c) because the four profiles were substantively meaningful.

Figure 1. Study 3: Plot of Fit Indices for Mothers and Fathers



Note. AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; CAIC: consistent AIC; ssBIC: sample-size adjusted BIC.

Following enumeration of the same number of profiles, we used multiple-group LPA to test for profile similarity across mothers and fathers. The results from these tests are presented in the bottom section of Table 9. We found support for configural, structural, and distributional similarity between mothers and fathers, as these models had subsequently lower BIC, CAIC, and aBIC values. However, we did not find support for distributional similarity across mothers and fathers, suggesting that different proportions of mothers and fathers belonged to the four profiles. As a result, we used the dispersion similarity model to test for predictive similarity, which examines if the relations between predictors (i.e., exogenous variables) and profiles are the same across mothers and fathers (Morin et al., 2016). The test of predictive similarity resulted in lower BIC, CAIC, and ABIC values compared to an unconstrained model, where the associations with

covariates were allowed to vary across mothers and fathers. Taken together, these results suggest that the profiles and their associations with study covariates were not significantly different between mothers and fathers.

Table 9. Study 3: Profile Enumeration for Mothers and Fathers and Tests of Profile Similarity

Model	LL	Parameters	AIC	BIC	CAIC	ABIC	Entropy	a-LMR	BLRT	Smallest Class %
Mothers (N = 277)										
1 Profile	-1239.215	8	2494.43	2523.42	2531.42	2498.06	-	-	-	-
2 Profiles	-1034.006	13	2094.01	2141.12	2154.12	2099.90	0.839	< .001	< .001	33%
3 Profiles	-929.439	18	1894.88	1960.11	1978.11	1903.03	0.866	0.105	< .001	16%
4 Profiles	**-882.647**	**23**	**1811.29**	**1894.65**	**1917.65**	**1821.72**	**0.876**	**0.052**	**< .001**	**9%**
5 Profiles	-855.778	28	1767.56	1869.03	1897.03	1780.24	0.908	0.181	< .001	1%
Father (N = 160)										
1 Profile	-723.506	8	1463.01	1487.61	1495.61	1462.29				
2 Profiles	-586.623	13	1199.25	1239.22	1252.22	1198.07	0.899	0.008	< .001	29%
3 Profiles	-522.223	18	1080.45	1135.80	1153.80	1078.82	0.885	0.101	< .001	11%
4 Profiles	**-487.808**	**23**	**1021.62**	**1092.34**	**1115.34**	**1019.54**	**0.880**	**0.020**	**< .001**	**10%**
5 Profiles	-468.786	28	993.57	1079.68	1107.68	991.04	0.896	0.017	< .001	1%
Profile Similarity Across Mothers and Fathers (N = 437, k = 4)										
Configural	-1657.505	47	3409.01	3600.77	3647.77	3451.61	0.880			
Structural	-1700.893	31	3463.79	3590.26	3621.26	3491.89	0.863			
Dispersional	**-1710.818**	**27**	**3475.64**	***3585.79***	***3612.79***	**3500.11**	**0.862**			
Distributional	-1721.465	24	3490.93	3588.85	3612.85	3512.68	0.858			
4 Profiles: Predictors	-1579.963	81	3321.93	3650.53	3731.53	3393.48	0.880			
Predictive	**-1610.893**	**54**	**3329.79**	***3548.85***	***3602.85***	***3377.49***	**0.867**			

Note. LL: Log likelihood; AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; CAIC: consistent AIC; ABIC: sample-size adjusted BIC; aLMR: Adjusted Lo, Mendell and Rubin's likelihood ratio test; BLRT: Parametric Bootstrapped Likelihood Ratio Test.

As a result of this dispersional and predictive similarity across mothers and fathers, subsequent models were completed using the entire sample (mothers and fathers together) using the dispersional similarity 4-profile model (where means and variances are constrained, and the probability of class membership are allowed to vary). The dispersional similarity model yielded four meaningfully distinct profiles; see Table 10, which summarizes indicator and covariate

statistics by profile, and Figure 2, which graphically summarizes the average factor score by indicator for each profile. The plurality of parents (41%; grey line in Figure 2) fell into an *Average Digital Mediators* profile characterized by scores near the sample mean on all four indicators. The second largest profile (*High Digital Mediators;* 34% of sample; yellow line in Figure 2) was characterized by relatively high scores on all indicators, although parents in this profile placed somewhat less of an emphasis on restrictive mediation and monitoring than the other digital-specific strategies. An additional 17.5% of sample parents fell into the *Moderately Digitally Uninvolved* profile (blue line in Figure 2), which was characterized by below average scores on all four indicators, suggesting that parents in this profile do not place great importance on digital-specific parenting strategies compared to the other parents in the sample. The smallest profile (*Digitally Disengaged;* 7.5%; orange line in Figure 2) was also characterized by lower (i.e., far below average) scores on all indicators, but markedly lower scores on active mediation, participatory mediation, and modelling than the *Moderately Digitally Uninvolved* profile.

Figure 2. Study 3: Four Profile Solution

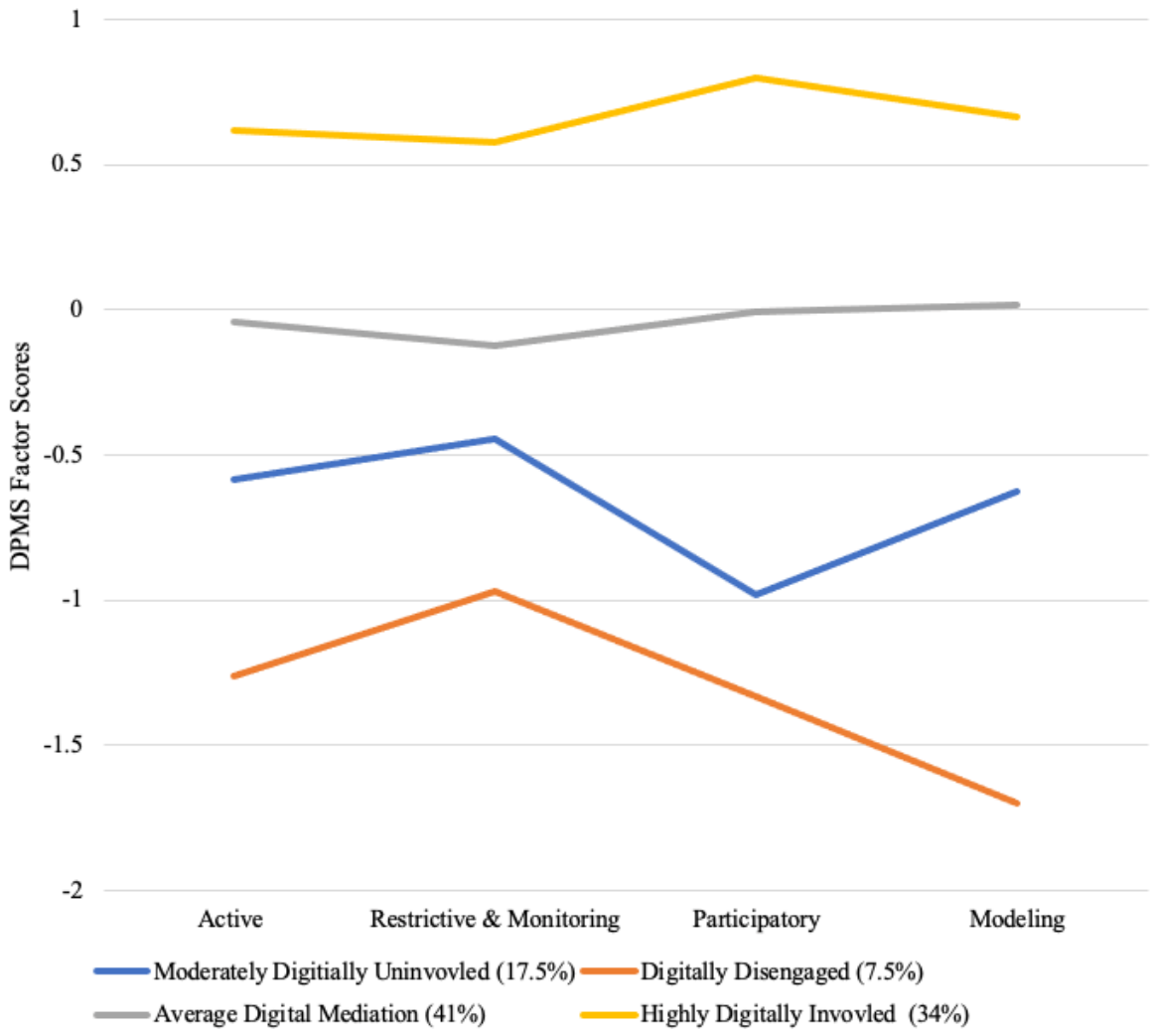


Table 10. Study 3: Descriptive Statistics by Latent Profile Membership

	Digitally Disengaged (7.5%)	Moderately Digitally Uninvolved (17.5%)	Average Digital Involvement (41.0%)	High Digital Mediators (34.0%)
Proportion by Gender				
Mothers	7.6%	22.0%	44.4%	
Fathers	5.6%	10.6%	38.8%	45.0%
Profile Indicators	*M [CI]*	*M [CI]*	*M [CI]*	*M [CI]*
Active Mediation	-1.259 [-1.517, -1.001]	-0.582 [-0.700, -0.464]	-0.040 [-0.117, 0.037]	0.617 [0.535, 0.699]
Restrictive Mediation and Monitoring	-0.968 [-1.421, -0.514]	-0.443 [-0.698, -0.188]	-0.120 [-0.262, 0.021]	0.578 [0.487, 0.699]
Participatory Mediation	-1.331 [-1.547, -1.115]	-0.981 [-1.142, -0.820]	-0.005 [-0.107, 0.096]	0.799 [0.710, 0.887]
Mediation by Modeling	-1.702 [-1.945, -1.460]	-0.626 [-0.845, -0.460]	0.018 [-0.071, 0.107]	0.667 [0.586, 0.749]
Parent Demographics	*M [SD] / %*	*M [SD] / %*	*M [SD] / %*	*M [SD] / %*
Age (years)	39.1 (7.42)	40.5 (8.10)	40.9 (6.93)	41.0 (6.99)
Income	3.13 (1.59) (~$32,600)	3.92 (1.56) (~$48,400)	4.51 (1.72) (~$60,200)	5.01 (1.88) (~$70,200)
Education – College+	33.3%	33.3%	48.1%	58.6%
Married	40.0%	66.7%	71.9%	77.2%
Race/Ethnicity				
Black	13.3%	6.4%	10.8%	13.8%
Hispanic	3.3%	2.6%	10.3%	7.6%
White	73.3%	80.8%	74.1%	75.9%
Other	10.1%	10.2%	4.8%	2.7%
Household Composition				
# Children in HH	2.07 (1.09)	2.40 (1.56)	2.48 (1.26)	2.39 (1.18)
Adolescent in HH	33.3%	57.7%	73.0%	69.7%
All Male Children in HH	46.7%	38.5%	28.6%	32.4%
All Female Children in HH	43.3%	43.6%	51.9%	51.0%
Mixed Gender HH	10.0%	17.9%	19.5%	16.6%
Technology Ownership, Use, & Attitudes				
Parent Screen Time (Hrs)	6.73 (2.94)	5.83 (3.04)	7.20 (2.91)	8.39 (2.93)
Child Screen Time (Hrs)	4.60 (2.75)	4.62 (2.46)	5.52 (2.82)	6.84 (3.11)
# Parent Devices	3.40 (1.54)	3.87 (1.33)	4.16 (1.83)	4.83 (1.94)
# Parent Platforms	4.50 (1.69)	4.68 (1.39)	4.80 (1.74)	5.32 (1.49)
# Child Devices	3.03 (1.64)	3.28 (1.20)	3.47 (1.44)	4.11 (1.82)
# Child Platforms	3.73 (1.55)	3.97 (1.64)	4.30 (1.61)	4.76 (1.65)
Confidence	7.97 (1.99)	7.99 (1.69)	8.28 (1.68)	8.88 (1.37)
Worry	3.10 (3.70)	3.12 (3.32)	3.58 (4.00)	4.30 (4.99)
Conflict	2.47 (0.85)	2.63 (0.88)	2.69 (0.88)	2.59 (1.10)

Note. *M*: Mean; *CI*: 95% confidence interval; *SD*: Standard deviation; HH: Household; Hrs: Hours.

Next, we used Vermunt's three-step procedure (Asparouhov & Muthén, 2013) to estimate multinomial logistic regression models to analyze whether profile membership was significantly related to demographic covariates, technology ownership and use, and technology-related attitudes and interactions (Table 11). In the initial model, summarized in the upper panel of Table 11, which included parent characteristics and household composition, only parent gender, income, identifying as Black, and the presence of an adolescent (14+ years) were significantly related to profile membership. Mothers in our sample were 0.37 times (Odds Ratio, 95% Confidence Interval: 0.15-0.94) as likely to be in the *High Digital Mediators* profile than in the *Moderately Digitally Uninvolved* profile, reflecting different proportions of profile membership between mothers and fathers as indicated by the test of distributional similarity. Parents who reported a higher income (i.e., one unit higher on a 7-point scale) were 0.59 times (OR, CI: 0.37-0.95) as likely to be in the *Digitally Disengaged* profile and 1.33 times (OR, CI: 1.00-1.76) more likely to be in the *High Digital Mediators* profile than in the *Moderately Digitally Uninvolved* profile. In addition, parents who reported higher incomes were 1.89 (OR, CI: 1.23-2.89) and 2.24 (OR, CI: 1.44-3.48) times more likely to be in the *Average Digital Mediators* and *High Digital Mediators* profiles, respectively, than in the *Digitally Disengaged* profile. Taken together, this suggests that parents with higher incomes tend to fall into the more involved digital parental mediation styles in our sample. In terms of racial identity, parents who identified as Black were 3.94 times (OR, CI: 1.02-15.14) more likely to be in the *High Digital Mediators* profile than in the *Moderately Digitally Uninvolved* profile. In addition, parents of adolescents were 2.36 times (OR, CI: 1.12-4.96) and 5.45 times (OR, CI: 1.70-17.47) to be in the *Average Digital Mediators* profile than in the *Moderately Digitally Uninvolved* and *Digitally Disengaged* profiles. Parents

of adolescents were also more likely (OR: 4.38, CI: 1.33-14.44) to be in the *High Digital Mediators* profile than in the *Digitally Disengaged* profile in our sample.

The second multinomial regression model estimated associations between technology ownership and usage and profile membership, while controlling for significant demographic covariates (i.e., gender, income, race, and the presence of an adolescent in the household). Of the technology use variables, only parent screen time and child screen time were significantly related to profile membership. Parents who reported higher screen time use (i.e., one additional hour) were 1.16 (OR, CI: 1.03-1.33) and 1.25 times (OR, CI: 1.09-1.43) more likely to be in the *Average Digital Mediators* and *High Digital Mediators* profiles, respectively, than in the *Moderately Digitally Uninvolved* profile. In addition, parents in our sample who reported more screen time use of their child (i.e., a one-hour increase) were 1.14 (OR, CI: 1.00-1.31) and 1.11 times (OR, CI: 1.00-1.23) more likely to be in the *High Digital Mediators* profile than in the *Moderately Digitally Uninvolved* and *Average Digital Mediators* profiles, respectively.

The third multinomial regression model examined relations between technology-related confidence, worry, and conflict and profile membership in our sample, alongside significant covariates from both previous models. Only parents in the *High Digital Mediators* profile were significantly differentiated by these variables compared to the other profiles retained in our sample. Parents who reported higher technology-related confidence (i.e., a one unit increase on the 13-point scale) (OR: 1.26, CI: 1.02-1.57) and worry (i.e., a one unit increase on a five point scale) (OR: 1.11, CI: 1.01-1.22) were more likely to be in the *High Digital Mediators* profile than in the *Moderately Digitally Uninvolved* profile, and were 1.22 (OR, CI: 1.01-1.40) more likely to be in the *High Digital Mediators* profile than in the *Average Digital Mediators* profile.

Table 11. Study 3: Multinomial Logistic Regression Models Predicting Profile Membership

	Reference: Moderately Digitally Uninvolved						*Reference: Digitally Disengaged*				*Ref: Average Dig.*	
	Digitally Disengaged		Average Digital Med.		High Digital Med.		Average Digital Med.		High Digital Med.		High Digital Med.	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Model 1: Demographics												
Parent Characteristics												
Gender	0.31	0.08-1.25	0.63	0.23-1.74	**0.37***	**0.15-0.94**	2.07	0.69-6.22	1.21	0.40-3.73	0.59	0.32-1.09
Education	3.07	0.48-19.50	1.30	0.45-3.78	1.25	0.44-3.53	0.42	0.10-1.89	0.41	0.09-1.81	0.96	0.48-1.91
Income	**0.59***	**0.37-0.95**	1.12	0.86-1.45	**1.33***	**1.00-1.76**	**1.89****	**1.23-2.89**	**2.24*****	**1.44-3.48**	1.19	0.94-1.50
Married	0.32	0.09-1.17	0.78	0.33-1.82	0.73	0.30-1.75	2.40	0.79-7.29	2.25	0.71-7.09	0.94	0.45-1.96
Black (Ref: White)	1.64	0.34-7.91	2.85	0.74-11.00	**3.94***	**1.02-15.14**	1.73	0.57-5.28	2.40	0.73-7.91	1.38	0.53-3.62
Other (Ref: White)	1.52	0.34-6.73	1.78	0.57-5.58	1.18	0.35-4.01	1.17	0.34-4.02	0.78	0.21-2.91	0.66	0.28-1.59
Age	0.96	0.89-1.03	0.98	0.93-1.03	0.99	0.93-1.04	1.03	0.96-1.09	1.03	0.96-1.11	1.01	0.97-1.05
Household Composition												
Adolescent	0.43	0.12-1.60	**2.36***	**1.12-4.96**	1.90	0.91-3.95	**5.45****	**1.70-17.47**	**4.38***	**1.33-14.44**	0.80	0.42-1.55
# Children	0.84	0.48-1.45	0.86	0.64-1.17	0.89	0.66-1.22	1.03	0.64-1.67	1.07	0.65-1.76	1.03	0.81-1.32
All Male Children	1.60	0.36-7.11	0.58	0.25-1.33	0.91	0.41-2.05	0.36	0.10-1.35	0.57	0.15-2.19	1.57	0.80-3.09
All Female Children	1.43	0.20-10.33	0.54	0.19-1.52	0.71	0.25-2.02	0.38	0.07-2.02	0.50	0.09-2.83	1.31	0.56-3.03
Model 2: Technology Ownership and Use												
Parent Screen Time	1.17	0.93-1.48	**1.16***	**1.01-1.33**	**1.25****	**1.09-1.43**	0.99	0.82-1.20	1.07	0.88-1.30	1.08	0.98-1.18
Child Screen Time	0.96	0.73-1.25	1.03	0.90-1.18	**1.14***	**1.00-1.31**	1.08	0.85-1.37	1.20	0.94-1.53	**1.11***	**1.00-1.23**
# Parent Devices	0.93	0.55-1.58	1.06	0.80-1.42	1.07	0.79-1.44	1.14	0.72-1.82	1.15	0.71-1.87	1.01	0.80-1.26
# Parent Platforms	0.96	0.61-1.51	0.89	0.68-1.15	0.98	0.74-1.30	0.92	0.61-1.39	1.02	0.66-1.58	1.11	0.87-1.42
# Child Devices	0.93	0.46-1.86	0.89	0.65-1.22	1.00	0.72-1.40	0.96	0.52-1.78	1.08	0.57-2.04	1.13	0.88-1.44
# Child Platforms	1.04	0.68-1.59	1.14	0.88-1.48	1.13	0.84-1.51	1.10	0.76-1.60	1.09	0.73-1.62	0.99	0.78-1.26
Model 3: Technology-related Attitudes and Interactions												
Confidence	1.00	0.66-1.50	1.04	0.85-1.26	**1.26***	**1.02-1.57**	1.04	0.72-1.52	1.27	0.86-1.87	**1.22***	**1.01-1.40**
Worry	1.03	0.90-1.19	1.04	0.94-1.14	**1.11***	**1.01-1.22**	1.00	0.88-1.14	1.07	0.94-1.22	1.07	0.99-1.15
Conflict	0.75	0.43-1.31	1.00	0.70-1.44	0.73	0.49-1.10	1.33	0.83-2.16	0.97	0.57-1.65	0.73	0.51-1.05

Note. Model 2 included significant covariates from Model 1 (i.e., gender, income, identifying as Black, presence of an adolescent in the household). Model 3 additionally included significant covariates from Model 2 (i.e., parent and child screen time).

* $p < .05$; ** $p < .01$.

Discussion

The first goal of this study was to identify sub-groups of parents who share similar parenting attitudes towards digital technology across four mediation domains (active, restrictive/monitoring, participatory, and modeling), which we call *styles of digital parental mediation,* using latent profile analysis. We found four profiles which are differentiated in large part by degree of importance parents placed upon the different dimensions of digital mediation. We found one "high" group (i.e., *High Digital Mediators*), which was characterized by above average scores on all four indicators, but relatively lower scores on restriction. The largest profile, *Average Digital Mediators*, was characterized by near-average scores on all four indicators, thus representing an average or "medium" profile.

We found two "low" profiles, *Moderately Digitally Uninvolved* and *Digitally Disengaged*, both characterized by below-average scores on all indicators. Parents in the *Digitally Disengaged* profile had the lowest scores overall, with markedly lower scores on mediation by modeling relative to parents in the *Moderately Digitally Uninvolved*. Parents in the *Moderately Digitally Uninvolved* and *Digitally Disengaged* profiles both placed the highest emphasis upon restrictive mediation and monitoring relative to active and participatory mediation strategies, suggesting that parents in these profiles see restrictive mediation and monitoring practices as being more viable strategies for mediating their child(ren)'s use of digital technology. Interestingly, restrictive mediation and monitoring had the least spread (1.55 points)

of mean factor scores across all four profiles. Less variability related to restrictive mediation and monitoring could be reflective of the fact that rule setting and enforcement practices are some of the most used mediational strategies (Lauricella et al., 2016). Given the moral panic surrounding digital and social media in the US, it is not surprising that parents in our sample reached for restrictive practices to mitigate risks, both real and imagined. As a macrosystemic influence, cultural fears about the impact of digital technology on children and youth are likely highly influential on this generation of parents.

Although the parental mediation literature has considered modeling to some extent (e.g., Hefner et al., 2019; Vaala & Bleakely, 2015), the current study is the first to incorporate modeling as a domain of parental mediation from a person-centered perspective. Further, the literature does not delineate modeling as being supportive or directive, but rather as a bidirectional influence related to social learning. As a result, we were uncertain how modeling might fit within our digital-specific typologies. We found that mediation by modeling had the largest spread of all indicators (2.37 points) and was key in differentiating our two "low" profiles, beyond differences in magnitude. Parents in the *Moderately Digitally Uninvolved* profile saw their own use of technology as being relatively similar in importance to other forms of mediation, whereas parents in the *Digitally Disengaged* profile saw their own technology use as a negligible source of influence.

Digital and General Parenting Styles

Paralleling general parenting typologies organized along axes of warmth/responsiveness and control/demandingness (Baumrind, 1978, 1991; Maccoby & Martin, 1983), we expected that we might find digital mediation styles characterized by (a) higher emphasis on all mediation practices (i.e. a digital analogue to the authoritative style), (b) higher emphasis on

active/participatory strategies and less emphasis on restrictive/monitoring (i.e. a digital analogue to the indulgent style), (c) higher emphasis on restriction and monitoring and less emphasis on active/participatory strategies (i.e. a digital analogue to the authoritarian style), and (d) little emphasis placed on any of the four mediation strategies (i.e. a digital analogue to the neglectful style), as other scholars (of offline parenting) using variable-centered approaches have found (e.g., Konok et al., 2020; Valcke et al., 2010).

The results of our person-centered approach to digital-specific parenting typologies mirrored general parenting styles to a limited degree, as we found support for authoritative and uninvolved styles, but not for authoritarian nor indulgent. Parents in the *High Digital Mediators* profile scored above average on all four profile indicators, suggesting a digital mediation style characterized by both high digital warmth/responsiveness and high digital control/demandingness, in line with the authoritative style we expected to find (Baumrind, 1978; 1991; Maccoby & Martin, 1983). These parents also placed the least importance on restrictive mediation and monitoring of all four digital-specific indicators and slightly more emphasis on participatory mediation, suggesting that this profile may better reflect Baumrind's (1991) democratic parenting style, an indulgent sub-type characterized by moderate demandingness and high responsiveness.

Garcia et al. (2020) proposed that indulgent styles, like the *High Digital Mediators* profile we identified, may be more adaptive in the digital era. Considering the reduced temporal and spatial limitations of virtual microsystems (Navarro & Tudge, 2022) and research suggesting that excessive use of controlling practices related to virtual microsystems can lead to parent–adolescent conflict and disconnection (Clark, 2011; Katz et al., 2019; Krcmar & Cignel, 2016),

Garcia and colleagues' findings and our *High Digital Mediators* profile may reflect parents' attempts to navigate the novel challenges of the digital era.

Parents in both the *Moderately Digitally Uninvolved* and *Digitally Disengaged* profiles, together comprising 25% of the sample, placed below average emphasis on all mediation strategies, similar to an uninvolved or neglectful general parenting style (Baumrind, 1978, 1991; Maccoby & Martin, 1983) and the quiescent profile identified by Wang and colleagues (2020), which was a subgroup of parents who offered little technology-related support and boundaries for their children.

Similarities and Differences Between Mothers and Fathers

In keeping with our neo-ecological frame, the second goal of this study was to explore whether mothers and fathers in our sample shared similar profiles of digital mediation style, as gender is a key person characteristic influencing development (Navarro & Tudge, 2022). Based on research suggesting significant differences in parental mediation strategies by parent gender (e.g., Connell et al., 2015; Valcke et al., 2010), we anticipated that the profiles for mothers and fathers might differ in emphasis placed on restrictive and participatory mediation.

However, the four profiles were optimal and relatively similar for both mothers and fathers in our sample. Despite this similarity in latent profiles, mothers and fathers had different relative makeups (i.e., the proportions of mothers and fathers) in each profile. For example, the *High Digital Mediators* profile was more prevalent among fathers (45.0% of fathers) than mothers (26.0% of mothers), whereas the *Digitally Disengaged* and *Average Digital Mediators* profiles were more prevalent among mothers (22.0% and 44.4% respectively) than fathers (10.6% and 38.8% respectively). This suggests that fathers in our sample were more likely

(relative to mothers) to be members of profiles characterized by average and above average scores on all four indicators.

Our demographic regression model also suggests significant differences in profile membership by parent gender; fathers in our sample were significantly less likely to be in the *Digitally Disengaged* profile than in the *High Digital Mediators* profile. While our findings do not match our a priori expectations of different profiles across mothers and fathers, our findings do partially support our expectations in that fathers were more likely to belong to the *High Digital Mediators* profile which was characterized by higher active, participatory, and modeling mediation relative to restrictive mediation and monitoring. These results support variable-centered findings of more co-use (Connell et al., 2015) and less restrictive mediation (Valcke et al., 2010) among fathers. It could be the fathers in our study had an increased capacity, both emotional and temporal, to embrace more engaged digital mediation styles because they engage in less child caregiving overall (Connelly, 2015; Navarro et al., under review; Warren, 2017).

Profile Membership by Parent and Household Characteristics

The third goal of the current study was to test whether parent characteristics, household composition, and parent technology use and attitudes were differentially related to profile membership. Here again we saw some similarity in profile membership across these dimensions, with several interesting differences emerging.

Lower-income parents were significantly more likely to be members in the *Digitally Disengaged* profile than in any of the other profiles, consistent with previous research suggesting that lower income parents tend to engage in less digital mediation (Livingstone et al., 2015; Warren & Aloia, 2019). Parent income was the only significant covariate to differentiate membership between the *Digitally Disengaged* and *Moderately Digitally Uninvolved* profiles,

which is also reflected by average income (i.e., ~$32,600 and ~$48,400, respectively). As highlighted above, these two profiles were demarcated by magnitude and a stark difference related to mediation by modeling, such that parents in the *Digitally Disengaged* profile placed far lower importance on modeling than did parents in the *Moderately Digitally Uninvolved* profile.

Our results replicate findings from Europe (Livingstone et al., 2015) and the US (Warren & Aloia, 2019), and raise questions about why, from a neo-ecological perspective, socioeconomic status appears to be a pervasive macrosystemic influence despite the ubiquity of digital technology across socioeconomic classes (Perrin, 2021). For example, cellphone and smartphone ownership rates for adults aged 30-49 (M_{study} = 40.7 years) in the United States are near saturation (100% and 95%, respectively; Perrin, 2021) and European research suggested little difference in device ownership by income (Livingstone et al., 2015). Further, low-income parents in the US have the highest screen time (Lauricella et al., 2016) and, in the current study, we did not find that parental technology use was a significant predictor of profile membership between the two "low" profiles. Instead, we speculate that this macrosystemic factor influences digital parental mediation because the additional time pressures and stressors faced by lower-income parents may reduce opportunities for (and thus emphasis on) mediational practices, and in particular, mediation by modeling (Livingstone et al., 2015; Warren & Aloia, 2019). Research also suggests that lower-income parents may feel less competence and greater insecurity related to digital technology and consequently find it more difficult to engage in active mediation and co-use (Nikken & Opree, 2018), as supported by the positive correlation between income and technology-related confidence in the current study. It could be that some of the lower-income parents in our study felt that their use own of technology was not an adequate or appropriate example for their child(ren) and/or adolescent(s). Clearly, socioeconomic status is a pervasive

macrosystemic influence on parents' attitudes about digital mediation; further research is needed to delineate the mechanisms behind this phenomenon and to elucidate specific strategies to support low-income parents.

In terms of race/ethnicity, we found that parents in our US-based sample who self-identified as Black were almost four times more likely to be in the *High Digital Mediators* profile than in the *Moderately Digitally Uninvolved* profile, paralleling previous research that has suggested that Black parents engage in more active mediation (Lauricella et al., 2016). However, when parent and child screen times were included in the model, race/ethnicity was no longer significant, suggesting that differences in technology usage account for a significant proportion of the differences between Black and White parents in our sample. Previous research has found that Black parents in the United States use technology more intensely (Lauricella et al., 2016) and that the children of Black parents are the most likely, compared to White and Hispanic parents, to watch YouTube daily (Pew, 2021). Our research suggests that Black parents may be more engaged in their children's digital socialization than are White parents, possibly in reaction to their children's frequent engagement in virtual microsystems, or it could be that Black children use technology more intensely because their parents are more intensive users themselves and embrace a more democratic digital parenting style.

Additionally, our results also show different patterns in digital mediation strategies and technology usage between the Black mothers and fathers in our sample. We found positive correlations between mothers who identify as Black and active/participatory mediation and parent/child screen time, but negative correlations between fathers who identify as Black and child screen time and the number of parent/child devices and platforms. Although the size of our sample was prohibitive in exploring these within-group differences further, it does suggest that

there may be nuanced differences between Black mother and fathers. This is an important avenue of future study, as research within virtual microsystems (e.g., Black Twitter) has identified macrosystemic influences (e.g., culturally specific "technoculutral" practices and structural inequalities) that may influence the digital parenting styles of Black Americans (Brock, 2012, 2018).

The presence of an adolescent in the home was a significant predictor of profile membership, as we had anticipated. Parents of at least one youth aged 14 or older were more likely to be in the *Average Digital Mediators* and *High Digital Mediators* profiles of than in the *Digitally Disengaged* or *Moderately Digitally Uninvolved* profiles. This could be because adolescents use digital technology more intensely than do children (Mullan & Chatzitheochari, 2019) and, consequently, parents of adolescents have had a more time and experience in which to develop their digital parenting style. Our findings support variable-centered research (e.g., Lauricella et al., 2016; Navarro et al., under review; Nikken & Jansz, 2014; Rudi et al., 2015) that has found higher engagement in active and participatory mediation among parents of older youth. In light of this evidence, it is important that scholars of digital parenting approach mediation from a neo-ecological perspective; the person characteristics of all family members (including the age of all children) are essential to gaining insight into the complex and dynamic process of digital socialization.

As we expected, parent screen time, child screen time, and parents' technology-related confidence were also positively related to membership in the more engaged digital mediation profiles, supporting previous findings suggesting that parents who use technology more frequently and who have higher digital self-efficacy are more likely to engage in digital mediation strategies, including active mediation, restrictive mediation, and co-use (Connell et al.,

2015; Glatz et al., 2018; Rudi & Dworkin, 2018; Shin et al., 2017; Valke et al., 2010; Wu et al., 2020). For both clinicians and researchers, this suggests that increasing access and improving digital literacy may be potential avenues for supporting parent's digital parenting efforts, as may support the development of digital parenting efficacy and confidence.

Limitations and Future Directions

To our knowledge, this is the first study to use a person-centered approach to explore digital parental mediation styles in the United States. In addition, our study embraced a recent methodological innovation (i.e., tests of profile similarity; Morin et al., 2016) to ensure the validity of our digital parental mediation styles across the mothers and fathers in our sample. Alongside these strengths, our study also has several limitations, including its cross-sectional study design, which limits casual inference.

The current cross-sectional study used neo-ecological theory (Navarro & Tudge, 2022) as a lens through which to organize, analyze, and process our hypotheses and data, which Bronfenbrenner and Morris (2006) described as "discovery mode" (p. 795), rather than a fully-fledged neo-ecological research design. We only examined digital mediation from a parental perspective and, as a result, we were unable to examine bidirectional and synergistic proximal processes of digital socialization. Further, time constraints precluded a thorough assessment and analysis of potentially different parenting attitudes and practices towards individual children within the family, and measures rather referred to the child(ren) in the family more generally. This potentially obscured nuances within the family system. Future neo-ecological research should utilize longitudinal designs with multiple informants, including all primary caregivers and children in the home to gain the greatest insight into the complex and dynamic family system. Careful thought must also be given to choosing substantively and theoretically relevant proximal

processes, person characteristics, and contextual influences. In addition, the current study did not utilize measures of general parenting typologies and so we were unable to analyze these associations directly; future research should explicitly examine these questions to elucidate the relation between digital and general parenting.

It is important to note that we collected our data at a unique macrotemporal moment. We recruited participants and collected data throughout January of 2020, only a few weeks prior to the COVID-19-related shutdowns in the United States. In the intervening years, the internet became a lifeline for many families; children attended school virtually and, when possible, many adults worked from home. Parents attitudes about digital technology and their mediation strategies likely shifted during and after the pandemic and post-pandemic styles of digital parental mediation may be characterized by different priorities. Future research should explore how pandemic-related changes in technology use (e.g., virtual schooling, remote work, telehealth) and social isolation impacted the bidirectional process of digital socialization between parents and children.

In addition, our sample was comprised of a unique macrotemporal cohort of parents who did not grow up with extensive technology themselves but must help guide their own child through a technologized world. The parents in our sample were approximately 40 years old, on average, making them approximately 24 years old when Facebook was launched and 27 years old when the first iPhone was released. In the coming years, cohorts for whom social media and smartphones were part of their childhood and adolescence (i.e., digital natives) will they themselves become parents; their styles of digital parental mediation will likely differ substantially from previous generations.

Research into parental mediation related to digital technology has been completed around the world. In addition to US-based research (e.g., Auxier et al., 2020; Glatz et al., 2018; Warren, 2017), researchers from the United Kingdom (Livingston & Helsper, 2008), Germany (Hefner et al., 2019), Europe (Livingstone et al., 2015), the Netherlands (Krcmar & Cingel, 2016; Sonck et al., 2013), China (Wu et al., 2020), Australia (Jeffery, 2020), Israel (Katz et al., 2019), Singapore (Jiow et al., 2017), and Belgium (Symons et al., 2017) have undertaken research about what strategies parents use to mitigate the risks and amplify the benefits of digital and social media. Nevertheless, most of these studies were completed within WEIRD (Western, Educated, Industrialized, Rich, and Democratic) societies and generalizability beyond these contexts is limited. Our study suffers from the same limitation; while our sample was representative of the US population, our findings are unique to the temporal and cultural context in which our data were collected.

Conclusion

Despite these limitations, our study underscores the heterogeneity in how parents approach parenting related to digital and social media, and how a diverse array of person characteristics and contextual factors relate to parents' digital mediation styles. Future longitudinal research should examine how digital parenting relates to child, youth, and family level outcomes in the short and long term. Evidence about the efficacy of digital parenting strategies will be crucial in helping practitioners, educators, and clinicians in supporting parents to develop and utilize the most effective strategies to support their child(ren) and adolescent(s) in the digital age.

CHAPTER V: GENERAL DISCUSSION

The goal of this dissertation was to develop and elucidate tools to encourage scholars of family and developmental science to consider the influence of digital and social media in their research, across diverse areas of inquiry. Study 1 outlined an adaptation of Bronfenbrenner's bioecological theory for the digital age, *neo-ecological theory*. In this study I posited the existence of two types of microsystems—physical and virtual. Virtual microsystems have fewer spatial and temporal limitations than physical microsystems, which influences the type, duration, and frequency of proximal processes in which children and adolescents engage in the digital age. The existence of virtual microsystems is particularly relevant to parent–child research, as contemporary parents must guide and support their children's interactions in these contexts without the wisdom of previous generations and with limited empirical evidence as to the efficacy of technology-related parenting strategies. In addition to these adaptations to the microsystem, neo-ecological theory builds upon Bronfenbrenner's bioecological theory by reintroducing the macrosystem as a central contextual influence on proximal processes. This paper considers how proximal processes, "the engines of development" (Bronfenbrenner & Morris, 2006, p. 798), are shaped by features of virtual microsystems.

Study 2, a cross-sectional empirical study with a sample of parents from the United States, sought to develop and validate a quantitative measure of parental attitudes of digital-specific parenting strategies (i.e., digital parental mediation). The resulting measure, the Digital Parental Mediation Scale (DPMS), is a 45-item survey instrument to assess parents' attitudes about four dimensions of mediation: active mediation, restrictive mediation and monitoring, participatory mediation, and mediation by modeling. In this study I applied a bifactor structure to the DPMS, with the general factor representing shared general parenting variance and the four

sub-factors representing digital-specific dimensions of parental mediation. Study 2 also found significant associations between these dimensions and participants' demographics, technology use and attitudes, and parenting self-efficacy and perceived influence.

Study 3 built upon both neo-ecological theory and the DPMS to identify four profiles of digital mediation styles among a sample of parents in the United States. Using a person-centered technique, this study utilized the four subscales of the DPMS to identify four typologies of digital parental mediation styles. Overall, these four styles were differentiated by both magnitude (i.e., one "high," one "average," and two "low" profiles) and differing emphases placed upon mediation by modeling, which was pointedly different between the two "low" profiles. All four profiles were generalizable across the mothers and fathers in the study and were differentially associated with parent income and race, child age, parent screen time, child screen time, and parents' confidence and worry related to technology. This person-centered study illustrates the heterogeneity across parents in how they approach parenting related to digital and social media and suggests that efforts to educate and support parents should not treat them as a single group, but instead be differentiated and targeted based on person characteristics and contextual factors.

Future Directions

As in Bronfenbrenner's bioecological theory, proximal processes are the driving forces of development in neo-ecological theory. Over time, development occurs as these increasingly complex interactions and activities synergistically shape (and are shaped by) a diverse and dynamic array of person characteristics and contextual influences. Ideally, I would have designed the current studies to measure digital socialization, the proximal process through which I believe parents and children bidirectionally shape their digital-related beliefs and behavior. However, due to fiscal and time restraints, I instead focused on exploring parents' attitudes about how they

can support and guide their child(ren) and adolescent(s) use of digital and social media. This approach, which Bronfenbrenner described as "developmental science in the discovery mode" is useful for "devising new alternative hypotheses and corresponding research designs" (Bronfenbrenner & Morris, 2006, p. 801). When viewed from the perspective of a discovery mode this dissertation offers a number of integrations and insights to generate new hypotheses and future research designs, including research related to person characteristics (i.e., parent gender, parents' technology-related confidence, and general parenting style) and research related to microsystemic (i.e., family size and composition) and macrosystemic (i.e., socioeconomic status and race/ethnicity) influences.

Person Characteristics

Parent Gender

Bronfenbrenner delineated gender as a key person characteristic in bioecological research; he described it as one of three person characteristics that was "so pervasive in future development that their possible influence routinely needs to be considered" (Bronfenbrenner & Morris, 2006, p. 814). However, research into parenting practices and styles has long been reliant upon samples comprised only of mothers, with limited (but growing) research on fathers' parenting styles and the interrelations between parents' styles within the family system (Tavassolie et al., 2016; Winsler et al., 2005). The extant general parenting literature suggests that mothers may employ more authoritative parenting styles than do fathers (Tavassolie et al., 2016; Winsler et al., 2005). Within the limited number of digital mediation studies that have included parent gender as a covariate, fathers have been found to be more likely to engage in active and discursive digital mediation practices. The current studies strengthen this area of the literature as the sample was comprised of both mothers and fathers (from different families) and

both studies found significant associations between parent gender and digital parental mediation. In addition, statistical tests of measurement invariance (Study 2) and profile similarity (Study 3) support the validity of these findings.

In Study 2, mothers were less positive about participatory mediation and mediation by modeling than were fathers, replicating the results from Connel et al. (2015) and Valke et al. (2010). The findings of Study 3, although based on the same US sample, offer additional insights beyond replication; fathers in the study were more likely to be members of the *High Digital Mediators* profile (paralleling an authoritative or democratic digital parenting style) than were mothers. This is at odds with general parenting research suggesting that mothers are more authoritative than are fathers. Perhaps the fathers in the current study had more time and energy in which to use technology (due to less child caregiving overall than mothers; see Connelly, 2015), resulting in higher digital literacy/confidence and more positive attitudes about digital parental mediation, particularly positive and hands-on practices. Perhaps macrosystemic gender stereotypes in the US related to science, technology, and math (Steele, 2003) also influence this differential finding in mothers' and fathers' attitudes in our sample; mothers in the sample may have internalized norms that they were not as capable in scientific or technological endeavors.

Clearly, additional research is needed to explore differences in digital parenting between mothers and fathers. Qualitative research would be particularly useful in this regard, as it could elucidate nuanced macrosystemic influences that may not be evident in quantitative research. In addition, future research should explore how the similarity (or dissimilarity) in digital parenting styles between parents relate to child and family level outcomes, as proximal processes (like digital socialization) are influenced by parents' joint and synergistic styles. Analytic techniques like the Actor Partner Interdependence Model (APIM; Fitzpatrick et al., 2016) may be

appropriate in this regard, as they examine dyadic phenomena (e.g., mother–father relationships) from a bidirectional and synergistic perspective, as opposed to treating parental influences as additive or independent from one another.

Technology-Related Confidence

Parents' perceptions of their own technological literacy, skills, and confidence constitute another key person characteristic (i.e., a resource characteristic) within this area of inquiry. Bronfenbrenner described such resource characteristics as "...assets that influence the capacity of the organism to engage effectively in proximal processes… and extend the domains in which proximal processes can do their constructive work" (Bronfenbrenner & Morris, 2006, p. 812). From this perspective, technology-related confidence may increase parents' capacity to engage in digital parental mediation practices. Although the cross-sectional nature of the current studies prohibits inferences about the direction of effects, I did find that parents' technology-related confidence was significantly related to positive attitudes about digital parental mediation in both Study 2 and Study 3. In Study 2, confidence was significantly associated with one dimension of digital parental mediation—participatory mediation. Utilizing a person-centered approach (as opposed to the variable-centered approach of Study 2), Study 3 found that parents who had higher levels of technology-related confidence were more likely to be members in the *High Digital Mediators* profile. These results replicate previous research that found that parents utilized more discursive mediation and co-use when they were more confident in their own use of digital technology (Connell et al., 2015; Glatz et al., 2018; Rudi & Dworkin, 2018; Shin et al., 2017; Valke et al., 2010; Wu et al., 2020).

However, a closer post-hoc examination of the data reveals that gender could potentially moderate these findings. For fathers, technology-related confidence was significantly (α =.01)

and positively correlated with discursive mediation (r = 0.272), participatory mediation (r = 0.312), and mediation by modeling (r = 0.286) (see Table 8). Mothers in the sample had a different pattern of correlations; technology-related confidence was significantly (α =.05) and positively correlated with discursive mediation (r = 0.157), restrictive mediation and monitoring (r = 0.129), and mediation by modeling (r = 0.162). For mothers, technology-related confidence was less strongly related to discursive mediation and mediation by modeling, not correlated with participatory mediation, and positively correlated with restrictive mediation and monitoring, which was not the case for the fathers in the sample. As the structural models in Study 2 were analyzed in separate models without covariates, the significant and positive relation between confidence and participatory mediation did not account for parent gender. As a result, it is likely that this finding from Study 2 was driven largely by fathers' technology-related confidence, not mothers'. This is supported by the findings of Study 3; fathers were more likely to be members of profiles demarcated by a higher emphasis on participatory mediation. It is possible that technology-related confidence may not be as influential a resource characteristic for mothers as they engage in the process of digital socialization as it is for fathers. Perhaps this relates to macrosystemic gender stereotypes in the US, as discussed above, and/or because mothers in our sample had less time to use technology and engage in participatory mediation. The extant literature offers little clarity in this issue, as parent gender is often controlled out (e.g., Glatz et al., 2018). This theoretically relevant post-hoc finding exemplifies what Bronfenbrenner envisioned as science in the discovery mode. It raises new questions and hypotheses for future research and could have important implications for educators and practitioners as they support parents in developing effective digital mediation skills.

Microsystemic Influences

Family Size

Proximal processes (e.g., digital socialization between a parent and child) do not work in isolation; such processes are bidirectionally and synergistically interrelated with the person characteristics of other persons in the microsystem, other proximal processes, the features of the virtual and physical microsystems in which they take place, as well as meso-, exo-, and macrosystemic influences. From a parental perspective, the number of children in the family may be an important microsystemic influence upon digital socialization, as increasing numbers of children may influence parents' person characteristics (e.g., temporal, fiscal, and emotional capacities), the features of the home microsystem, relationships among members of the household, and parent–child interactions. General parenting research suggests that increasing family size is associated with fewer positive parenting behaviors (Jenkins et al., 2003). Similarly, Valke and colleagues (2010) found that parents of smaller families were more likely to use warm and supportive digital parenting practices.

The current studies did not replicate these findings but do spark questions for future research. Study 2 found that increasing family size was associated with greater emphasis on restrictive mediation and monitoring, mirroring the results of Sonck and colleagues (2013). However, family size was not significantly related to digital parental mediation style profile membership in Study 3. A post-hoc examination of the correlations between study variables again suggests that parent gender may explain some of this discrepancy. Restrictive mediation and monitoring was significantly and positively associated with the number of children in the family for mothers ($r = 0.149$) but not for the fathers in our sample, suggesting that mothers' attitudes likely drove the significant finding in Study 2. Why might mothers of larger families,

but not fathers, use more restrictive mediation practices? These mixed findings and questions suggest that further research, guided from a family systems perspective as opposed to a parent–child perspective, is necessary to elucidate how family size may influence parents' attitudes and behaviors and the digital socialization process.

Adolescence

Although Bronfenbrenner considered age to be a person characteristic, the current studies operationalized the age of participants' child(ren) and adolescent(s) as a microsystemic influence (i.e., households with/without at least one adolescent aged 14 or older) to account for the presence of multiple children in the home. Previous parental mediation research suggests that parents modify their use of digital mediation practices across the course of development, generally utilizing less restrictive and more participatory strategies over time (Glatz et al., 2018; Navarro et al., under review; Nikken & Jansz, 2014; Padilla-Walker et al., 2012; Rudi et al., 2015; Sonck et al., 2013; Vaala & Bleakley, 2015; Valcke et al., 2010; Warren, 2017). The current studies support these assertions; Study 2 found that parents of adolescents placed greater importance on discursive mediation, participatory mediation, and mediation by modeling, and less importance upon restrictive mediation and monitoring. Similarly, Study 3 found that parents of adolescents were more likely to be members of the *High Digital Mediators* and *Average Digital Mediators* profiles. Taken together, the evidence base and the current studies suggest that, in general, parents (at least in the US) are modifying their use of (and attitudes about) digital mediation across the course of development. However, this inference is drawn from mostly cross-sectional studies and could be related to parent cohort effects or macrotemporal influences. Additional longitudinal studies are necessary to research the trajectory of parental

mediation from childhood through young adulthood and its relationship with child and family level outcomes.

Macrosystemic Influences

Neo-ecological theory reasserts the importance of considering macrosystemic influences on development in the digital age. Socioeconomic status, operationalized as income within the current studies, was a significant macrosystemic influence in both Study 2 and Study 3, paralleling the findings of other recent research in the US (Warren & Aloia, 2018) and Europe (Livingstone et al., 2015). In Study 2, income was significantly and positively related to all four digital parental mediation dimensions and in Study 3, lower-income parents were more likely to be members of the *Digitally Disengaged* profile (i.e., the least digitally engaged profile) than in any of the other profiles. Again, a closer look at these findings by parent gender suggests that the impacts of social class may differ across parent gender. For fathers, income was significantly, positively, and strongly correlated with all four dimensions of the DPMS, but for mothers, only restrictive mediation and monitoring and mediation by modeling were significantly (and weakly) correlated with income. This suggests that income may not be as influential over mothers' attitudes about digital mediation as fathers, a novel post-hoc finding in discovery mode.

Another discovery mode finding was related to parent racial/ethnic identity. In Study 3, parents who self-identified as Black were four times more likely to be in the *High Digital Mediators* profile than in the *Moderately Digitally Uninvolved* profile. This finding mirrors recent research (Lauricella et al., 2016), but akin to gender and other demographic variables, race/ethnicity status is often used as a covariate in digital mediation research, with little attention paid to the influence of culture over parents' attitudes or behaviors. Correlations amongst study variables (Table 3) suggested that Black mothers and fathers may have different patterns in their

preference for mediation strategies, but the small sample size was prohibitive to further post-hoc analyses. Additional research with Black parents is needed to clarify these associations and explore possible mechanisms influencing the digital parenting styles of Black mothers and fathers.

The extant literature and the current studies offer little insight into *how* and *why* these macrosystemic factors (i.e., social class and race/ethnicity) influence digital parenting. In terms of socioeconomic status, access to portable digital devices is likely not responsible, as device ownership in the US and Europe is similar across income levels and evidence even suggests that low-income parents may use technology more intensely (Lauricella et al., 2016; Livingstone et al., 2015; Perrin, 2021). In Study 3, I speculated that the daily temporal, fiscal, and emotional stressors faced by low-income parents could potentially influence their person characteristics, both resource (e.g., technological skills and knowledge, time) and force (e.g., confidence, self-efficacy). In light of the discovery mode findings related to parent gender and race/ethnicity in the current studies, future digital mediation researchers should adopt an intersectional perspective. How might the intersections of gender, race/ethnicity, and social class influence parents' engagement in digital socialization? Neo-ecological theory offers a systematic framework for scholars to explore these complex and interrelated macrosystemic influences in a step wise, and yet comprehensive, manner.

Limitations

Despite the unique contributions of this dissertation, several limitations must be acknowledged and explored to advance this area of inquiry, namely the temporal, global, and developmental challenges associated with both the current studies and the broader technology-related family, child, and adolescent literature. In moving forward with this important area of

research, it is important to acknowledge the limits to generalizability across time, cultural context, and developmental stage.

A Temporal Perspective

Neo-ecological theory underscores the importance of macrotime in considering the influence of technology on development and the family system. Digital and social media are neither easily defined nor described, as technological innovation is not static. Digital technology is dynamic, changing across time as new devices, platforms, and features are released in rapid succession and as billions of users all around the world synergistically shape digital cultures. This dynamism is hard to pin down and research, especially given the slower speed of academic research. Data for this dissertation were collected in 2020, when adolescents primarily used visual platforms (e.g., Instagram); our findings may not be applicable in the future when the features, affordances, and culture of platforms are different. Parents of the future may be dealing with different issues than were the parents in our sample, and thus the DPMS, in its current form, may not necessarily be applicable. Given this possible temporal instability, scholars should engage in rigorous analysis of measure validity and reliability.

Additional threats to temporal generalizability are cohort effects. The sample utilized in Studies 2 and 3 was comprised of a unique macrotemporal cohort of parents who did not grow up with technology themselves, but who must engage in digital parental mediation. The average age of parents in my sample, collected in 2020, was 40 years old, making them approximately 24 years old when Facebook was launched in 2004 and 27 years old when the first iPhone was released in 2007. These parents did not begin using social media or mobile technology as a tween or teen, unlike their own children who have been described as “digital natives.” This cohort of parents will quickly age, with individuals born in the 1990s and 2000s aging into

parenthood; the parents of future cohorts will likely parent very differently as they will be able to draw on their own childhood experiences with their parents as models. This limitation is not unique to the current studies or digital parenting research, but a limitation of parenting research in general. In the digital age, childhood and adolescence are not the only developmental trajectories to be altered—parenthood today is vastly different than it was a generation ago, and these differences are likely not limited to digital-specific parenting as parenting attitudes and goals, parenting styles, and parenting practices (including domain-specific practices) are interrelated (Darling & Steinberg, 1993). Recent cross-cultural research suggests that the efficacy of general parenting styles may be shifting; indulgent styles may be similarly effective as authoritative styles in the digital era (Garcia et al., 2019). Just as neo-ecological theory questions the applicability of pre-digital era research on children on adolescents, scholars must also question the applicability of past research and not assume generalizability across generations, both past and future.

The COVID-19 pandemic also presents threats to temporal generalizability. The data utilized in the current studies were collected in January of 2020, weeks before global shutdowns and social isolation protocols. The use of digital and social media by children, adolescents, and parents shifted overnight; virtual learning and social interactions replaced those in physical microsystems. Parents' attitudes about digital technology and their mediation strategies likely shifted during the pandemic, as they reevaluated the role of technology within the family system. Post-pandemic styles of digital parental mediation may be different from the styles prior to the pandemic, and as a result, findings from the current studies and other pre-pandemic research may be outdated.

A Global Perspective

Digital and social media are not solely a western phenomenon. Of the roughly 8 billion people on earth, 5 billion own a mobile phone, with 2.5 billion of those being smartphones (Taylor & Silver, 2019). Even in emerging economies where the overall use of digital technology, the internet, and social media is lower (e.g., 90% of adults in advanced economies use the internet compared to 60% in emerging economies), youth are the most intense users of digital devices and social media. For example, in the Philippines, three-quarters of adults aged 18–34 owned a smartphone in 2018 compared to only 27% of adults 50 and older. Similarly, in South Africa, 73% of adults 18–34 owned a smartphone compared to 35% of adults over 50 (Taylor & Silver, 2019). This suggests that although parents in emerging economies may not be users of digital technology themselves, their children likely own a smartphone, use the internet, and utilize social media. From a digital parenting perspective, parents in emerging economies may face similar challenges as do parents in advanced economies: How can they protect, guide, and support their children and adolescents in virtual contexts about which they have little knowledge or experience? This technology-related generational divide may be even more marked in emerging economies as parents may not own or utilize digital technology at all. This raises questions about digital parental mediation in diverse global and cultural contexts: What is similar and different about how parents approach digital mediation across macrosystemic contexts? How might strategies, their degree, and their efficacy vary? Would support and educational interventions for practitioners and parents in advanced economies be applicable to parents in emerging economies, and vice versa?

The current sample was recruited in the United States, and thus offers little insight into these cross-cultural questions, but parental mediation research has been undertaken by

researchers from around the globe. In addition to research in the United States (e.g., Auxier et al., 2020; Glatz et al., 2018; Warren, 2017), scholars from the United Kingdom (Livingston & Helsper, 2008), Germany (Hefner et al., 2019), the Netherlands (Krcmar & Cingel, 2016; Sonck et al., 2013), Australia (Jeffery, 2020; Smith et al., 2015), Israel (Katz et al., 2019), and Belgium (Symons et al., 2017; Valke et al., 2010) have engaged in research examining the intersection of parenting and digital technology. Nevertheless, these studies are from Western, Educated, Industrialized, Rich, and Democratic (WEIRD; Henrich et al, 2010) societies and generalizability is limited. However, the global evidence base is growing; scholars from China (Wu et al., 2020), Singapore (Jiow et al., 2017; Shin & Li, 2017), Peru (Smith & Barad, 2018), Hungary (Konok et al., 2020), and Russia (Soldatova et al., 2020) have published papers examining parental mediation.

To my knowledge, a meta-analysis of these studies has yet to statistically analyze findings across cultures and determine whether there are significant patterns. However, a literature review of these studies reveals *both* similarities and differences with my findings and other WEIRD research. Several studies drawing on non-WEIRD samples mentioned knowledge gaps between parents and their children and/or adolescents (Konok et al., 2020; Soldatova et al., 2020; Wu et al., 2020). Socioeconomic status, measured by education and/or income depending on the study, was significantly associated with digital mediation strategies and styles among Hungarian and European parents (Konok et al., 2020; Livingstone et al., 2015) but not among Singaporean families (Shin et al., 2017). Konok and colleagues (2020) found that that less educated parents were more likely to embrace an authoritative or permissive digital parenting style and that their children were more intense users of technology, contrary to the current findings, but partially in line with cross-European research suggesting that lower income and less

educated families have high device ownership in the home (Livingstone et al., 2015). Restrictive digital mediation strategies were related to lower digital skills among Hungarian and Russian adolescents (Konok et al., 2020; Soldatova et al., 2020) and conflict between Peruvian mothers and sons (Smith & Barad, 2018), whereas Chinese adolescents had higher digital literacy if their parents embraced a more engaged mediation style (Wu et al., 2020). In keeping with the current studies and other WEIRD research (e.g., Jeffrey, 2020; Padilla-Walker et al., 2012; Sonck et al., 2013; Vaala & Bleakley, 2015), increasing child age was significantly associated with parents' choice of less restrictive mediation strategies in Hungary and Russia (Konok et al., 2020; Soldatova et al., 2020), but was not significant (Shin et al., 2017) or unexplored in others (Wu et al., 2020). There are clearly threads stretching across cultures, namely that parents are engaging in digital mediation and that mediation is influenced by a constellation person and contextual factors, and yet there is great heterogeneity in the bidirectional process of digital socialization both within and across cultures.

Among non-WEIRD studies of parental mediation, there is a lacuna of studies that have investigated the construct validity of parental mediation. Of the studies reviewed, all embraced some version of mediation dimensionality (e.g., active mediation, restrictive mediation, co-use, and monitoring) as developed by scholars in WEIRD societies (e.g., Livingstone & Helsper, 2008; Nikken & Jansz, 2006), without considering whether these dimensions or scales are applicable in different cultural contexts. Future researchers, across both cultural and temporal contexts, should engage in more rigorous measurement of parental mediation; without analyses of construct and scale validity in a wide variety of contexts researchers may draw erroneous conclusions, potentially impacting the quality and efficacy of parent education and interventions.

In addition to cross-cultural considerations, Study 3 suggests within-society variation in digital parenting styles by parent race/ethnicity, supporting previous research in the United States (Auxier et al., 2020; Lauricella et al., 2016). Black parents in my sample were significantly more likely to embrace an involved digital parenting style compared to White parents. As the current studies are cross-sectional, I was unable to draw causal inferences about the bidirectional process of digital socialization among the Black families in my sample. Future longitudinal research with multiple informants and specific sampling frames, as well as qualitative and within-group research designs, are necessary to elucidate the unique patterns of digital socialization among cultural groups in the United States (i.e., Black, White, and Latinx families).

A Developmental Perspective

In addition to limited generalizability related to temporal and global context, caution is warranted in generalizing across the course of development. While not the primary variable of interest in most studies of parental mediation, child age or grade level is frequently entered as a covariate in statistical analyses, and a review of the literature reveals significant patterns in how parents alter their mediation strategies across the course of childhood and adolescence. Children and adolescents use technology differently; adolescents tend to engage in more screen time and significantly more frequent use of messaging, blogging, and social networking platforms (Vaala & Bleakely, 2015). Parents are cognizant of the differing patterns of technological use by children and adolescents, and research suggests that many alter their mediational strategies in relation to child age (Connell et al., 2015; Jeffrey, 2020; Glatz et al., 2018; Livingstone & Helsper, 2008; Nikken & Jansz, 2014l; Padilla-Walker et al., 2012; Sonck et al., 2013; Vaala & Bleakely, 2014; Warren, 2017).

Studies of digital parental mediation tend to focus on adolescents, as they are heaviest users of technology, but Nikken and Jansz (2014) explored parental mediation in children under the age of 12 in the Netherlands. They found that supervision (i.e., direct observation) was the most frequent form of mediation for young children, while restrictive mediation was more frequently employed with older children. Studies incorporating older children and adolescents suggest that parents' application of restrictive parental mediation may be curvilinear, peaking in late childhood and early adolescence, when youth begin to use digital devices and platforms independently but have yet to develop the digital skills, autonomy, and self-regulation of older adolescents (Glatz et al., 2018; Sonck et al., 2013; Vaala & Bleakely, 2014). Research suggests that active mediation likely also decreases as children enter adolescence (Padilla-Walker et al., 2012; Warren, 2017), potentially peaking in late childhood (Nikken & Jansz, 2014). The results of Studies 2 and 3 support these patterns; parents of at least one adolescent (14 and older) in our sample were more likely to engage in discursive mediation and participatory mediation, less likely to engage in restrictive mediation and monitoring, and have an involved digital parenting style.

Both the current findings and the extant literature suggest that parents are modifying digital mediation to fit with the developmental age and needs of their child, but fewer studies explore why. Parents may alter their mediation based upon their differential concerns about online risks. In a qualitative Australian study, Jeffrey (2020) found that parents of younger children were more concerned with the impact of technology on cognition and development, whereas parents of older children were more concerned about the risks of cyberbullying and cybervictimization. These concerns may differentially predict mediation strategies by age, with parents of younger children setting and holding boundaries on screen time, and parents of older

children discussing how to navigate and avoid risky situations online. Futher, Vaala and Bleakley (2015) suggested that decreasing concerns about online risks may be associated with declines in mediation. In addition, Glatz et al. (2018) suggested that parents may feel less confident in their ability to effectively mediate as their child ages, and thus engage in less mediation in general, as was found by Livingstone and Helsper (2008). Vaala and Bleakley (2015) suggested that lower levels of mediation by parents of older adolescents may reflect adolescents' increasing individuation and less parental concern about rules and limits.

As a result, scholars, educators, and practitioners should use caution when generalizing mediation strategies and digital parenting strategies across the course of adolescence. Future research should continue to consider developmental time as an important influence in the process of digital socialization, especially using longitudinal designs to explore stability and change in digital mediation across time and to make causal inferences linking trajectories of mediation, digital socialization, and outcomes.

Concluding Thoughts

The three studies of this dissertation illustrate both the importance of and the complexity in considering the influence of digital technology on child development and the family system. Further, the challenges outlined above (i.e., limited generalizability across temporal, cultural, and developmental contexts) do not exist in isolation; they are simultaneously and synergistically influencing the process of digital socialization in which parents and children engage. While this may seem overwhelming and act as another barrier to the inclusion of digital technology within developmental and family research, scholars are encouraged to utilize neo-ecological theory and the Process-Person-Context-Time (Bronfenbrenner & Morris, 2006; Navarro, Stephens et al., under review) model as a theoretical framework in which to organize their inquiries and build,

piece by piece, a more complete and holistic understanding of digital mediation and socialization.

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APPENDIX A: STUDY 2. SUPPLEMENTAL MATERIALS

Latent Variable Measurement Model of the PLOC Efficacy Subscale and PIS

We modeled this subscale of the Parental Locus of Control scale (PLOC; Campis et al., 1986) as a latent factor model; after accounting for the reverse-worded items in the PLOC using the correlated traits-correlated method (CTCM; DiStefano & Motl, 2008), the model had acceptable fit. However, closer evaluation of the item parameters revealed that two items on the efficacy subscale ("I am often able to predict my child's behavior in situations" and "My child usually ends up getting his/her way, so why try") had a very low factor loadings (0.025 and 0.021, respectively) and high residual variances, both outside Brown's (2015) recommended cut-offs. We respecified the model without these two items and while model fit remained unchanged, all item parameters had good fit to the data ($\chi^2(12) = 45.754$, $p < .001$, RMSEA = 0.079 [Upper-bound 90% CI = 0.104], SRMR = 0.067, CFI = 0.904). We also estimated a latent variable measurement model for the Perceived Influence Scale (PIS; Freeman-Doan et al., 1993); the model had acceptable fit according to the CFI and SRMR closeness-of-fit indices, although the RMSEA, which is sensitive to the number of degrees of freedom, was above the prespecified cutoff value ($\chi^2(5) = 51.359$, $p < .001$, RMSEA = 0.145 [Upper-bound 90% CI = 0.183], SRMR = 0.035, CFI = 0.941) (Brown, 2015).

Measurement Invariance

We estimated measurement invariance models of the DPMS bifactor model with respect to mothers ($N = 280$) and fathers ($N = 180$). The configural model ($\chi^2(1697) = 2693.71$, $p < .001$, RMSEA = 0.052 [Upper-bound 90% CI = 0.055], SRMR = 0.082, CFI = 0.906) had good model fit, suggesting that the structure of the model fit both mothers and fathers adequately. The metric model (i.e., factor loadings constrained to be equal across groups) could be specified

across mothers and fathers without significantly worsening model fit ($\Delta\chi^2(82) = 81.78$, $p = 0.486$, Δ CFI = 0.003). However, scalar invariance (i.e., item intercepts also held equal across groups) could not be specified without significantly worsening model fit according to the chi-square difference test ($\Delta\chi^2(39) = 53.85$, $p = 0.057$). The change in CFI (0.001), however, suggested negligible difference between the two models. We examined modification indices (Dimitrov, 2010), and found that freeing intercepts for two items related to video games (items 23 and 24) across mothers and fathers would optimize model fit. This modification is appropriate given previous empirical data to suggest fathers engage in more video game play with children than mothers (Vaala & Bleakley, 2015). After freeing these two parameters, we found that the partial scalar invariance model did not significantly worsen model fit when compared to the metric invariance model ($\Delta\chi^2(41) = 43.633$, $p = 0.210$ Δ CFI < 0.001).

Results of Structural Models

Discursive Mediation (DM)

Parents who had higher education ($\beta = 0.092$, $SE = 0.034$, $p \leq .05$), were married ($\beta = 0.119$, $SE = 0.047$, $p \leq .05$), and had a higher income ($\beta = 0.142$, $SE = 0.052$, $p \leq .01$) were significantly more positive about discursive mediation, as were parents of adolescents ($\beta = 0.240$, $SE = 0.091$, $p \leq .05$). In terms of technology use and attitudes, parents who used more screen time ($\beta = 0.130$, $SE = 0.046$, $p \leq .01$), and whose children used more screen time ($\beta = 0.159$, $SE = 0.040$, $p \leq .001$), had more devices ($\beta = 0.131$, $SE = 0.049$, $p \leq .01$), and used more applications ($\beta = 0.115$, $SE = 0.045$, $p \leq .01$), had more positive attitudes about discursive strategies. Parents who felt more strongly that they had influence over their child(ren)'s behavior ($\beta = 0.196$, $SE = 0.076$, $p \leq .01$) were also more likely to place emphasis on discursive mediation.

Restrictive Mediation and Monitoring (RMM)

Participants who were married reported less favorable attitudes about restrictive and monitoring practices (β = -0.134, *SE* = 0.053, $p \leq .05$), although participants with higher incomes placed more emphasis on these strategies for mitigating online risks (β = 0.134, *SE* = 0.052, $p \leq .01$). Participants who had more children in their family were also more likely to place emphasis on restrictive mediation strategies (β = 0.132, *SE* = 0.046 $p \leq .01$), as were participants who reported using screens more hours per day (β = 0.127, *SE* = 0.050, $p \leq .05$). In terms of general parenting attitudes, parents with higher beliefs in their parental efficacy were less likely to place emphasis on RMM (β = -0.231, *SE* = 0.093, $p \leq .05$), while parents who felt that they had more influence over their child/adolescent's behavior (β = 0.212, *SE* = 0.065, $p \leq .001$), were more likely to report RMM as a viable avenue for mediation.

Participatory Mediation (PM)

Mothers were less likely than fathers to see the benefit of using participatory strategies (β = -0.248, *SE* = 0.047, $p \leq .001$). Paralleling attitudes about discursive mediation, parents who were college-educated (β = 0.226, *SE* = 0.044, $p \leq .001$), married (β = 0.188, *SE* = 0.044, $p \leq .001$), of higher income (β = 0.283, *SE* = 0.043, $p \leq .001$), and had an adolescent child (β = 0.458, *SE* = 0.107, $p \leq .001$) were more likely to have positive attitude about participatory mediation. Unsurprisingly, parents who use screens more intensely (β = 0.279, *SE* = 0.044, $p \leq .001$), have more devices and applications (β = 0.107-217, *SE* = 0.029-0.044, $p \leq .001$), and whose children do so as well (β = 0.205—0.209, *SE* = 0.043—0.046, $p \leq .001$) also had more favorable attitudes about PM. Parents who had high efficacy were less likely to see PM as important (β = -0.201, *SE* = 0.079, $p \leq .05$), while parents who had higher scores on influence (β = 0.361, *SE* = 0.054, $p \leq .001$) were more likely to have positive attitudes.

Mediation by Modelling (MM)

Mothers were also less likely to place emphasis on modeling as a form of mediation (β = 0.142, SE = 0.052, $p \leq .01$). Like DM and PMM, parents who were college educated (β = 0.114, SE = 0.048, $p \leq .05$), married (β = 0.201, SE = 0.052, $p \leq .001$), of higher income (β = 0.240, SE = 0.049, $p \leq .001$), and had an adolescent (β = 0.316, SE = 0.120, $p \leq .001$) were also more positive about MM. In terms of technology usage and attitudes, parents who had more devices, used their devices more hours per day, and who reported similarly higher intensity use by their children (β = 0.106—0.163, SE = 0.046—0.050, $p \leq .05$—.001) were more likely to feel positive about mediation by modeling. In terms of general parenting attitudes, parents who report high efficacy placed less emphasis on MM (β = -0.179, SE = 0.085, $p \leq .01$), while parents who felt that they had more influence (β = 0.184, SE = 0.080, $p \leq .05$)were more likely to feel positively about modeling strategies.

General Parenting Factor (GPF)

The general parenting factor had a very different pattern in relation to the demographic variables, technology usage and attitudes, and perceived parenting influences than the DPMS subscale. Parents who reported higher levels of screen time by their child(ren) scored lower on the GPF (β = -0.147, SE = 0.052, $p \leq .01$). Parents who reported higher confidence in their technological capabilities (β = -0.269, SE = 0.043, $p \leq .001$) scored lower on the GPF, whereas parents who reported more conflict with their child or adolescent about technology scored higher (β = 0.179, SE = 0.050, $p \leq .001$). In addition, parents who reported high levels of efficacy were more likely to have a higher GPF score (β = 0.453, SE = 0.069, $p \leq .001$), which suggests that the GPF is more representative of general, as opposed to digital-specific, parenting attitudes.

Revised Bifactor Model Items and Loadings

	Item	PF	M	M	M	MM
1	Discuss ways of interacting positively online	.704	.325			
2	Discuss what type of content is appropriate to post on social media	.700	.103			
3	Talk about posts or messages your child has seen/received which worry them	.710	.078			
4	Talk about how they are portraying themselves online	.659	.139			
5	Talk about the risks and benefits of social media	.722	.158			
6	Discuss the content of online videos	.553	.498			
7	Encourage your child to reflect on how digital and social media makes them feel	.474	.551			
8	Encourage your child to reflect on which is the best medium for response (e.g., text, phone call, in-person)	.638	.434			
9	Use your own digital devices to model where it is appropriate to use them	.615		.475		
10	Use your own digital devices to model when it is appropriate to use	.633		.578		
11	Use your own digital devices to model how much time should be spent online	.575		.534		
12	Use your own social media platforms to model how to present oneself online	.566		.646		
13	Try to use social media in a way consistent with the guidelines you have set for your child	.661		.335		
14	Model positive interactions online	.699		.321		
15	Model choices about when to it is appropriate to text, call, or talk to another in person	.702		.286		
16	Model screen-free time	.602		.333		
17	Model responding to text messages in an appropriate way	.717		.348		
18	Text them as part of a family group chat	.347			.651	

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19	Send messages over a social media platform (e.g., Instagram, Snapchat)	.145	.744	
20	"Like" their social media posts	.142	.631	
21	Comment on their social media posts	.170	.681	
22	Share their social media posts	.098	.728	
23	Play video games together online	.266	.641	
24	Play video games together in-person	.232	.620	
25	Watch online videos with your child	.305	.620	
26	Look at online content (e.g., memes, photos, posts) together in-person	.399	.543	
27	Send or share articles or videos to them online	.227	.754	
28	Ask your child to teach you or show you how to do something online	.249	.620	
29	Look for information about new applications and how to use them	.442	.634	
30	Download and use new applications to learn how they work	.338	.706	
31	Develop social media profiles to learn how the platform works	.374	.614	
32	Discuss limits on content viewed online	.767		.118
33	Set limits on who your child can communicate with via text message	.676		.409
34	Set limits on who your child can communicate with via social media	.762		.228
35	Set limits on who your child can communicate with via online gaming	.734		.243
36	Set time limits on use of digital devices	.778		.202
37	Set rules on what online content they can access	.771		.168
38	Set rules about where digital devices can be used	.729		.166

39	Check their computer browser history	.422	.741
40	Look through their text messages	.305	.778
41	Look through their social media feeds	.523	.634
42	Monitor they are interacting with on social media	.726	.324
43	Monitor they are interacting with on online games	.682	.353
44	Monitor they are interacting with over text message	.636	.455

Note. GPF = general parenting factor, DM = discursive mediation, RMM = restrictive mediation and monitoring, PM = participatory mediation, MM = mediation by modelling.

MPlus Code for the DPMS Bifactor Model

```
Variable:

Names are DPMS01-DPMS44;

Model:

! General parenting factor

GPF by DPMS01-DPMS44*;

! Digital mediation factors

DM by DPMS01-DPMS08*;

MM by DPMS09-DPMS17*;

PM by DPMS18-DPMS31*;

RM by DPMS32-DPMS44*;

! Set variance to 1 for identification purposes

GPF@1; DM@1; MM@1; PM@1; RM@1;

! Set GPF to be uncorrelated with mediation factors

GPF with DM@0 MM@0 PM@0 RM@0;

! Set social media and gaming related items to correlate

DPMS20 with DPMS21;

DPMS20 with DPMS22;

DPMS21 with DPMS22;

DPMS23 with DPMS24;
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