Centering Children's Health in Technology Design: Understanding Online Behaviors and Perspectives of Children and Parents in a Digital World

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Information)
in the University of Michigan
2024

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DEDICATION

To my family and mentors, who encouraged me to dream big and persevere.
To my younger self, for her unwavering focus, resilience, and determination to succeed.

ACKNOWLEDGEMENTS

I would like to start by expressing my deepest gratitude to my advisor, Dr. Tiffany Veinot, for her support over the years. I could not have asked for a more brilliant advisor. Tiffany taught me the importance of rigor and clarity. From the bottom of my heart, I am thankful for her positive impact on my development as a scholar.

Being a part of UMSI for the past few years has been a privilege. There are too many people to thank by name, but I am deeply grateful to the faculty, staff, and fellow students who have supported me and made this journey exciting and fulfilling. I would like to begin by thanking my dissertation committee members, Drs. Mark Ackerman, Alison Miller, Mark Newman, and Sun Young Park. I appreciate their feedback and support of my research interests.

Next, I would like to thank Dr. Gabi Marcu. Her contagious enthusiasm brought me to UMSI. She mentored me as a young researcher and provided opportunities for me to find my passion for digital technology for children. She also connected me with the most incredible collaborators- Alli Spiller and Dr. Carol Scott- and for that, I'm forever grateful.

I also thank my undergraduate research mentee, Jolana Babjak, and my peers, including Lu Xian, Woosuk Seo, Alicia Williamson, and Zhixin Li, for their data analysis and collection support.

Thank you also to Dr. Robin Brewer for her mentorship, as well. Although it has been a *very* virtual experience, co-working over Zoom with my peers has been a nurturing space to grow as a scholar, especially Dr. Elsie Lee-Robbins, Dr. Bradley Iott, Alicia Williamson, Cassidy Pyle, Steve Cedarquist, Sylvia Darling, and Linda Huber. A special thanks goes to Elsie for writing with me almost daily during our final months. A huge thanks to Brad, as well, for taking me under his wing as the best peer mentor I could ask for. Finally, I am thankful for the incredible support in the UMSI administrative, facilities, HR, and PhD program teams, Jacques Chestnut, Barb Smith, Debbie Pipkin, Judan Flanagan, Amy Eaton, Erin Krupka, and many others who supported me over the years.

While this PhD results from my graduate research and education, countless educators helped make this degree attainable. From puzzles to calculus, each of my math teachers helped me develop a knack for problem-solving and a love for math. Colleen Lamberti, Mary

Krolewski, Sam Elias, and Andrea Raineri encouraged me with their energy and excitement and inspired me to become a mathematician. Amanda Mendoza, Mollie Caffrey, and my Mom helped me learn to be a better writer. However, the notion of a technology-related career became apparent through the Millennium Scholars Program at Penn State. A few incredible people equipped me with the tools to pursue an interdisciplinary research career: Dr. Star Sharp, Dr. Nate Brown, Georjanne Williams, and Tina Thomas.

Mentors have significantly shaped my PhD journey. These have been teachers, professors, and fellow students who are contagiously passionate about what they do and dedicated to the success of junior scholars. I decided to pursue my PhD because of the tremendous impact of a few in particular.

Dr. Taylor Soucy is family. Her passion for research is contagious, and her work ethic is inspiring. Her drive for excellence exudes from all she does. Her encouragement led me to apply for the Millennium Scholars Program and graduate from the Pennsylvania State University with a B.S. in Mathematics. Her love as a roommate and dog aunt ran so deep. She has *shown up* for me for my entire life, from PA to DE to MI, and for that, I will forever be grateful.

Dr. Starlette Sharp, one of the kindest and most supportive humans I have met, directed the Millennium Scholars Program at Penn State. She taught me that excellence indeed requires sacrifice and commitment and that it can only be achieved through the development of good habits, consistent hard work, and resilience in the face of challenges. She played a formative role in establishing that *I have everything it takes to achieve a PhD.*

Dr. Katie Siek was my first mentor as an undergraduate researcher in a summer REU at Indiana University. I never thought I could learn so much from someone in such a short amount of time. She helped me realize that *there is no limit to what I can do* with my education, service, and scholarly pursuits. I am also profoundly grateful to her for broadening my research horizons, jump-starting my repertoire of skills, and offering her continued support and guidance over the years.

This PhD took a village of support, including my therapist, Rachel, who supported my tremendous growth throughout this PhD journey, and my stretch therapist, Sam, for making sitting every day a bit less terrible. A big shout-out to Orangetheory Fitness Ann Arbor and my colleagues in the York Wine Shop for their support.

Finally, and from the bottom of my heart, I thank my family and friends. I could not have done this without their support. My parents taught me the value of hard work and being exactly who I am - no matter what anyone else thought.

I thank my rock, my mother, Sandi. I would not be writing this dissertation without her. Her unwavering support has guided me throughout my life. Her belief in my success and

achievement shaped my educational journey from elementary to graduate school.

I thank my father, Doug, and my grandfather, Lee, for encouraging me to pursue my dreams, no matter how big. I thank my sister, Gabby, my travel partner and best friend, for helping shape the person I am, and recommending I take a fun class in college - wine appreciation. I thank my brother, Luke, for his unwavering support and laughter. I thank my best friend, Missy, for talking with me and supporting me every day for the last five years. I sincerely thank my Michigan friends who have made this place home: Alli and Jackson, Carol, Ashley and Austin, Gizem, Allison and Tim, Brad and Julie, Camille, and the York Wine Shop Team. I will cherish these friendships and memories in Michigan and those to come!

A very big thank you also goes to the love and support from my extended Namey, Soucy, and Grant families.

Most importantly, I thank my little family: my fiancé, Phillip, and our dogs, Jean Grey and Bruno. Phillip has supported me every day, listened to more than his fair share about children's screen time, and believed in me, especially when I didn't believe in myself. I am a better person because of him. Jean Grey has been the light of my Michigan life. Bruno was our family's greatest addition, keeping me on my toes, laughing, and smiling.

The National Science Foundation partially funded the work discussed in Chapter 2 under Grant No. IIS 1816319. The research in Chapters 3 and 4 was supported by a University of Michigan School of Information and two Rackham Graduate Student Research Grants.

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LIST OF ACRONYMS

CSCW Computer-Supported Cooperative Work & Social Computing

SDT Self-Determination Theory

HCI human-computer interaction

IEP individualized education program

ADHD attention-deficit/hyperactivity disorder

ASD autism spectrum disorder

OT occupational therapy

ST speech therapy

US United States

UK United Kingdom

JITAI just-in-time adaptive intervention

AADC Age-Appropriate Design Code

CA California

KOSA Kids Online Safety Act

ABSTRACT

Child health challenges are on the rise, exacerbated by a decline in preventive care, a global pandemic, and heightened use of digital technology for varied aspects of life, all of which were catalyzed by the COVID-19 pandemic.

This dissertation explores the intricate relationship between children's health and digital technology use, with a focus on screen time in middle childhood (ages 7-12). Using a multi-method approach, this dissertation investigates the perspectives of children and their parents on the health implications of screen time.

Three multi-method studies form the basis for this dissertation. The first, a longitudinal survey study followed by interviews with parents of children with behavioral needs, examines the impact of technology on children and their receipt of care due to the COVID-19 pandemic. This work identified the impacts of digital behavioral health services on children's health and receipt of care, as well as parental care burden. This prompted an in-depth investigation into children's and parents' perspectives of the impacts of digital technology use on children's health, more broadly. Using a dyadic interview study with children and their parents/grandparents, the next study elicited empirical findings on children's nuanced views of the implications of screen time on child health and their strategies for navigating their concerns. Building on these insights, the final study used child design workshops and parent focus groups to understand their perspectives on dark design patterns in digital media, seeking to inform the development of healthier, more beneficial digital environments for children.

This dissertation contributes a comprehensive examination of children's and parents' perspectives on children's digital technology use, from telehealth to entertainment. Findings illuminate the nuanced influences of children's screen time on their health. Children and parents identified positive health implications, such as social and emotional health benefits using digital technology. However, findings also show the negative implications of excessive screen time, inappropriate content exposure, and challenges regarding the delivery of special education services online. Notably, children's and parents' insights suggest that manipulative design patterns in digital media undermine children's autonomy and overburden parents, calling for a redesign that affords autonomy support and potentially lightens caregivers'

loads.

In conclusion, this work highlights the urgent need for revision to health practice, technology policy, and digital technology design, ensuring that digital technology better meets children's developmental needs and promotes their health. It recommends a nuanced approach to technology design that provides autonomy support and design interventions like nudges and controls. The insights from this dissertation inform future human-computer interaction (HCI) research, behavioral health services, pediatric screen time recommendations, and inclusive technology design.

CHAPTER 1

Introduction

Over the past decade, challenges to child health–which includes physical, social, emotional, and intellectual well-being–have grown in number and severity. Between 2016 and 2020, healthy behaviors and preventive medical visits decreased [146], while childhood anxiety and depression increased. The COVID-19 pandemic further negatively impacted children's health behaviors, physical, and mental health due to global school closures [144, 195, 233]. Consequently, the American Academy of Pediatrics, the American Academy of Child and Adolescent Psychiatry, and the Children's Hospital Association declared a national emergency in child mental health in October 2021 [5]. Thus, a greater understanding of, and support for, children's health is desperately needed.

Children's daily activities are a major determinant of their health [177, 62, 85], and their ability to meet developmental milestones [33]. Daily activities include children's health behaviors; these develop within the family unit [87], from infancy through adolescence. Health behaviors include physical activity, screen time, health care services, eating, and sleep.

One prominent daily activity, and health behavior, for children is screen time, which occurs when they use digital technology. Screen time should be defined as a type of health behavior, as it represents choices, actions, or practices that can impact health outcomes [221, 39]. Digital technology use is involved in most children's activities, including socializing with family and friends, education, health care, and entertainment [194, 239]. Children's use of digital media for all of these activities has risen tremendously since the COVID-19 pandemic [69, 170], especially for telehealth or the delivery of care over a distance [135]. Indeed, United States (US) children in middle childhood spent over 5.5 hours daily using digital media in 2021 [207]. The digital activities of focus in this dissertation include telehealth and digital media, such as social media and video games.

This dissertation focuses on middle childhood [159], an age group that occurs from 7-8 to 12 years old. This group is often overlooked in technology design, yet, it represents a critical

window for fostering positive screen time behaviors. Children in middle childhood transition from relying on their parents (ages 7-8) to relying on peers (ages 12 and beyond). Since the ages 10-14 are indicative of challenging transitions and tensions related to screen time, middle childhood may be a more suitable age range for proactive screen time intervention as their independence develops.

1.1 Impacts of Screen Time on Children's Health

Screen time has mixed impacts on children's health. In terms of their physical health, excessive screen time negatively affects children's sleep [110], and can contribute to eye strain [178], sedentary behavior, and strain injuries [181]. Screen time may also negatively impact children's emotional, social, intellectual, and spiritual health [233]. Emotionally and mentally, children can be exposed to violent content and developmentally inappropriate sexual content [54, 197], as well as conflictual interactions and bullying online [35]. Excessive screen time is also related to higher levels of depression, anxiety, and attention-deficit/hyperactivity disorder (ADHD) in children [181, 121, 195], and conversely, excessive screen time is common amongst children with these diagnoses. Indeed, studies conducted amidst the COVID-19 pandemic show that increases in screen time were associated with worsened mental health [195, 158], although the order of events could not be established due to the cross-sectional nature of the research.

There are also potentially positive impacts of screen time for child health [107, 141, 206]. Screen time often fosters positive emotions in children [35, 196]. For instance, 61% and 48% of 8-12 year olds reported "enjoying" the following "a lot": watching online videos (e.g., TikTok, YouTube) and television (i.e., cable or streaming) [206]. Some children also play computer games or listen to sounds or music to reduce their stress levels [254]. Playing social video games and communicating with peers online using digital media can reduce the number of conflicts in both online and offline peer relationships [141]. Learning can also be fostered with educational apps, digital toys, and eBooks [29, 139, 67, 202].

While the aforementioned impacts of screen time are mixed, most of this research was conducted before the COVID-19 pandemic. The pandemic led to a surge in screen time for children and has had unknown impacts for children's health, particularly for those with disabilities. The dramatic shift to digital platforms for education, telehealth, and leisure imposed additional strains on children with disabilities and their parents — a group already identified as vulnerable due to their developmental stage and need for specialized support [85]. The disruption caused by the COVID-19 pandemic exacerbated the challenges facing families of children with disabilities such as autism [25, 180] and ADHD [260]. Indeed,

children's daily activities (e.g., socialization, play, and learning) were stopped [240] and their services had to be significantly altered by special education teachers, psychologists, social workers, and therapists [111]. Multiple studies reported that a majority of parents of children with disabilities reported disruptions in children's receipt of health services [240, 251]. To mitigate these disruptions, digital technologies were rapidly adopted to perform telehealth services, including special education [240]. Although this transition to digital service delivery is well recognized, the impact of increased technology use on the health and care of children with disabilities and the role of parents during this period has not been clearly defined, underscoring an area in need of further investigation.

Another shortcoming of prior research is that it has largely presented parent's perspectives. Research on relationships between digital technology and child health rarely presents children's perspectives, instead relying on adult interpretations [133].Little research has investigated children's perspectives on the relationship between screen time and their health and the potential for improved technology design to better suit their health needs.

The lack of post-COVID-19 research and research drawing from children's perspectives are critical gaps. One reason for this is the drastic increase in children's daily screen time during and after the COVID-19 pandemic may have changed the balance of positive and negative impacts of children's screen time on their health. Furthermore, children's perspectives are critically needed because they know their experience best. Adults, including developers, teachers, and parents, often have biases and preconceived notions of what children need in technology design [70]. Evidence also points to varied parental awareness of their children's online activities and the risks [123, 18]. Thus, in addition to parents' perspectives, children's perspectives are needed to provide authentic parental advice and develop effective clinical and technological interventions to support children in their screen time [133]. This dissertation will investigate children's and parents' perspectives together on both the health impacts of screen time, as well as their management of concerns about these impacts.

1.2 Managing Children's Screen Time and the Implications for Children's Health

Parents use a variety of strategies to manage the implications of screen time on children's health. Some prior work shows that parents employ mediation strategies with and without digital technology, which means trying to manage the content and types of interactions to which their children are exposed. Other parents employ restrictive mediation practices [241, 154] by setting rules regarding the content allowed or the time spent viewing media,

using tools such as timers, schedules, and digital parental controls [49, 120]. Parents may also attempt to bolster the positive impacts of technology use [35, 117, 153], such as by allowing minimal entertainment screen time, but unlimited time for educational content. However, we know little about how children themselves may attempt to manage any personal concerns about their screen time.

One reason that children may experience challenges in managing their screen time stems from the design of the digital media that they use most often. Digital media, by design, often engrosses users' attention, a practice that does not change for child users. Furthermore, digital platforms often employ manipulative designs which necessitate conscious decision-making from users to disengage [198], a task that proves notably challenging for children for reasons to be outlined shortly. Patterns within these designs that coerce extended and potentially unhealthy consumption of digital media have been linked to "addictive" behaviors among children [65].

On the other hand, intentional technology design could mitigate the challenges users face. Digital design that promotes health can actively prompt positive health behaviors [39], such as through the use of scaffolding or nudges, and might also deter negative behaviors by way of monitoring [255]. This dissertation argues that a promising path for both reducing negative health impacts of screen time on children, and for increasing its positive impacts, is through design that supports child autonomy and self-regulation.

1.3 Theoretical Framework: Child Autonomy and Self-regulation

This dissertation utilizes child autonomy and self-regulation as an overall framework for understanding digital technology use and intervention. During middle childhood, autonomy and self-regulation are deeply intertwined and play a critical role in children's developmental trajectory.

Self-Determination Theory (SDT) [60] suggests that all humans have three basic psychological needs— relatedness, competence, and autonomy— which are equally essential for growth and development [60, 212].

Relatedness is the social feeling of connectedness that we feel with others, such as peers or teachers, and to experience a sense of belonging [60, 211, 212]. Competence is the need to feel capable and able to master skills [60, 211, 212]. Autonomy is "the power and the opportunity to decide for oneself how to do something" [60, 211, 212], a human need that predicts well-being [243]. As autonomy increases, children increasingly learn to act based on

their own free will to make independent decisions [179].

Children's autonomy is aided by their ability to self-regulate, which involves managing their own behaviors, emotions, and attention. In middle childhood, children are refining their ability to self-regulate [200], and while cultivating their emotional regulation skills [57, 38].

Child development flourishes in environments that nurtures their autonomy, competence, and relatedness [60]. However, children's autonomy is restricted when their behaviors are controlled. Autonomy-supportive environments offer choice, enhance interest, and support motivation [134, 242, 193], thereby fostering self-esteem and intrinsic motivation [212]. In particular, autonomy supports can foster autonomous motivation to perform health behaviors [253], such as brushing their teeth or going to the bathroom when needed. In middle childhood, children are significantly influenced by parental guidance on health behaviors [215], such as their digital media use. Thus, supporting autonomy should be emphasized more than enacting control to foster child development in this area [60].

Digital media can aid in children's healthy development. In particular, digital media use can enhance children's feelings of competence, relatedness, and autonomy; all three essential components of SDT.

Video games provide children with a sense of competence by keeping them in a *flow channel* where skill difficulty levels align seamlessly with their abilities [79]. Quality video games are designed to increase difficulty gradually, ensuring that players feel capable and engaged [79] and fostering a sense of confidence and achievement.

By offering social interactions and peer engagement, video games can also foster children's relatedness. Many games include multiplayer modes where children can play with friends, engage in virtual experiences, and connect with others [129, 79, 131]. To help with cope with difficult periods in life, De and colleagues [59] found that to children use Twitch, a platform for video game streaming, which can support their relatedness.

Moreover, to foster children's autonomy, video games can afford the opportunity to practice emotional regulation and social behaviors in a low-stakes environment. Gaming can help children manage their emotions, practice perspective-taking, demonstrate empathic concern, and exhibit prosocial behaviors. For instance, Farber [79] describes how his son used Mario Kart for mood management after remote learning due to the COVID-19 pandemic, illustrating how games can help children regulate their emotions and improve their well-being.

Despite the potential benefits of digital media for children's competence and relatedness, their autonomy is often undermined. Digital technology typically employed by children often aims to retain their attention [198]. Consequently, this design can inhibit children's autonomy, their independent decision-making capacity, precisely at a stage when they are honing self-regulation skills [60, 57]. Thus, it seems counterintuitive that digital design does

more to control children's behavior than it does to foster their autonomy.

Scholars have also highlighted the potential advantages for children that could arise from autonomy-supportive digital media design [247, 92] that includes community support from parents and other caregivers [57]. Nudging is one design mechanism that can support children's autonomy and their developing self-regulation as part of their screen time [247]. From the perspectives of adolescents, Wisniewski and colleagues [255] recommended filters and nudges in digital media to protect their adolescent privacy. Interventions such as Romi [257], Watch with Joy [10], Plan and Play [116], and Coco's Videos [118] directly involve children in managing their screen time. These interventions incorporate strategies like screen time timers, planning screen and post-screen activities, and letting children help set filters and controls [257, 10, 116, 118, 113]. However, there is yet a gap in understanding the specific types of digital support that both children and parents actually prefer as part of screen time.

This theoretical framework guided the research involved in this dissertation. Initially, findings from Chapter 2 revealed that children had little autonomy over their virtual behavioral health activities and this led to difficulties in their self-regulation. Autonomy and self-regulation guided our interpretation of parents' perspectives in Chapter 2. Instances in which child autonomy was supported via choices and appealing to children's preferences in the design and use of telehealth technology often contributed positively to the recovery of behavioral health services using telehealth, as children could more easily participate and self-regulate. These findings helped frame the next study (Chapter 3). After identifying the need for autonomy support in telehealth as a means to more beneficial health impacts in Chapter 2, Chapter 3 sought to understand the health impacts of children's digital activities and the extent to which children had or exerted autonomy in their screen time. Accordingly, self-regulation informed our data collection, data analysis, and interpretation of my findings in Chapter 3 regarding the strategies used by parents and children in screen time management and mediation. Finally, Chapter 4 was guided by the hypothesis that digital media design restricts children's autonomy. From this, we investigated children's and parents' perspectives on manipulative design patterns and aimed to uncover their perspectives individually on how they envision digital technology being more health-supportive.

1.4 Overview of the Research

Digital technologies, such as telehealth and digital media, are inappropriately designed for children. From the perspectives of children and parents gathered for this research, this thesis shows that: (1) the design of telehealth services used due to COVID-19 was incompatible

with the needs of children with behavioral disabilities and these activities impacted their health, (2) children have nuanced views and strategies for addressing the physical, social, and emotional health impacts of screen time, (3) digital media design is fraught with manipulative design patterns that inhibit children's limits and present inappropriate content, and (4) children and parents want digital media design to be health-centered by providing autonomy supportive nudges and expanded controls. Children and parents are actively addressing their health-related screen time concerns but they need support. This dissertation argues that design should center children's physical and emotional health needs by providing autonomy support instead of parental mediation alone.

This dissertation addresses a crucial knowledge gap by exploring children's perspectives on screen time and its impact on their health, a previously underrepresented area in the literature on children's screen time literature which has primarily focused on parental insights. By incorporating the perspectives of children in middle childhood, the research provides novel contributions to the understanding of how digital technology affects children's health and how it can be redesigned to meet their needs. Additionally, the study examines the suitability of the design of telehealth and digital media for children, offering guidance for future technology developments that prioritize children's health and autonomy. This work will inform stakeholders across various domains including healthcare, education, technology design, and policy.

A critical aspect of this approach is ensuring that findings are applicable across demographic groups. Accordingly, this dissertation's research design was motivated by the lack of representation of disadvantaged populations in information research, as well as the equity and access challenges that impact technology use. Recent literature reviews call for increased child engagement and participatory research with families [25, 28, 75, 150], especially socio-economically diverse groups and younger children (under 12 years old) [28]. Moreover, Disadvantaged children and families are more likely to experience a wider scope of health disparities, and less likely to be referred to or access healthcare services [25, 171]. Additionally, disadvantaged populations, such as socioeconomic diverse families and people with disabilities are disproportionately impacted by disasters/emergencies [25]. The COVID-19 pandemic exacerbated disparities [105] and highlighted challenges such as the lack of access to digital resources among some families [156]. For example, a 2021 Pew Research Center poll found that 43% of low-income homes in the United States do not have broadband, while 35% of lower-income households with school-age children did not have a broadband internet connection at home in 2015 [245]. Thus, it was important to recruit a diversity of participants, across socioeconomic status and abilities, as there may be important differences between groups.

The research in Chapter 2 investigated the disruption, recovery, and technological adaptation of children's behavioral health services due to the COVID-19 pandemic, and the associated impacts on children's health. A six-week survey study and follow-up interviews with parents of children with behavioral disabilities were used to investigate children's receipt of behavioral health care amidst the COVID-19 pandemic. This work identified the acute negative impact of inappropriate technology design and implementation on disabled children's health, ability to self-regulate, and receipt of behavioral health services. Support for children in this disruptive and stressful situation was infrequently successful. However, parents providing autonomy support in activities such as choices or catering to preferences had a favorable impact on their participation in telehealth services and self-regulatory capabilities. Yet, the negative impacts of telehealth activities on disabled children's health suggested the need for additional study of the health impacts on children more broadly, and from diverse children's perspectives.

To address this need with a wider sample of children, Chapter 3 sought children's and parents' perspectives on the relationship between screen time and children's health, and how they navigate any health-related concerns about screen time. We conducted surveys and 33 dyadic child-parent interviews with both typically developing children (i.e., neurotypical) and children with disabilities. The sample intentionally included a diverse set of families with varying structures and socioeconomic status. This work uncovered children's and parents' views of the positive and negative impacts of digital activities on their health, which were largely in agreement. Their perspectives are encapsulated by the following themes: even beneficial screen time needs limits to avoid physical discomfort, screen time can produce both intentionally positive and unintentionally negative emotions, and joint media engagement strengthens relationships, but fighting over it does not. Findings also showed how parents addressed these concerns using restrictive and mediational approaches, and by actively encouraging healthy behaviors and transitions away from screen time. Children actively navigate their health-related concerns by adhering to established screen time limits, listening to their bodies, and deliberately engaging with content that makes them feel happy and helps them learn. These findings revealed an opportunity to learn how children and parents want digital technology design to change to reduce the negative impact and improve the positive implications of screen time on children's health and autonomy – which was the focus of the next study.

Finally, Chapter 4 addresses this gap through a qualitative study involving design workshops with 16 children in three Midwestern cities, as well as focus groups with their parents. We elicited the perspectives of a diverse set of families of children with and without disabilities, and with a range of socioeconomic status. We uncover child and parent perspectives

on dark design patterns of digital media as inhibiting healthy limits and transitions and presenting age-inappropriate content. We outline how, without prompting, children's designs and parental recommendations involved various digital "nudges" to break the stream of continuous content, each of which are forms of autonomy support. Often incorporated into technology design, nudges are aspects of choice architecture that encourage individuals to make a particular decision [235]. Specifically, children incorporated nudge-based controls and blocking features to reduce exposure to age-inappropriate content. Without asking, designs. Parents described a need for streamlined parental control in light of the burden of screen time management.

As a whole, this dissertation research addresses issues related to the implications of children's technology use on children's health, as well as the family as a whole. Across three studies, this scholarship illuminates different ways in which digital technology, typically designed for adults or very young children, often does not meet the needs of children–especially in middle childhood. Notably, given the diverse participants included in this dissertation, we expect that findings will be broadly applicable across abilities and socioeconomic status. This poor fit has implications for children's health that require the attention of researchers, technology designers, and policymakers. More HCI research should be conducted with children in middle childhood, as this age group is underrepresented in research and often overlooked in digital design. Broadly, this dissertation argues for a need for greater focus on providing autonomy support so that children can learn to self-regulate. By drawing from the perspectives of children, this dissertation is an exemplar of such an approach. More specifically, findings from this research can inform the practices of behavioral health services for children, pediatric screen time recommendations, and inclusive technology design that meets the needs, and acknowledges the perspectives, of younger users.

CHAPTER 2

Disrupted Behavioral Health Routines for Children During a Public Health Crisis: A Mixed-Methods Study of Digital Technology's Role in Routine Recovery

2.1 Abstract

The COVID-19 pandemic caused a global disruption of daily routines. Children with behavioral disabilities were particularly impacted, losing access to critical face-to-face behavioral health services. In response, providers and families worked to reconstruct these routine services, primarily with digital technology.

In April-July 2020, we conducted a mixed-methods study with parents of children with behavioral disabilities. Using a six-week survey study followed by semi-structured interviews, we identified which (and how) behavioral health routines were disrupted, how care teams recovered these services, and what roles digital technology played in these processes.

The recovery of children's behavioral health services was delayed, resulting in negative consequences for the children. The stoppage of services undermined in-person care coordination mechanisms, necessitating parents and providers to reconfigure their communication processes virtually. This digital communication led to the digital reconstruction or replacement of some services, but not most. Video conferencing was overstimulating for some children, and most recovered services required parental involvement.

Our findings have substantial implications for the Computer-Supported Cooperative Work & Social Computing (CSCW) community regarding the design of digital technology to increase usability by (and supports for) children with disabilities, and enable resilient care routines that could help withstand the impact of future disruption.

2.2 Introduction

Children with behavioral disabilities such as autism spectrum disorder (ASD), ADHD, and/or anxiety rely on the repetition, predictability, and stability of routines for their optimal functioning [75, 165]. Routines are specific, predictable, and repetitive behaviors [227, 62, 87, 86, 165], and an important type for children with behavioral disabilities is the regular delivery of behavioral healthcare services like occupational therapy (OT), speech therapy (ST), and special education. Typically, behavioral healthcare services are delivered in a routine manner: at a clinically recommended frequency (from daily to monthly), in a predictable location (at school, at home, and/or in clinics), and with the same professional behavioral health care providers and patients over time. In the United States (US), the services delivered at school specifically fulfill the requirements of the child's individualized education program (IEP) or 504 plan: legally binding agreements for a child's teachers and behavioral health providers to provide supportive services to meet the child's behavioral and developmental needs [256].

Despite their importance to children with behavioral disabilities, there has been scant research attention to the disruption of behavioral health routines, and how they can be reconstructed in the event of disruption. Understanding these dynamics is critical for ensuring continuity of support for children who are particularly vulnerable in the face of routine disruption [25]. Learning to respond effectively to disruption is especially critical given the growing number of natural disasters [3] and global health emergencies worldwide (e.g., SARS, ZIKA, Swine flu, and COVID-19).

The COVID-19 pandemic is a salient recent case of behavioral health service routine disruption from which to learn. Indeed, COVID-19 protective measures led to halting of existing in-person behavioral health care services in 2020 until routines could be recovered—primarily by changing modes of service delivery. Recovery required providers and parents to change the modality of service delivery and coordination, including information exchange to facilitate effectiveness and continuity of care and at-home supports. In the interim period between service suspension and recovery, parents of children with disabilities were left to cope on their own [75, 204, 251]. Thus, the COVID-19 pandemic, with its widespread and sudden stoppage of face-to-face behavioral health services, provides an unprecedented opportunity to study routine disruption and recovery in real time.

Prior research on routine disruption in work settings suggests that work teams recover from disruption using an intentional process of face-to-face communication. In that communication, employees deliberately reconstruct or replace the work that is performed face-to-face [73, 81, 122]. However, little is known about how such reconstruction might be achieved in

the contexts in which a professional provides a service with more informal support from family members, or in routines that involve children. Moreover, prior research has not examined reconstruction in situations in which face-to-face communication is not possible, as was true in the early COVID-19 pandemic.

Finally, little is known about how technology may play a role in routine reconstruction, especially in situations where face-to-face contact is not feasible. Prior CSCW research shows that face-to-face contact is particularly important for the coordination of children's behavioral health services and at-home supports between parents and providers [161]. This is because effective communication to coordinate behavioral health services is heavily reliant on synchronous information exchange about children's behavioral needs ("descriptive" information) and strategies to address them effectively ("prescriptive" information) [203]. Therefore, we conducted a mixed methods study that examined routine disruption and reconstruction involving behavioral health service providers, parents, and children. We also investigated the role of digital technology in these processes in order to envision design opportunities for supporting routine reconstruction in the future. The contributions of this paper extend prior CSCW research in four overarching ways:

- Provide empirical findings describing the stoppage of (all) critical behavioral health routines for children with behavioral disabilities and the negative impacts this had on their health and well-being in the wake of the COVID-19 pandemic.
- Make empirical and theoretical contributions on the process of (and roles of technology in) routine recovery, in the context of children's behavioral health, amidst disruption.
- Share empirical findings on the challenges of inappropriate technology design for children with disabilities and the excessive demands forced on parents to facilitate virtual behavioral health services.
- Offer various recommendations for designers and researchers to create more usable and supportive technology for resilient care routines, including less overstimulating video conferencing platforms, more support embedded into digital tools for children, a blended care model with parent training, continuous communication, and a future recovery plan to withstand potential disruptions.

2.3 Related Work

2.3.1 Behavioral Health Services: A Critical Resource for Children with Disabilities

Children with behavioral disabilities such as autism spectrum disorder ASD, ADHD, and/or anxiety often require specialized services in clinics and schools to overcome potential challenges and improve their functioning. Behavioral health services for children include occupational therapy, speech therapy, behavioral therapy, and special education. In the US, some of these services are legally mandated: the federal Individuals with Disabilities Education Act requires that special education services be tailored to a child's individual needs and delivered regularly [2]. Thus, special education services are offered in schools to address the unique behavioral (e.g., mental, emotional, sensory) needs of a child with disabilities to best suit their learning [51] with fewer students in the classroom, more teachers, or a higher level of support [187].

Special education services include teachers, social workers and other behavioral aides who provide 1:1 behavioral support within the mainstream classroom. Furthermore, resource rooms provide supportive environments with behavioral health providers focused on remediating academic skills, managing behavior, and enhancing study, organizational, and test-taking skills. Sensory rooms may also be provided; these are therapeutic spaces in schools that provide customized sensory input to manage behavioral and emotional responses in children with sensory processing disorders like ASD and ADHD [43].

Children with disabilities often receive clinical services in addition to special education [185]. One such service is behavioral therapy, which can help with challenges related to behavior management, emotional regulation, and social interaction. Such behavioral therapy can equip children with effective coping strategies, help them to understand and manage their emotions, and enhance their social skills [143]. Consistent long-term behavioral therapy, such as Applied Behavioral Analysis, has a positive effect on children with autism's intellectual functioning, language development, acquisition of daily living skills and social skills [244]. Children with disabilities may also receive psychotherapy to increase their quality of life beyond symptom change [142]. Psychotherapy offers children safe, structured environments to express their feelings and learn new skills and coping strategies. Children with behavioral disabilities may also receive psychiatric services, which often involves the use of medication to manage or alleviate symptoms.

Children with behavioral disabilities may also receive behavioral health services for related challenges and conditions. For example, many children with behavioral disabilities also

have disorders of speech and language development, which can cause communication barriers. speech therapy (ST) delivered by Speech-Language Pathologists helps these children improve their communication skills, articulation, language understanding, voice regulation, and fluency [1]. Goorhuis-Brouwer & Knijff [104] found that early and consistent ST can dramatically improve communication skills in children with speech and language disorders. Hence, children with disabilities often receive regular ST.

Additionally, children with behavioral disabilities often face struggles in performing daily life tasks like eating and bathing. occupational therapy (OT) delivered by trained occupational therapists is often used to address these struggles since it aids in improving children's fine and gross motor skills, problem-solving, cognitive skills, and social interaction [26]. Both OT and behavioral therapy focus heavily on muscle strengthening, increasing muscle tone, and behavioral/sensory regulation [185]—all of which necessitates physical interaction with behavioral health service providers.

Regardless of the modality (i.e., face-to-face, virtual) of behavioral health services, establishing and maintaining a therapeutic alliance, or rapport, between children and providers is critical for the success of behavioral health services for children [115, 94].

Overall, children with behavioral disabilities may be in receipt of a mix of the above behavioral health services depending on their particular needs. Overall, however, consistent, regular behavioral health services tailored to a child's specific needs can improve their educational outcomes, social interactions, behavior, and communication skills [142, 185, 244]. Regular and consistent services also allow for continuous monitoring of the child's progress, adjustment of approaches as needed, and the delivery of appropriate interventions in a timely manner. Consistent behavioral health services over time also positively contribute to their behavioral health outcomes as they reinforce learned skills and help the child gradually integrate the tools into their daily lives [142, 244].

Given the importance of these services, it is important to understand what happens when they are disrupted, and how they are reconstructed. We now turn to prior literature about these issues.

2.3.2 Behavioral Health Service Disruptions during COVID-19: The Impacts on Children with Disabilities

Disruptions in behavioral health services are especially challenging for children with disabilities. This is because they typically rely psychologically on consistency and are still honing their coping and adjustment capabilities [251]. Accordingly, children with behavioral disabilities are particularly vulnerable in the face of major disruptions due to natural disasters

or public health crises like COVID-19, which disturb the regular behavioral health services upon which they rely. This was undoubtedly the case in the early COVID-19 pandemic, when routine behavioral health services and interactions with behavioral health providers in schools and clinics were abruptly halted and then significantly altered [240, 251]. Unsurprisingly, many children with particular disabilities, like autism and ADHD faced intense behavioral challenges due to the disruption of the COVID-19 pandemic [25, 262]. Although prior studies have highlighted the negative impacts of COVID-19 on children with behavioral disabilities, we lack a full account of which services were disrupted, and how the COVID-19 pandemic mentally impacted children with disabilities [191, 148]. Therefore, we investigate the following research questions (RQ1):

- Which routine behavioral health services did children receive prior to the COVID-19 pandemic (RQ1a)?
- Were these routine services disrupted by the COVID-19 pandemic, and if so, how (RQ1b)?
- What was the impact of any disruptions on children (RQ1c)?

2.3.3 COVID-19 and Transitions to Digital Healthcare Services

In health care, one of the major responses to restrictions on in-person contact was to begin to deliver services via technologies like phone and video, a phenomenon labeled "telehealth." While the introduction of digital technology in healthcare settings typically requires lengthy time and effort [12], this was not possible during COVID-19. Consequently, most healthcare organizations and private practitioners rapidly deployed technologies with little preparation. Moreover, behavioral healthcare providers had little prior experience with telehealth prior to the COVID-19 pandemic [37] and were slow to adapt [100, 230]. Indeed, the use of telehealth in schools and clinics for children with disabilities and their families has only increased since the pandemic [262]. Additionally, mobile applications for children's behavioral management such as social stories and visual schedules [19, 151] only became popular after the pandemic.

Prior to the pandemic, most use of telehealth for children with behavioral disabilities occurred in the context of clinical trials [27, 82, 152, 172, 58]. Other digital experiences created by HCI researchers to promote social emotional skills, such as toys [236, 128], apps [67], shared displays [228], and digital visual schedules [114], primarily occurred in the context of research and not usual care. Given the lack of widespread experience with technology-based, remote behavioral health services, there is a significant research gap pertaining to their impact on children's health and well-being [99, 149].

In addition to lack of experience, several additional pre-existing characteristics make us posit that any transition to digital behavioral health services for children may not have been entirely smooth. First, prior research tells us that parents and behavioral health service providers relied on proximity for regular communication [203]. Furthermore, while some special education teachers had adopted digital technology for classroom management and parent communication prior to the pandemic [157, 56], they mostly communicated with parents when they picked up and dropped off their child from school [203], or used other non-digital communication media (e.g., paper notes, phone calls) [162, 213]. In addition, parents and school-based providers came together for in-person meetings at least yearly [203]. Finally, children with disabilities may possess short attention spans, making virtual implementation of education and therapies particularly challenging [262]. Given the importance of delivering behavioral health services to children virtually amidst disruption, as well as the aforementioned challenges, it is crucial to fully comprehend how digital technology was used in their reconstruction or replacement. Thus, we asked the following questions (RQ3[1]):

- How did children's behavioral health care teams recover services, if at all (RQ3a)?
- Which services were reconstructed or replaced (RQ3b)?
- How did families respond to these services recovered using digital technology (RQ3b)?

2.3.4 Care Coordination and the Problem of Disruption

Healthcare delivery across multiple providers and settings, along with at-home supports for children with behavioral disabilities, require "coordination," or a process of interaction that manages interdependencies between these activities [160]. CSCW research has focused extensively on coordination in healthcare settings, and more recently, shifted to coordination activities outside of clinical settings, such as between patients, family members, and providers in the context of both children and adults living with chronic illness [21, 22, 74, 108, 219]. Similarly, coordination of care for children with behavioral disabilities and other conditions has received growing attention due to its complexity and importance for children's health outcomes [203, 11, 219, 184, 204, 219].

Prior CSCW research shows that coordination of children's behavioral health services and at-home supports (henceforth, "care coordination") between parents and providers is heavily reliant on the synchronous exchange of descriptive and prescriptive information to

[1]Please note that the literature relevant to Research Question 3 (RQ3) is discussed before Research Question 2 (RQ2). This order allows the results to be presented in accordance with the sequence of the research questions from 1 to 4, reflecting the chronological sequence of disruption and recovery processes. By doing this, it also helps us to prevent separation of the literature relevant to both RQ2 and RQ4.

address children's needs at home and in schools and clinics [203]. Effective and consistent information exchange and relationships between parents and providers are also imperative for the development of shared understanding of a child's behavioral health and needs, which is enabled by both descriptive and prescriptive information [203]. However, previous work suggests that coordinating a child's care is challenging even without disruptions like a global pandemic. Indeed, parents and providers can encounter various barriers to developing shared understanding of the child's needs [203], and may face collaborative breakdowns [163].

Although problems and issues have been found in typical care coordination, most prior coordination research has been conducted in relatively stable environments. "Regular" changes, or those that are limited in scope or impact, require some form of response. Differently, however, crises and disasters typically require rapid response under a period of collective stress and uncertainty [36, 16, 209].A crisis creates an environment in which typical plans for task coordination are often inappropriate, and can even have negative consequences [71]. Moreover, part of what makes coordination challenging in a crisis is that people often do not fully know what is happening in the environment. However, people must coordinate their efforts to develop and implement an appropriate response to crisis, with insufficient coordination contributing to unsuccessful crisis responses [36]. Thus, understanding coordination in a situation that lacks stability could help us learn how to improve coordination whether there is disruption or not.

Limited research has investigated the processes by which coordination of care is reconstituted after disruptions, especially crises. Some research based in workplaces offers some hints, however. For example, Mark and Semaan [164] studied collaborative work amidst the prolonged disruption of war in Iraq. They found that people reconstructed, modified, and developed new routines. Additionally, technology provided people with critical resources for these new routines (e.g., conducting psychotherapy via phone, authors collaborating using digital tools instead of in person interaction). This intriguing study shows that reconstruction may follow crises that disrupt usual routines, and that technologies may facilitate reconstruction. However, the applicability of these findings to care coordination, where services are provided to other people rather than the self, is unknown. Moreover, applicability is uncertain given that Mark and Semaan's research [164] focuses on adults without identified disabilities using technologies designed for them. Care coordination for children with behavioral disabilities may diverge from this in critical ways. Therefore, we pose the following research questions (RQ2 and RQ4):

- How were children's behavioral health services coordinated prior to the COVID-19 pandemic (RQ2a)?

- How was this coordination disrupted by the COVID-19 pandemic (RQ2b)?
- What role did technology play in parent-provider information exchange (RQ4a)?
- What role(s) did technology and other artifacts play in children's reconstructed and replaced behavioral health services (RQ4b)?

2.4 Methods

We conducted a mixed methods sequential explanatory study [130] in the initial phase of the COVID-19 pandemic in April-July 2020 with parents of children with behavioral health conditions. Methods included a six week, twice weekly survey (N= 46), and follow up interviews [237] with a subset of survey participants whose interviews were used partly to probe survey responses (n=16). The study was approved by our University's Institutional Review Board.

2.4.1 Recruitment

Recruitment for the longitudinal survey study occurred via word of mouth, social media posts (i.e., Facebook, Reddit, and Nextdoor), and our University's Health Research website. Interested potential participants completed a screener survey hosted by Qualtrics. To be eligible for the study, participants needed to be: (1) a parent/guardian of a child in Pre-Kindergarten through 8th grade with documented behavioral needs (e.g., IEP, 504 plan); (2) at least 18 years old; (3) comfortable writing and speaking in English; and (4) have internet access or text messaging capability. Of the 116 parents screened, 78 qualified and 59 participated (75.6% participation rate).

2.4.2 Longitudinal Survey Design

2.4.2.1 Survey instrument

The survey contained both open- and closed-ended questions that each participant received twice weekly for six weeks, for a total of 12 surveys requested per person. The questionnaire was reviewed and revised based on feedback from a social worker, as well as two parents of children with behavioral needs.

The initial open-ended part of the questionnaire prompted parents to provide insights into their child's behavior or behavioral needs within the recent days. Next, the survey asked about the behavioral health services their child had received, if any, and whether

service delivery was in-person, via telephone, or online. We then asked parents, in a free text section, to describe the extent to which these services were helpful or challenging.

Moreover, the questionnaire aimed to gather specifics concerning recent communication with or services provided by the child's care team, if applicable. In cases where communication or services had not occurred, we asked parents whether they had a desire or necessity to communicate, what they intended to address concerning their child's behavioral health, and whether they sought this information elsewhere.

Closed-ended questions asked parents about their child's replaced services and other online activities, and open-ended questions asked for their observations of the child's behavior while engaging with said online activities.

Parents also self-reported demographic information about themselves and their child, including their child's documented behavioral needs and diagnoses.

2.4.2.2 Survey administration

Participants selected specific days, and a preferred communication method (such as email, text, or phone call), for receiving the twice weekly questionnaires. Following the aforementioned stakeholders' advice, we deployed the questionnaire to participants twice a week for six weeks, always at 3 PM. We also sent a concise reminder message to participants who had not completed the questionnaire within 24 hours of receiving the link. We compensated participants $2 for each completed entry, accumulating up to $24 for completing all twelve questionnaires.

Survey responses were monitored closely during the first two weeks of the study. Informed by this monitoring, to enhance clarity, we modified a few questions to provide additional explanations and illustrative examples. Of the 696 questionnaires sent to participants, 197 were not completed (28.3%); leaving a response rate of 71.7%. Forty-six of the 59 participants who agreed to participate completed 4 or more of the 12 questionnaires (78%). We excluded participants who responded to fewer than 4 of the 12 questionnaires from our analysis as it was insufficient to understand the child's behavioral health services and the care team's coordination over the six weeks of the study. Thus, the final sample size for the longitudinal survey study was 46 parents who were parents of 46 children with disabilities.

2.4.3 In-depth, Semi-structured Follow-up Interviews

Participants completed a post-survey study questionnaire in which we asked parents if they would be interested in participating in a follow-up interview. Of the 59 longitudinal survey participants, 50 indicated that they would like to participate. From those, we invited 37

parents who had responded to at least four surveys to participate in a one-hour follow-up interview to further probe experiences based on survey responses which indicated experience with service routine reconstruction attempts. Of the 37 parents invited, 18 parents accepted our invitation, and 16 completed the interview (43% participation rate). Thus, the final sample size for the follow-up interviews was 16.

The first and second authors conducted semi-structured interviews with 16 parents between June and July 2020. Thus, interviews took place approximately three months after COVID-19 was declared a global pandemic and most schools had shut down. Using a semi-structured interview protocol, we asked parents about their experiences with behavioral health services for their children, before and during the disruption from COVID-19 that aligned with our research questions.

Interviews lasted between 29 and 66 minutes (mean=49 min, M=48 min) and were conducted remotely using Zoom. Each participant received a $25 gift card to a store of their choosing as an incentive. All interviews were audio-recorded, fully transcribed by a human transcription service, and verified by the first author.

2.4.4 Data Analysis

2.4.4.1 Longitudinal survey data

To help answer RQ1a, we used descriptive statistics to characterize the reported behavioral health services children received just prior to the pandemic.

To address RQ1b and RQ3b, the first author compared the reported services the child was supposed to receive with the parents' responses to questions about their child's actual receipt of behavioral health services, if any, throughout the six-week survey study. We noted which service(s) were reconstructed or replaced, the number of service delivery occurrences, and the service modality. This coding involved a binary identification of whether the behavioral health services occurred and few inferences were to be made; thus, it was unnecessary to calculate IRR [169] for these binary data. The first and last author reviewed this analysis in weekly meetings.

To answer RQ1c, the first author analyzed the open ended, parent-reported behavioral data on their child's recent behavioral functioning using a mixed approach of both inductive and deductive analysis [214]. The first author read all behavioral data points to familiarize herself with the data and took notes while developing a draft list of codes with reference to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition [9]. Concurrently, a social worker author individually read 50 (7%) randomly chosen behavioral data points. The two authors met several times to discuss patterns in the behavioral data submitted by

parents and collaboratively developed the codebook to code behavioral data. Of the 696 survey responses about child behaviors, an initial set of 114 behavioral data (16.4%) were randomly selected and coded by the first author and a research assistant. Interrater reliability (IRR) between the two coders was 0.8934. After reaching reliability, coder 1 completed 183 study entries (26.3%) and Coder 2 completed 399 study entries (57.3%) after coding initial reliability entries. Each coder reviewed each other's coding and discussed disagreements (30 entries). 197 entries are blank due to survey nonresponse (28.3%).

To help answer RQ3a, we used descriptive statistics to characterize survey responses about the exchange of information between parents and behavioral health practitioners to learn the content of communication with providers.

2.4.4.2 Interview data

The first author initially analyzed transcripts inductively using a first cycle open coding approach [214] to identify initial codes in conversation with the research team. The research team iteratively reviewed the initial codebook relevant to RQs1-4. Two coders (i.e., first author and research assistant) reviewed each other's coding and compared use of initial codes across three randomly selected interviews and then discussed the codes and disagreements in weekly meetings to generate, review, define, and finalize the codebook.

Next, the two coders deductively coded four different, yet randomly selected, interviews in NVivo with the codebook. Interrater reliability (IRR) between the two coders was substantial at 0.65. After this, the first author coded the remaining twelve interviews.

In a secondary round of analysis, the first author completed structured review of all data using forms for each code. Then, the first author wrote memos regarding broad insights related to the research questions.

2.4.4.3 Mixed analysis of data

To conduct mixed analysis of data for survey participants who were interviewed, the first author combined data types within a single display to help answer research questions about the process of reconstruction. Key qualitative data about each attempt at reconstruction was summarized next to the quantized data from the survey responses about the reported services. We also paired our analysis of replaced services with the survey responses about the digital media children engaged to obtain qualitative data on child engagement and behavioral response to online activities.

2.4.5 Characteristics of Participants

Parents enrolled in the study were mostly white, women, or from the Midwestern US (see Table 2.1). Most participants had an education beyond high school and incomes beyond $30,000 per year. The average number of children in participants' households was 2.06 (SD=1.19).

Table 2.1: **Characteristics of Parent Participants**

		Surveys		**Interviews**	
		N = 46	**%**	**n = 16**	**%**
Gender	Woman	39	85%	13	81%
	Man	7	15%	3	19%
Race/ Ethnicity	White	33	72%	13	81%
	Black	6	13%	2	38%
	Mixed	6	13%	1	6%
	Hispanic	1	2%		
Marital Status	Married	32	70%	10	63%
	Single	10	22%	4	25%
	Divorced/ Separated	3	7%	2	13%
	Prefer not to answer	1	2%		
Location	Midwest	39	85%	13	81%
	South	4	9%	2	13%
	Northeast	2	4%		
	West	1	2%	1	6%
Education	High School	3	7%		
	Bachelors	22	48%	7	44%
	Some college	12	26%	4	25%
	Associate	4	9%	2	13%
	Technical	2	4%	2	13%
	Doctoral	3	7%	1	6%
Income	Less than $29,999	7	15%	2	13%
	$30,000-59,999	13	28%	5	31%
	$60,000-89,999	9	20%	3	19%
	$90,000 or more	15	33%	5	31%
	Prefer not to answer	2	4%	1	6%

Table 2.2 describes the demographics of the participants' children. On average, their children were approximately 9 years old (SD=3.4) with a mean of 2 diagnoses (SD=1.35). The most common diagnoses among children were ADHD (59-63%) and ASD (35-44%).

Table 2.2: **Characteristics of Participant's Children** (Survey N=46; Interviews n=16). 'Other disorders' reported include: Obsessive Compulsive disorder, Social Pragmatic communication disorder, provisional tic disorder, Adjusted Disorder, Phelan Mcdermid Syndrome, Reactive Attachment Disorder, and Sensory Processing Disorder.

		Surveys		**Interviews**	
		N = 46	**%**	**n = 16**	**%**
Gender	Girl	34	74%	11	69%
	Boy	12	26%	5	31%
Type of School	Public	36	78%	13	81%
	Charter	5	11%	3	19%
	Private	3	7%		
	Other	2	4%		
Age	3-6 years	14	30%	5	31%
	7-9 years	14	30%	4	25%
	10-12 years	10	22%	2	13%
	13-14 years	7	15%	5	31%
	15-18 years	1	2%		
Diagnosis	Attention-deficit/ hyperactivity Disorder (ADHD)	27	59%	10	63%
	Autism Spectrum Disorder (ASD)	16	35%	7	44%
	Anxiety Disorder	14	30%	5	31%
	Oppositional Defiant Disorder (ODD)	10	22%	6	38%
	Depression	5	11%	2	13%
	Learning Disability (LD)	4	9%	2	13%
	Post-Traumatic Stress Disorder (PTSD)	3	7%	2	13%
	Speech Disorder	3	7%	2	13%
	Conduct Disorder (CD)	2	4%		
	Other Disorders	12	26%	4	25%
	Prefer not to answer	5	11%		
Race/ Ethnicity	White	30	65%	10	63%
	Black	7	15%	3	19%
	Mixed	9	20%	3	19%
Disability Documentation Type	IEP	31	67%	13	81%
	504	5	11%	2	13%
	Other	10	22%	1	6%

2.5 Findings

2.5.1 Children's Behavioral Services, Disruption, and the Impact on Children (RQ1)

2.5.1.1 Routine pre-pandemic behavioral health services (RQ1a)

Prior to the COVID-19 pandemic, 98% of children in the study (N=45) received routine behavioral health services in school, and 67% (N=31) in clinics outside of school. School-based services included special education, OT, ST, behavioral therapy, and social skills training. Clinic-based services included each of those therapies, as well as psychiatry. For a comprehensive overview of the children's received pre-pandemic services, see Table 2.3.

Table 2.3: **Status of Children's Behavioral Health Services** (N=46 children). Special education services are exclusively school-based and noted with an asterisk(*).

Type of Routine Service	School				Clinic			
	Pre-pandemic	Pandemic			Pre-pandemic	Pandemic		
		Reconstructed	Replaced	Stopped		Reconstructed	Replaced	Stopped
Occupational Therapy	19	2	2	15	6	0	1	5
Speech Therapy	18	1	3	14	6	1	1	4
1:1 Behavioral Aide*	16	0	1	15	5	0	0	5
Psychotherapy	18	5	4	9	15	7	0	8
Resource Room*	17	2	1	14				
Special Education Classroom*	12	3	8	1				
Tutoring*	5	0	0	5	3	1	0	2
Sensory Room*	5	0	0	5				
Behavioral Therapy	3	0	0	3	11	5	0	6
Psychiatry					5	3	0	2
Total Services	**113**	**13**	**19**	**81**	**51**	**17**	**2**	**32**

Children received an average of 2.43 different types of routine services in school (1-5, SD= 1.15). Of the 32 children who received behavioral health services from private clinicians in the clinic or in their home, they received an average of 1.56 services routinely (1-4, SD=0.89). As expected, children with multiple diagnoses received more services.

Each clinical service was a routine: performed at a regular interval for a consistent duration in the same location with the same care provider. Some services were delivered daily (e.g., special education, behavioral therapy) or multiple times each week (e.g., OT, ST, and social skills training), while others had less frequent sessions occurring weekly (e.g., psychology, group psychotherapy) or every few months (e.g., psychiatry).

Within schools, special education was common: 70% of children received one or more of these services (see Table 2.3). While some children were in dedicated special education classrooms (N=12), most spent the majority of their school days in mainstream classrooms and received 1:1 behavioral support within that classroom (N=16). Many children visited

resource rooms (N= 17) or sensory rooms (N=5) daily or more often. Both of these rooms are a supplement to the mainstream classroom experience.

2.5.1.2 The Disruption of Children's Routine Services (RQ1b)

The COVID-19 pandemic disrupted both school-based and clinic-based behavioral health routines, creating a stoppage of services for varying lengths of time. Indeed, adherence to the standardized protocol for the delivery of services outlined in the child's IEP/504/other education plan and/or clinical care plan became impossible without physically being together in-person.

Half of the children whose parents were in the study did not have any behavioral health service routines recovered during the course of the study. Of the 23 children (50%) who did have one or more services reconstructed, the median time to recover services was 30 days after their child's school closed (min=16, max=60, mean=30.4 days). The median stoppage for clinic-based services was 23 days (min=16, max=60, mean=28.6 days), while the median stoppage length for school-based services was 37 days (N=9, min=16, max=56, mean=34.2 days).

2.5.1.3 Impact of Service Disruptions on Children (RQ1c)

Parents described negative impacts of the stoppage of behavioral health services on their child's behaviors, emotions and skills. Almost all parents (N=44) characterized their child's behavioral functioning as negative "over the last few days" at least once, and they reported it in 53% (n264) of the 483 survey responses. Twenty-one parents explicitly described their child's behavior as worsening, at least once, without being asked whether or not it was. This pattern was echoed in the interviews. For example, P12 explained how her daughter was showing negative new behaviors:

> *"Before quarantine, she at least would go outside and try to talk to her friends. Now, she completely shut herself down to the world. And she said it had nothing to do with the shutdown or anything like that, but she just all of a sudden became very... much of a hermit... I could barely get her to come out of her room just to spend family time with her siblings or myself"* (P12).

P21 described another negative behavioral pattern in her child, which she linked to the loss of routine,

> "*[Lack of routine] was so overwhelming and confusing to him that he didn't know quite how to handle it. He was just really angry. It was very easy to get him*

upset, and for him to throw things... hit things. He's still struggling with that. He'll just walk up and hit somebody. He really just... wanted to play video games nonstop and eat mac 'n' cheese... He was just really on edge, really anxious, very upset, loud and aggressive. And he was not behaving like that beforehand... he became a very different kid during quarantine" (P21).

The stoppage of behavioral health services due to COVID-19 also halted children's opportunities for skill development and personalized support. Parents simultaneously described a decline in their child's gross-motor, fine-motor, social, and general behavioral skills as the impact of the disruption. For instance, P37 related,

> *"He was bored. It caused a lot of pacing... sleep issues became a thing. He was putting more and more things in his mouth... prior to this year, he was a lot more capable than he is now. He lost a lot of skills"* (P37).

However, behavioral reports were not all negative, as 47% of the 483 survey responses about children's behavioral functioning "over the last few days" were neutral or positive. In 150 survey responses (31%), parents described child behavioral functioning as neutral. For example, P1 shared halfway through the study that her son's *"behavior varies some days he wakes up in a good mood and others he wakes up very resistant and has meltdowns just getting dressed."*

In 78 (16%) of survey responses, parents characterized their child's behavioral functioning as positive. Twenty-eight parents in 66 (14%) responses described improvement in their child's behavioral functioning without being explicitly asked. P44 explains her son's behaviors:

> *"As our days progress and our quarantine/home school routine becomes the norm,* [my son] *seems to be calming down and less anxious. For him, anxiety begins when he feels out of control, so giving a clear routine and expectations has been crucial. We have had few outbursts, and a lot of compliance, although he does require one-on-one supervision which is getting pretty old"* (P44).

2.5.2 (Disrupted) Care Coordination for Children's Behavioral Health (RQ2)

2.5.2.1 Pre-Pandemic Care Coordination by Parents and Service Providers (RQ2a)

Prior to the pandemic, behavioral health service providers created, maintained, and controlled a distinct and protocol-driven structure, environment and routine for each service

and child. Written protocols such as the IEP helped to coordinate school-based services by establishing roles and the division of labor, and were mutually agreed upon by parents and providers during an annual IEP meeting.

Additionally, parents spoke with their child's providers informally at child handoffs before and after services, and some communicated asynchronously using digital technology and artifacts like paper documents. Prior to the pandemic, providers updated parents directly at handoffs in-person (i.e., child pickup and drop-off), or communicated updates from the day with parents using paper documentation or behavioral management software (e.g., ClassDojo). Parents shared descriptive information about their child's particular needs or behaviors and providers shared strategies or offered parent training to help with at-home supports. Providers and parents also met during formal or informal meetings on an as-needed basis, and some used artifacts that traveled between home and school. For example, before the pandemic, P57 received "*a daily sheet*" from her son's behavioral therapist describing "*. . . what he ate,* [and his] *behaviors. . .* [she] *would tell us through a text or when she dropped him off, 'This is Trevor's goal for the week.*'"

2.5.2.2 Disruptions in Pre-Pandemic Coordination by Parents and Service Providers (RQ2b)

The stoppage of in-person behavioral health services profoundly disrupted the ways in which parents and service providers provide and coordinate care. A lack of proximity abruptly stopped the exchange of information between parents and providers using artifacts and in-person communication at child handoffs or during meetings, thus undermining opportunities for parent training and support. Additionally, as described above, many parent's pre-pandemic strategies for behavioral management at home were not working well. This meant that there was a significant need for both services and communication methods to be reconstituted.

However, the pandemic distancing requirements required providers to fundamentally rethink the delivery of behavioral health services, including how they would meet with children and communicate with parents. This led to a period of confusion as parents awaited communication or actions from providers. P6 explained, "*I think for the first month there really wasn't much of anything. It was sort of the* [school] *district was still figuring out, 'What is their plan?'* Similarly, P14 was surprised at the stoppage of communication and was "*taken aback because* [she] *hadn't heard much*" from the special education team until. . . *"they finally sent an email saying, they're doing training. . . blah, blah, blah."*

2.5.3 The Routine Recovery Process within Children's Behavioral Health Services (RQ3)

2.5.3.1 Reconstituting Parent-Provider Communication using Digital Technology for Information Exchange and Monitoring (RQ3a)

Before behavioral health care providers had the plans or the resources to renew children's services, many established a line of digital communication with families to exchange crucial information—whether at their own or the parents' initiation—and maintain rapport. Some parents reached out to providers, before the providers themselves reached out, to ask about what they were planning to do.

> *"In the beginning, it was initiated through me because I was kind of like, 'Hey, I know that due to the circumstances we're in... I just want to make sure that... my child isn't being forgotten, or how are we going to proceed with certain services.' Inquiring, 'Hey, what are we doing,' in that sense... to the head person over the special education program"* (P31).

As expected, digital tools were used for synchronous and asynchronous communication, including text, email, patient and student portal messages (e.g., Google Classroom, ClassDojo), and phone or video calls. Of the 46 participants, 38 reported communicating with their child's providers during the study period. Those parents reported communication with providers in 131 survey responses, most of which (81 instances, 61.8%) were initiated by providers. The other 50 instances (38.2%) were initiated by 22 different parent participants.

Parents' and providers' goals in communication varied. Parents focused on the process for reestablishing service. They contacted practitioners, mostly asynchronously, to ask how they planned to sustain the child's IEP, what the timeline was for returning to in-person services or reconstructing services online, and for strategies to help their child adjust to the stoppage of their behavioral health service routine.

Providers, however, focused conversations more on monitoring child behaviors and well-being. They often communicated synchronously via phone or video call, and sought descriptive information about the child and family. In doing so, providers could assess the need for further support, what services the child may need, and maintain rapport with the family. For example, P21 described a scheduled Zoom call with her son and his therapists for them to observe his behaviors,

> "*It was kind of concerning how it was going.* [His behavioral therapist] *was checking in with us, because it took a while to start the telehealth visits. We*

> *would all be on the call with* [my son] *and they would see his behavior. And we were just like, 'This is what's going on. This is what he's been doing. We need . . . ' It was clear he was losing skills that he had gained*" (P21).

This communication equipped the providers with the descriptive information needed to revise the child's behavioral services.

Families responded positively to opportunities to maintain rapport and a relationship with their behavioral health provider(s), which they differentiated from an attempt to replicate therapy online. Parents reported that having some communication with providers, even if it was infrequent or brief, supported child well-being, which made parents happy. For example, P27 shared in a survey response that his son's "*teacher called just to say hi. That made him very happy."* P47 said that his son appreciated *"knowing that he has someone to talk to."* Additionally, P28 shared in a survey response that *"it helps* [her son] *feel like he is still a part of school and it makes him feel better to tell* [the school counselor]*how he feels*".

Regardless of who initiated communication, the descriptive information about the child's behaviors was often followed by prescriptive information provision by providers. As P27 outlined,

> *"His* BCBA (i.e., Board Certified Behavioral Analyst) *called me a couple times, just to check in and say what's going to happen and is there anything that I can [do]...*[My son] *broke a TV while he got mad at the video games, so* [his BCBA] *brought me the two social stories that they had written in the clinic for him. . . "* (P27).

P27 observed that using this prescriptive information helped to reduce the child's negative behavior, as he began to recite the social story on his own as a way to cope with his feelings when he was angry with his video games, as an alternative to the negative behavior.

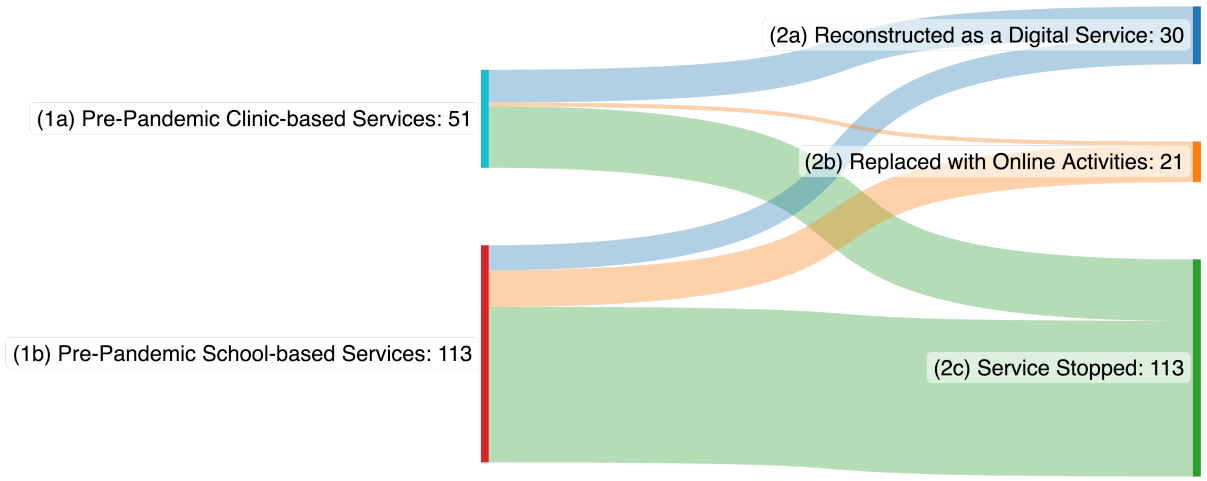
2.5.3.2 Behavioral Health Services Recovered using Digital Technology (RQ3b)

If and when behavioral health service providers were ready, they used the aforementioned newly established digital channels to communicate about the new protocol for services, and to coordinate the child's receipt of care. For example, P15 described in one mid-study survey response that her daughter's occupational therapist "*. . . reached out to me asking how often we should have zoom meetings and around what times would best fit my schedule.*"

Reconstructed Services. Although all children (N=46) had in-person behavioral health routines prior to the pandemic, only half (N=23) of the children had one (or more) services reconstructed digitally using video conferencing or phone calls. Most (113, 69%) of the 164

predominantly one-on-one daily or weekly services stopped (see Figure 2.1, 2c), and were not reconstructed at all by the end of the six week survey study in May 2020. By the time the interviews were conducted in June-July 2020 though, 30 behavioral health service routines (Figure 2.1, 1a) were reconstructed digitally.

Figure 2.1: **Service Recovery in the Early COVID-19 Pandemic.** This figure details the total number of behavioral health services received by all participant's children across settings, and whether and how the services were reconstructed or replaced during the study.



Twenty three children received 30 live *reconstructed* services online (see Figure 2.1, 2a). Seventeen children had one routine service reconstructed and six children had two or more services reconstructed. 17 of the 30 reconstructed services were clinic-based services received by 13 children (28% of sample). Notably, only 13 school-based routine services (9%) across 12 children (26% of sample) were reconstructed digitally despite the fact that the majority of pre-pandemic behavioral health services were school-based (113/164, 68.9%). Few behavioral therapy (e.g., applied behavior analysis therapy (ABA) or social skills) (N=5 of 14 services) or OT services (N=2 of 25 services) were reconstructed.

For those behavioral health services that were *reconstructed,* the ways in which providers observed and evaluated the child and provided care fundamentally changed. Digitally reconstructed services modeled the in-person service experience as closely as they could using telehealth via phone or video (i.e., weekly therapy sessions via Zoom). Most behavioral health routines were reconstructed using video calls (N=26) or phone calls(N=4). Talk-based therapies (e.g., speech therapy and psychotherapy) were mostly preserved following

reconstruction over video call due to the conversation intervention style, to the extent that the child was able to focus on the screen and sit still.

Parents of children whose OT or behavioral therapy was reconstructed found it challenging to perform the services in close replication via video call, without physical interaction with the therapist. Since they were not in person to physically perform therapeutic exercises with the child, the parent had to help facilitate the session. Parents also felt that occupational and behavioral therapists were also limited in their ability to observe or evaluate the child to determine progress or success, as described by P48, who shared that her son's OT is *"limited in what can be provided as far as assessments."*

Replaced Services. While the majority of services stopped (N=113), some were *replaced* with other activities (N=21) (see Figure 2.1, 2b). The 21 replaced services included: resource room (N=2), OT (N=3), ST (N=4), psychotherapy (N=4), and special education (N=8) (see Table 2.3). Replaced services involved both online activities or worksheets sent to families digitally, as well as infrequent/irregular check-ins, which occurred once or twice during the study period via phone, video call, or email.

For those services that were replaced with other activities like online videos and brief check-ins, much was expected of the child. Children were asked to complete online activities, worksheets, and games, watch instructional videos from providers on YouTube, and view informational slide decks on their own. As P43 describes:

> *"On Monday morning, all of her* [special education and mainstream] *teachers would give all the assignments for the week and you had to turn them in on Thursday. It's all self taught. Read this website, fill out this thing"* (P43).

2.5.3.3 Families Attempt and Respond to Recovered Services (RQ3c)

With the help of parents, children attempted to perform almost all reconstructed or replaced behavioral health services, thus following the initial new protocol created by behavioral health providers. While some attempts were positive, most parents faced a plethora of negative physical and emotional reactions from children when engaging them in services. Consequently, parents communicated suggestions to providers as to how reconstructed and replaced services could be improved, hoping that they would adjust the services to better meet children and parent's capacities and needs.

Reconstructed Services. A handful of children responded positively to the reconstructed services, their excitement evident, especially when engaging with their provider in short, small-group or one-on-one sessions via video or phone calls. Although it was difficult for P43 to get her daughter to initially engage in therapy via Zoom on a cell phone, she

explained how, to her surprise, virtual therapy was more productive for her daughter than the previous in-person therapy:

> "*We did* [therapy] *virtually...It was kind of more of a pain to have her sit in front of the phone for a Zoom meeting than it would actually be for her to be at the therapist's office. But other than that, it was pretty good. Addie... started talking more and opening up compared to when we were in therapy, she would just be... shelled, not talking, let me do all the talking type deal. So, that's one thing that was better with the Zoom meetings with her therapist is just because she started opening up more*" (P43).

A few children, like P43's daughter, had a better ability to focus at home in a comfortable or less stimulating environment, which highlights the potential for telehealth delivery for some children.

Services that demanded parental involvement beyond their capacity or those that induced strong negative responses from children were largely unsuccessful after a few attempts. Regarding the latter, children had negative reactions and disengaged when digital experiences were over- or under-stimulating. Parents did their best to help improve their child's experiences. One parent described her approach to reducing overstimulation in a survey response:

> *"We flex away from brightly colored online school activities and lean towards less visually distracting content (love Khan Academy)"* (P44).

Children also reacted negatively when the reconstructed or replaced services were inappropriate for their abilities, needs, or skill levels. Children's reactions—mostly attributable to the format, length, or mode of virtual interaction—included distraction, discomfort, frustration, and sometimes defiance, violence, anger, elopement, and avoidance. Such reactions were the case with reconstructed or replaced services that asked too much of children.

One particular area of challenge was use of group video calls (e.g., using Zoom, Google Hangouts) for services, including special education classes and group therapy. These were chaotic, overstimulating, and taxing for children. Many parents reported that their children were frustrated and had a negative behavioral response to multiple people talking at once and gallery view (e.g., class-wide calls or group-therapy having many faces on screen), as both made it challenging to focus on their behavioral health provider (e.g., the speaker). Thus, it was challenging for many children to focus on the provider during video calls without individual attention. The ambient opportunity to use other applications and websites while online for school or clinic-based behavioral health services created additional distractions.It was also very challenging for some children to engage due to difficulty with sitting still.

One parent conveyed how difficult it was to get their child to engage with the reconstructed service,

> *"... one thing that did not work for him... virtual meetings. And I think it was because even when it was stacked, you can see everybody, it's distracting... [*the] *classroom style. She had everybody on, and she would read a book, and [children] were talking about different things... "* (P14).

Another parent said that the modality of engagement in video calls was problematic:

> *"Online learning is not for him... face-to-face is even hard for him, but seeing somebody on a computer and your whole class is staring at you, it... put him on the spot. Closer to the end of the* [school]*year, we figured out a plan just to keep him off video and keep his new mute button on so he just felt more comfortable. On Zoom, he wasn't comfortable... He doesn't have to have his video on. He doesn't have to have the volume on... or the mic on, but they wanted him to still answer questions, and he wouldn't"* (P57).

The requirement for vocal engagement was atypical of a special education classroom where children could typically interact using mixed modalities. In light of the discomfort that P57's child and many others felt, several additional children refused to participate in behavioral health services over video call. P4 described how her son refused to engage in video services, and this elopement undermined their ability to perform virtual services:

> *"My son was with his father and he ran away and they weren't able to continue the lesson. He kind of got in trouble with his father for doing that. And I told his father, 'you know he's got his challenges so you can't be mad at him.' But, it wasn't successful. My son just would not participate in it. He just ran away and it was impossible to sit him in front live and to work with his speech therapist."* (P4).

Other children refused to participate in reconstructed behavioral health services because they: (1) did not have an existing, pre-pandemic relationship with the provider (and refused to develop one virtually) or (2) had a poor pre-pandemic relationship with the provider. In either case, children exercised their right to choose by refusing to participate.

Replaced Services. As mentioned, the protocols for replaced services, typically provided in special education, involved lists of online and paper-based activities, including pre-recorded videos with little live contact with service providers. This reliance on children to work independently, a skill demanding high executive functioning. Such demands for independent functioning could result in a negative response,

> "[E]*xecutive functioning is a big issue for* [my daughter]*...she needs help with organizing, keeping track, knowing what she needs to do next. It's really hard for her to go down a list of directions and be able to do it. She gets really overwhelmed..."* (P43).

With high executive functioning requirements, such activities required either extremely engaging content or a parent nearby to lead activities. This level of parent engagement was not always feasible or considerate of the family's needs and capacity, as one parent described:

> *"We didn't really get anything aside from, 'Here's a list of activities. Here are some links you can use.' And he's not one to attend to screens for very long, unless it's a video of people, so he really didn't really care for these online activities. They were a little too advanced anyway. It was like matching numbers, and I was like, 'Again, this is not a thing we're going to do"* (P37).

Indeed, replaced services, an approach used more often in special education, required considerable effort from parents to maintain their children's focus and/or manage the behaviors that followed. As a result, most special education services were discontinued by parents and/or children until in-person services could resume.

2.5.3.4 Parents Identify Challenges

As mentioned, it was difficult and unrealistic for many parent participants to be present for the duration of the virtual therapy sessions, or facilitate their replaced special education activities. Indeed, parents were typically working from home, or had other children attend to during school hours. Overwhelmed by the situation, many parents reacted with frustration at their changed role and the increased level of involvement expected to make their child's reconstructed or replaced services work. Mostly, they perceived that their child's unique needs were not adequately addressed. Consequently, parents identified declines in their child's skills, and struggles with online engagement, and shared this with providers.

Expanded parental roles were also challenging because almost all parents lacked the necessary skills and training to provide behavioral services such as OT exercises. Some therapists directed parents to paper-based instructions or instructional videos on YouTube for demonstration of the exercises they needed to learn to perform with their child, while others instructed the parent on the video call, prior to the session. Two parents described how they were sent instructions before Zoom OT sessions on how to lead their child through behavioral therapy or OT exercises. One said,

"Her occupational therapist was really good at telling me how to do certain things, telling me how to get her hands warmed up for the hand exercises. She would send me pamphlets for getting her to do crab walks and stuff like that to build up her upper body and lower body muscles...during the meeting, we would do stuff together" (P43).

While this level of involvement worked for P43, the preparatory work was not possible for P48 to complete before all of her son's services: "*I would have to print* [resources] *out... look it over. Same thing with OT. That just became a lot to do.*"

Parents also reported that the video technology used for behavioral therapy and ST did not meet their needs for appropriate services. P34 shared in an open-ended survey response that meetings with the behavioral aide over video were not helpful because *"...it's hard to modify behavior during video chat."* Alternatively, P19 described how his daughter attempted ST but they stopped due to poor sound quality:

"*She also attempted to do a live session a couple weeks ago, but it was very difficult for* [the speech therapist] *to hear over the computer audio to really tell if the pronunciation was adequate... So I think they only did maybe one or two of the live sessions"* (P19).

Thus, for both child- and technology-based reasons, initial, new protocols required further adjustment. Parents were the source of information about these challenges.

2.5.3.5 Parents Request Support and Adjustment

In response to these challenges, many parents contacted their child's behavioral health service providers to share their identified difficulties with implementing the new protocol. This involved sharing descriptive information about their child's behaviors and initial response to the protocol (Figure 2.2, 3a). In these discussions, many parents requested that providers make changes to the protocol to better accommodate their child's capabilities and their own resources.

Several parents requested additional support in light of the lack of one-on-one attention services. In response, providers sent additional resources, such as YouTube videos and worksheets, and scheduled regular one-to-one support over Zoom. For example, P23 communicated her son's need for structure and one-to-one academic support at the end of the third study week, when one teacher complied with her request but another had not:

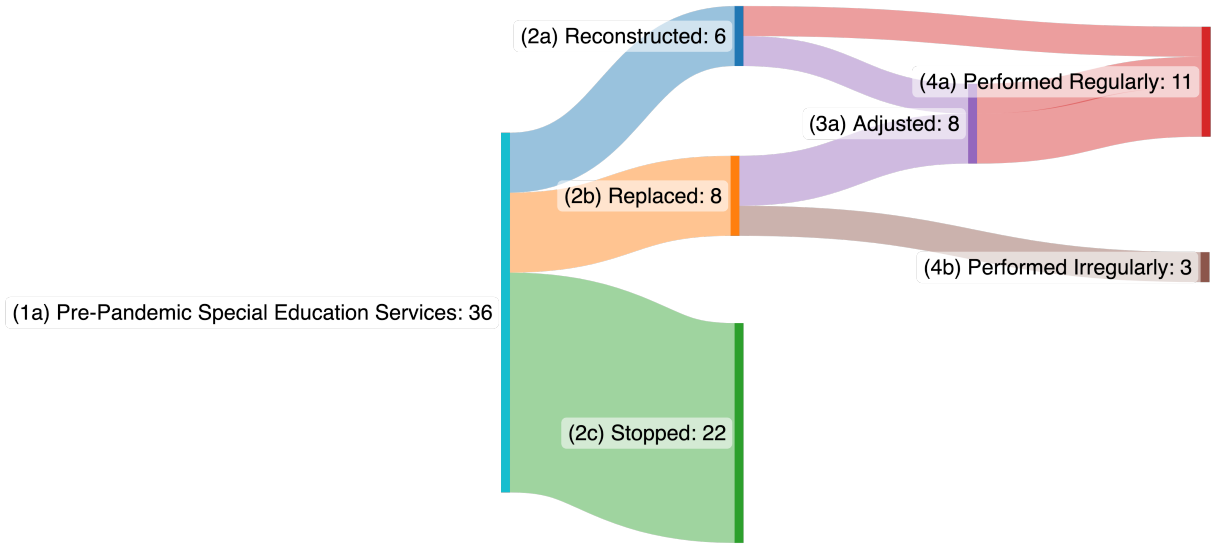
"I have reached out to the teachers asking them to work with my son to complete these assignments. One reached out to him and was able to explain things to him. Another continues to send lists of things he needs to do" (P23).

Several parents suggested specific alterations to the protocol or modality for services, including requests for one-on-one meetings with their behavioral aide or a transition from video- to phone-based services (Figure 2.2, 3a). However, not all parents initiated contact with their child's provider to request changes, as some waited for provider outreach or decided to discontinue their attempts at the service. For example, P43 described how her child's special education team sent a survey to communicate their needed adjustments:

> *"...asking what would help you, what's the most important, obviously because we can't do the full IEP distance learning, so what are the most important things. So we responded to that"* (P43).

After two weeks of school, they had not yet reached out to address those concerns, so P43 *"emailed them and said, 'Hey, this is just not working'."*

Figure 2.2: **Process of Recovery for Children's Special Education Services.** This figure shows the process parents and providers followed to recover some special education services. It shows how many services were adjusted, and whether they led to regular performance.



After requesting change(s), parents waited for a response from providers. While waiting, several parents paused their child's attempts at the behavioral health services, or reduced the pressure on their child to complete replaced behavioral health activities until the protocol was

adjusted. Even if they tried to continue, some children refused or were extremely resistant to performing activities. One parent explained,

> *"... we didn't push super hard on the schoolwork. My son was extremely resistant to any kind of schoolwork at home. I think for him it felt like a real blurring of his boundaries and that was super hard for him. What they sent was videos. We used Boom Cards. There were some reading tools. We could get him to sit and do it for maybe 15 minutes at a time but he was resistant* [to] *pretty much the whole process"* (P6).

Many providers responded to family needs for adjustment by setting up virtual meetings, which were used to adjust children's new services (Figure 2.2, 3a). Technology enabled and synchronous information sharing allowed parents and providers to create a shared understanding of the challenges, and discuss potential changes and the ways in which they would use technology in the adjusted services. After initially wanting to give up, P10 explained how he worked with his child's resource room teacher to reduce his workload:

> *"There were weeks where I was just like, throw in the towel and do nothing... So, that was nice of them.* [His resource room teacher] *really worked hard adjusting his... assignments... down to a manageable level for him. And then we needed to... adjust it further... that's when we came up with three days a week of tutoring of science, math and ELA. So he gets that core stuff and then does some other online stuff that I was more comfortable and familiar with ... I felt we worked well together... the resource teacher, myself and him, in coming up with a plan where we all felt that he was getting enough during this time"* (P10).

For some families, conversations between parents and providers resulted in a temporary reduction or stoppage of required work for family members. For instance, P21 and her son's special education teachers decided to make schoolwork optional:

> *"Because it was really hard to get him engaged. He didn't just stop school, he stopped ABA. So he had two hours a week on the phone with a tech via Zoom and it's like nothing. And so it was really disruptive for him. ...He was a hot mess if I could say that. He just got really upset. It was a big struggle for him to focus, to concentrate, and get into a school schedule. So the fact that he didn't have to do the work... it was like huge. You know? It saved a lot of things from being broken around here"* (P21).

Service adjustment helped alleviate parent and child frustrations and made a consistent routine possible for 8 services (Figure 2.2, 3a) . For example, P43 sought and received adjustments to her daughter's replaced special education services, in light of the previously described challenges with executive functioning. She describes how daily one-on-one guidance and structure enabled her daughter to follow the replaced activities and know what she needed to do next:

> "*...We finally went back* [to her teachers] *and said, 'Hey this is not working.' She was refusing to do stuff. Then the last two weeks* [of the school year], *her case manager would.... Every morning at 9:30 I think, they would spend 30 minutes together, and she had actually made a slide show. They would go through the slide show and it had links and say, click here and then click here. It had it all, and that was great, but it was only like two weeks"* (P43).

An important factor making this possible were several parents' strong pre-existing relationships with their children's providers. As one parent details:

> *"So there were already some good relationships with them which has helped facilitate me feeling comfortable, like I could push back and say, 'no, we need to do something else.' I felt comfortable that we could work together on creating a plan that was specialized for him"* (P10).

Once the protocols were modified, parents reported improved adherence, and an increase in child service engagement. Although several parents described successful changes to service protocols, other parents did not receive a response from providers, or the response did not adequately address their concerns. This resulted in irregular performance of the replaced activities (see Figure 2.2, 4b). Some dissatisfied parents sought guidance and advice on how to better support their child at home from other parents online.

2.5.4 The Role(s) of Technology in Children's Virtual Behavioral Health Services (RQ4)

Digital technology played crucial roles in the delivery of all behavioral health services amidst disruption from the COVID-19 pandemic. Reconstructed services relied on technology for teaching or practicing skills while working with providers or working independently. After the aforementioned adjustment, 11 reconstructed services fell into a regular schedule (see Figure 2.2 - 4a) and were delivered in a way that met the child and parent's changed needs and capacity. While replaced services were not regularly performed, parents and artifacts

such as visual schedules and social stories provided structure and support that some children needed.

2.5.4.1 Enabling Parent-Provider Shared Knowledge (RQ4a)

Due to service interruptions, parents had new information needs to facilitate their child's behavioral health services and manage their child's new behaviors at home. Technology-mediated information resources were a critical support tool, enhancing parental involvement and information sharing to equip them in fulfilling their new roles to the extent possible. Parents turned to diverse resources to meet these information needs. They used online searches, social media, and digital communication with providers, or communicated with other parents. Parents who acquired needed information were able to use it to support their child's behavioral health services. Indeed, their presence, understanding of the protocol, and ability to assist or prepare their child for participation were integral to service delivery.

Although providers and parents could no longer share information through in-person child handoffs during the pandemic, providers still needed to understand the child's and parent's needs, capacities, and the child's behavioral progress with the adjusted services. Thus, digital communication was the only approach feasible. Accordingly, digital technology, including video calls and asynchronous communication (e.g., texts, email, and portal messages) helped providers and parents perform their changed roles. Regular communication created shared knowledge amongst providers and parents. The descriptive information provided by the parent about the child at home kept providers abreast of changes in the child's health and wellbeing, enabled them to provide tailored prescriptive information to parents, make necessary changes to the protocol, and engage in informal conversations as needed. For example, providers used a combination of artifacts like videos or instruction sheets and live experiential learning during Zoom telehealth sessions to prepare parents for how to help facilitate OT sessions.

According to parents, regular asynchronous communication and live video-based services helped providers to learn about the success of service delivery in the home environment. For example, P6 had weekly meetings with other parents and her son's care providers. This supported the flow of descriptive and prescriptive information, as needed:

> *"Our BCBA had weekly parent sessions with us still. It was by video. It was a conversation. Yeah. She'd check in on how we're doing, she writes us social stories when we need it. We talked about some strategies"* (P6).

As P6 shows, sharing descriptive information resulted in some providers making adjustments to services. They also shared prescriptive information to help parents managing

behaviors at home.

2.5.4.2 Influencing Child Engagement in Virtual Behavioral Health Services (RQ4b)

The crucial roles of technology and other artifacts in helping to establish and maintain child engagement were twofold: (1) *supporting adherence* to the schedule and the protocol for behavioral health services, and (2) *maintaining rapport*.

Supporting Adherence. Digital and physical artifacts including visual schedules helped children adhere to a schedule involving behavioral health services and activities. These artifacts kept children informed about the day's plan and provided a cue for its performance. Parents reported that cues provided by visual schedules increased their child's comfort, and also alleviated anxiety about the activities for the day by helping children know what to do next.

> *"He likes following the rules, even at home...He's a really, really good kid. But he had been fighting from the beginning with both my husband and I. And my husband even made... this awesome... two feet tall board, with a Velcro, and things were laminated. And it had a schedule like, 'This is what we're going to do.' And we were kind of mimicking what he does in school. And my husband talked to the teacher for like an hour to get all the information"* (P14).

Many of these ideas came from special education teachers and behavioral therapists in response to child challenges.

Parents also leveraged technology to encourage child compliance with behavioral health service protocols by rewarding their adherence with enjoyable screen time. Thus, the interplay of protocol compliance and skill development ensured a structured yet engaging approach for children.

Influences of technology on child engagement also manifested through digital activities such as individual video calls, pre-recorded videos, and educational games like Prodigy, Funbrain, ABCYa, Khan Academy and abcMouse, which supplanted traditional special education activities in an engaging manner. Pre-recorded instructional videos from providers themselves or from other service providers on YouTube were used to replace the services they provided. P4 described one video from her son's speech therapist:

> *"It's a pre-recorded video that we play and she'll say, 'Hi Aidan.' My son knows her very well. She'll say, 'Good morning, Aidan. This is today's lesson. We're going to start with the letter O and what I want you to do is say O to make your*

mouth. Go O like that.' And then she'll say, 'Orange... I want you to say orange three times.' Because that's what helps" (P4).

Providers relied on email and behavioral and classroom management software to send both digital and non-digital activities to support skill maintenance and development. Several children found videos of their teacher reading stories, or videos of their classmates doing things, to be engaging. For example, P7's child *"enjoys playing the online educational games. Improves her mood, makes her smile and be happy."* P15 also shared how her *"daughter loves doing online activities. She doesn't put up a fight or throw a temper tantrum when asked to do these types of activities. She sees them more of being fun than actually work."* This fun aspect of online learning kept children engaged enough for the activities to be performed regularly, which was helpful for parents like P44:

"I am able to walk away and do a load of dishes, laundry, make a phone call, etc. he looks forward to the calls, and it is now a pleasant part of our routine" (P44).

However, others disagreed on which suggested activities they should follow, such as P10. His son "*prefers online learning that is more fun and game oriented while I prefer one that is more straightforward and solely educational so we clash on that."*

Maintaining Rapport. After being stopped for a period of time, reconstructed services via Zoom helped children re-established social connections with peers and maintain rapport with their behavioral health service providers digitally. Parents described that these interactions positively supported their child's social skills and well-being. Video calls with occupational and behavioral therapists provided children with some much needed social and emotional support. Due to the challenges that several children experienced with special education classrooms reconstructed on live video calls, some special education teachers recommended that parents schedule one-to-one video calls for their children to engage with their peers or teacher and build social skills from home. In one entry, P10 wrote about his child's video call with teachers:

"It was more just a check-in with [the special education teacher], the other resource teacher, and the school social worker. They talked about the things they are doing at home in quarantine, movies liked, and how online school learning is going. They got him to smile and laugh. They got him to engage. It was nice to see" (P10).

Alternatively, some teachers suggested video calls between peers. P14 took this advice and scheduled 30-minute Zoom calls for her son to meet online with a friend of his choosing.

She said that they typically went longer as "*they talked about video games...It makes them happy, both of them.*" Other parents such as P21 mentioned the positive impact of peer interactions: "*He zoomed with his class and it made him the happiest he has been since he's been home. He was elated.*"

Several parents saw these new opportunities for social connectedness with peers and professionals as a lasting benefit of the disruption, especially since these spaces served as outlets for children to cope with routine disruption. In comparison to digitally reconstructed special education classrooms, children were not required to participate in these small-scale virtual social activities, but since they had more control with respect to who they wanted to talk to, what they wanted to discuss and how they wanted to engage, they wanted to participate. Several parents, like P10 and P14, believed that these activities had a positive influence on their overall well-being.

2.6 Discussion

Findings of this research revealed that prior to the pandemic, 46 children received 164 behavioral health services delivered in schools and clinical settings (RQ1a). At the onset of the COVID-19 pandemic, few of these routine services were reconstructed or replaced at all (RQ1b). There was also a median delay of 30 days until any service was reconstructed or replaced. These delays negatively impacted children emotionally and psychologically, with concomitant behavioral challenges and some parents identifying loss of children's behavioral skills (RQ1c). Given this disruption of services and impact on child well-being, reconstruction or replacement of services—wherever possible—was greatly needed, yet challenging for parents and providers.

At the same time, pre-pandemic care coordination mechanisms of in-person communication and artifact sharing (RQ2a) were disrupted with the pandemic (RQ2b). During the study period, a small number of behavioral health services were reconstructed or replaced using digital technology (RQ3a). However, the process was often fraught with initial difficulties with engagement and abandonment due to inappropriate demands on children and parents (RQ3c). Where services were reconstructed successfully, parents and behavioral health care providers established digital communication channels as replacement coordination mechanisms (RQ4b). Furthermore, we found that providers, parents and children maintained rapport using these communication channels (RQ4b), and providers revised the service protocol until it could be regularly performed . Parents also sought information using technology (RQ4a), and engaging technologies supported child adherence to the schedule and protocol services (RQ4a). Successfully reconstructed behavioral health routines primarily used

telehealth technologies to offer services and foster socialization, and educational games to supplant special education (RQ4b).

In this discussion, we compare findings to previous research, and provide implications for the design of technology to support routines through periods of disruption and reconstruction. While our focus is on children's behavioral health services, as we show, findings have broader conceptual implications for children's remote care delivery. They also have broader theoretical and empirical contributions regarding the reconstruction of routines after disruption. Our study advances CSCW by examining how technology can better support children's behavioral health services during disruption, offering potentially broader generalizability to children's use of technology.

2.6.1 Extending our Understanding of the Role of Technology in Recovering Disrupted Routines

The role of technology amidst significant disruption, such as the COVID-19 pandemic, has previously been under-explored. Given the increasing frequency of global crises [3] and situational changes in families, such as separation and divorce [61], a deeper understanding of this aspect is vital. Since routines are often regarded as stable [80, 81], we strategically studied behavioral health services amidst a crisis situation (i.e., the COVID-19 pandemic) to contribute an understanding of routine reconstruction and the role of technology in this process.

As you recall, Mark and Semaan [164] found that technology plays a "major role" in the recovery of routines amidst disruption; we confirm their findings [164] by showing that routine reconstruction did follow a crisis that disrupted children's usual routines, and that technologies may facilitate reconstruction, as well as the replacement of routines with other online activities. We also extend their concept by outlining the specific roles of technology in the delivery of behavioral health service amidst disruption: 1) supporting information exchange for care coordination, 2) enhancing child engagement, and 3) maintaining rapport.

Our work confirms other HCI research which has established that people use technology amidst a crisis to meet their information needs [189, 167], work and socialize with others [164], and seek support to cope with stressful events [21, 109, 204] —in this case, parents do so for their children. Indeed, we found that digital technology enabled the crucial exchange of descriptive and prescriptive information and helped maintain rapport, both of which have been found to aid behavioral health care coordination in face-to-face settings [203]. Our findings bolster the appeals of both Massimi [167] and Richards [204] and colleagues who emphasize that digital technology and other artifacts should be designed to provide

informational support and connection to emotional and social support amidst disruption, instead of strictly informational support to help people be productive or efficient.

2.6.2 Extending Concepts about the Process of Routine Recovery

Prior research in HCI, CSCW, and organizational change, has investigated processes of routine reconstruction in workplaces. To recover routines, scholars suggest that teams undergo intentional processes of face-to-face communication [73, 122, 81]. Birnholtz and colleagues [31, 32] also studied the "regenerative process" of reconstructing routines in a summer camp following annual disruption. They found that after months of dormancy, the camp, and its associated protocols, actors, and artifacts (i.e., coordination mechanisms), could be regenerated as "the same organization" in the same place, even with the typical turnover of people. The process involved *skill demonstrations* and *rapid bursts of communication.* Like Birnholtz [31, 32], we found that providers used demonstrations to teach children behavioral skills and parents how to perform exercises (e.g., Youtube videos, over video calls). However, it could be difficult to fully demonstrate needed skills online. Also similar to Birnholtz et al. [31], due to lack of face-to-face contact, communication between parents and providers also occurred in *bursts*, during scheduled video or phone calls. Where such communication did not occur, however, reconstruction was not successful. Indeed, following Birnholz et al.'s [31] example of the *action and narrative exchange* in the kitchen, successful examples of this routine reconstruction process involved *iteration* until satisfactory solutions to match parent and child capabilities could be found. However, the *opportunity to practice generic skills in specific contexts* was undermined for many parents due to lack of prior training or opportunities to iterate and receive feedback. In this sense, we confirm and qualify Birnholz et al.'s [31] typology concerning routine reconstruction processes. This qualification is that each of the processes outlined by Birnholz et al. [31] may be partly explained by its face-to-face context, making demonstration straightforward and coordination via communication straightforward. Additionally, those concepts may have been shaped by its non-crisis-oriented setting, where prior training allowed for familiarity with generic skills that could subsequently be applied iteratively.

To this prior theory, we contribute theoretical understanding to reconstruction involving multiple parties when face-to-face communication is not possible and in disruptive situations —both characteristics of the early COVID-19 pandemic. In our study, parents and providers often recovered routines by first re-establishing their coordination mechanisms. They created digital channels for (a)synchronous communication which were necessary before information exchange, rapport building, and service delivery were possible. These digital tools were

later used to adjust activities until children could perform them regularly. Thus, we extend Birnholz et al.'s [31] typology of activities involved in the process of routine reconstruction to include the concept of *early coordination mechanism replacement*.

As mentioned, prior conceptualization of reconstruction of organizational routines did not consider unplanned, sudden disruptions from crises. Parents helped repair routines by increasing their communication with providers and their active role in their child's services. These findings confirm that of Semaan [218] who found students whose studies were disrupted by war elected to, and took on, new roles to support one another. Students regained control of their education through "*routine infrastructuring*," or "*building everyday resilience with technology*" by taking and sharing notes to distribute educational materials. Similar to Semaan [218], we also found that parents and providers relied on each other to coordinate care (e.g., share information, adjust the protocol) and perform services. The time that it took to establish this crucial, yet new early coordination could have contributed to the slow process of recovery.

2.6.3 Children's Preferences and Needs for Virtual Behavioral Care

Technology's role in child engagement in behavioral health services ranged from positive to negative depending on the tools used and style of engagement demanded of them. On the negative side, parents reported that video calls for both school- and clinic-based behavioral services were overwhelming and distressing. This was especially the case for group calls, such as those used in some special education classrooms and for group therapy. In contrast with Mark and Semaan's findings on the successful transition by adults to telehealth amidst disruption [164], children with behavioral disabilities could not engage with providers using telehealth in the same way as adults without identified disabilities. Moreover, our findings align with Zolyomi et al. [264], who found that autistic adults experience stress during video calls, caused by sensory overstimulation, cognitive overload, and anxiety.

While video calls with providers were effective for some children, group video calls were generally not possible. These findings suggest a limitation to the digital reconstruction of special education and group therapy, as most approaches used were not initially successful. The inability to successfully perform special education services or group therapy via video call led to the cessation of formal behavioral health routines—or their replacement with one-on-one services—until in-person school and services could resume. For example, group therapy was replaced with individual therapy in several cases. In light of our findings, future HCI research should study how to improve the design of telehealth technology for children's

special education and group therapy.

Furthermore, the current design of video platforms like Zoom restricted the methods of children's engagement to written or verbal communication, both of which were not possible for some children in this study. Some children were not at that developmental level and/or speaking was uncomfortable for them. Thus, future research is needed to explore how systems for telehealth can better support the delivery of care to children of varying diagnoses. In particular, OT and behavioral therapies that rely on physical interaction need increased attention, as those services were largely unable to be reconstructed. Our findings suggest the value of incorporating new digital modalities for engagement in video conferencing, besides speaking and typing. In light of the need for physical interaction, artifacts like smart clothes and gloves [14, 223] could be used to simulate physical touch, such as using wearables, VR, or digitally enhanced stuffed toys for physical engagement. Playing virtual games together or using the shared embedded whiteboard for creative activities could also appeal to children's interests. Such approaches to engagement could allow for provider observation, while also maintaining children's engagement and child-provider rapport.

We found that rapport between children and providers was crucial for their virtual engagement, yet challenging to establish online. This confirms recent research on the importance of establishing therapeutic alliance, or rapport, in in-person prior to telemental health with children [94, 115, 201]. Indeed, some parents in our study shared that meeting new therapists online did not work for their children, and their children refused to participate. Other parents in our study reported the provider's rapport-building practices (e.g., check-in calls) left their child feeling cared for and looking forward to future appointments —significantly, these were not with new providers. Thus, we recommend that future research is needed to study the differences in child-provider perceptions of rapport in online and offline settings.

2.6.4 Information Exchange and Parent Support Seeking

Existing CSCW research on care coordination between parents and health care providers has been conducted amidst relatively stable conditions within clinics and the home [11, 219, 203, 204, 108]. Thus, a unique aspect of our study is our focus on the recovery of coordination mechanisms following disruption. We found that parents and providers replaced their coordination mechanisms using digital technology. This contrasts with pre-pandemic CSCW research, which found that technology was rarely used to facilitate information exchange between parents and providers in children's behavioral health care. Rather, information exchange typically occurred in-person or non-digitally (e.g., through use of paper notes or phone calls) [162, 161, 203, 213], as that was standard practice. In that pre-pandemic

era, any digital communication was focused on behavioral observations of the child, or assignments (e.g., homework) from teachers or therapists [20, 138, 157]. Thus, we establish the crucial role and usefulness of digital technology for information exchange following the onset of the COVID-19 pandemic, and potentially moving forward — especially in any future public health crises or situational changes (e.g., parent separation, illness) that may limit face-to-face contact.

Past work has identified that parents face significant informational challenges when navigating their children's complex care needs [11, 108, 204, 219], such as when developing and maintaining a shared understanding of their child's needs with providers [203]. Maintaining shared understanding requires the continuous exchange of descriptive and prescriptive information [203]. Care coordination, like other forms of task coordination, requires an understanding of each person's role and the interdependency of tasks [160]. Our findings suggest that when disruption prohibits information exchange or the delivery of services, all providers and parents should holistically reassess their protocol together. This echoes Edmondson and colleagues [73] who similarly urge teams to collaboratively reassess roles and needs. Problematically, we found that this shift in division of care labor increased parent burden without an explicit change in the protocol (IEP) or in the availability of resources (e.g., information or training) for parents. This likely contributed to what prior CSCW and social work research has identified caregiver burden, a significant challenge felt by parents in navigating children's care needs [108, 47, 176].

2.6.5 Implications for Design, Practice, and Research

Our study findings identified several barriers to both the reconstruction and performance of children's much-needed service-based routines. These barriers can be traced to four major factors: (1) design of technologies and activities that were unusable or inappropriate for children with behavioral disabilities; (2) assumed and excessive reliance on parents who were not (properly, if at all) trained to make behavioral health routines work; (3) "broken" coordination mechanisms that needed replacement before any other activities could proceed; and (4) lack of clarity concerning the process that should be followed when reconstructing or replacing routine behavioral health services. We conceptualized the latter three as barriers that could be addressed with greater *routine resilience*. We now discuss opportunities for addressing these barriers with technology design, practice, and policy.

2.6.5.1 Inclusive Technology Design for Children's Behavioral Health

Findings underscore the need for an increase in the accessibility of digital technology for behavioral health services to protect parents, children, and healthcare providers from the impact(s) of disruption. Similar to the concept of universal design [231], digital tools, and especially those for behavioral health, should strive to accommodate children and adults of all abilities with greater flexibility and ease of use.

The recommendations that follow build on both past work and our findings. In particular, Sobel and colleagues [225] detailed various barriers to inclusive technology use that children encounter in special education classrooms. They identified four key facilitators for inclusive engagement: (1) direct and embedded supports, (2) transparency, (3) adjustability, and (4) an emphasis on children's interests and strengths. In line with these concepts, we discovered that reconstructed or replaced behavioral health services were effective when children received support from a parent and/or provider while performing activities. In replaced services, one-to-one provider support was not initially provided or embedded, which left parents responsible for providing this support themselves or requesting this support from providers, if they could. Furthermore, replaced services were perceived as more helpful when direct and embedded supports were offered via one-on-one Zoom or phone calls. Parents indicated that these one-on-one sessions allowed providers to build a rapport, manage behavioral issues, and determine resource needs or protocol adjustments.

Consequently, we propose that digital technology for behavioral health services should be further developed to (1) *increase usability* and (2) *incorporate direct and embedded supports.*

1. *Increase usability.*

   Video conferencing and telehealth tools would benefit from re-design to *reduce children's overstimulation* and *improve their comfort* with the technology.

   First, to *reduce children's overstimulation* through both visual and auditory channels, we recommend that a change in the default setup of Zoom calls for telehealth platforms. The default could be that all speakers are muted initially and speaker view is set to "on." Future research should test such visual and auditory changes on video conferencing platforms with children. Further work could also investigate how children and/or providers could be enabled to more effectively adjust settings.

   To improve children's comfort, digital technology for behavioral health should also prompt providers to check on children's comfort with the tools they use for both synchronous and asynchronous engagement. Video conferencing could also provide on-screen prompts [261] to remind them to check in with the child about their comfort with the technology before, during, or after a session. Children could also respond to

on-screen prompts asking about comfort within the patient or student portal that the provider could receive and respond to asynchronously. Such considerations would also support children's emotional safety online [47, 217], and in therapy [94], to enhance their overall experience and help build trust and improve the therapeutic relationship.

2. *Incorporate direct and embedded support.*
   Incorporating direct and embedded support into existing tools and systems could both structure children's experiences and lighten caregivers' loads. Within existing behavioral and classroom management software, we recommend providing (a) access to one-to-one support, and (b) artifacts to provide structure and transparency.

   To improve the ease of parents or children accessing intermittent or regular one-to-one support from providers, digital scheduling or meeting requests could be incorporated directly within existing behavioral or classroom management software (e.g., families can book a one-time or recurring appointment on the provider's calendar). This could alleviate some barriers children and parents face when requiring extra support amid disruption.

   Recall that our findings identified how artifacts (e.g., lists, schedules) helped foster child adherence to behavioral health services. This adds to previous research on how artifacts can enhance the resilience of health routines in adults [186] and extend it to children. Specifically, written protocols or lists of assigned activities were appropriate for children who could accomplish individual tasks on their own and when structure was available from providers (e.g., individual Zoom calls with a provider and a slide deck with links to each online activity). Furthermore, parents appealed to children's strengths by using visual schedules (i.e., a chronologically ordered, pictorial list of daily activities) at home, and catered to their interests by offering digital technology time (i.e., "screen time") or a new toy to obtain their adherence to the schedule and the protocol for reconstructed and replaced services. This confirms Sobel and colleagues' [225] classroom-based finding about the effectiveness of screen time as an appealing reinforcement for positive behaviors.

2.6.5.2 Digital Technology for Resilient Care Routines

Resilience is the ability of a technical or human system to recover from setbacks [44], and can be identified as a process or an outcome [17]. In the HCI literature, Semaan [218] describes resilience as creative and adaptive processes that individuals employ to navigate routine disruptions. HCI researchers have identified resilient technology practices in individuals [15, 218], families [96, 184], and communities [137, 140]. For example, in terms of

resilience of daily routines, Semaan [218] found that individuals innovated in their routines and technology usage to meet their information needs during a major disruption: a nation at war. Novak and colleagues [186] also found that household objects and spaces can contribute to the resilience of health routines at home. They also identified planning for recovery from disruption as an opportunity for adults with diabetes to develop resilient routines that withstand disruption; for example, planning medication adherence while traveling. However, HCI and CSCW scholars have not sufficiently considered the resilience of healthcare routines to aid in continuous delivery of care amidst disruption. Thus, Gui and colleagues [108] recently called on health technology researchers and technology designers to consider both the "resilient-self" in supporting individuals' needs and autonomy and "resilient care networks" to provide resilient health care. Such resilience would account for the team of care providers, their relationships, and their coordination.

Our findings begin to answer this call; our work shows that many routine behavioral health services faltered amidst disruption—thus demonstrating a lack of resilience. We characterized a slow (for some) and non-existent (for many) process of recovery for children's behavioral health services. The present research underlines the urgent need for practice and policy changes and the improvement of digital technology to create more resilient behavioral healthcare processes. Thus, to enhance resilience, we suggest four changes to the design of digital technology, behavioral health practices, and associated policies, with (1) a blended care model, (2) parent training, (3) continuous digital parent-provider communication, and (4) a plan for recovery.

First, we contend that parents, children, and behavioral health service providers should incorporate telehealth into their routine where appropriate, so that everyone can be prepared if and when a disruption occurs. Thus, we advocate for a "blended" care model involving in-person and telehealth services both with and without parent involvement. Regularly providing virtual services could maintain practitioners' and children's comfort with the technology, and help maintain care continuity and rapport, especially if therapy is disrupted. As described previously, digital tools could enable this model of blended care upon redesign. Additionally, increasing regular, deliberate parental involvement in services may make children's behavioral health services less susceptible to disruption, with the added benefit of increasing the continuity of the child's care [111] which can improve long term health outcomes. Moreover, routine parental involvement may address the aforementioned problem of excessive parental responsibilities by testing these assumptions outside of an emergency. Where responsibilities prove excessive, adjusting services and/or technologies to make the burden on parents more reasonable should be undertaken over time.

Second, to prepare more proactively for future routine service disruptions, we argue that

ongoing parent training should be seen as crucial to the delivery of virtual behavioral health services. HCI scholars have identified the crucial role of parents in the provision of children's care and learning from home [25, 204, 262]. Through clinical trials, medical informatics scholars have shown the effectiveness of telehealth in children's behavioral therapy when parent training on behavioral health interventions and how to use the technology are provided [27, 58, 82, 152], and it positively contributes to children's behavioral outcomes [172].

Our findings add to this body of knowledge with how successful reconstructed or replaced services relied upon parents. Early in the service routine reconstruction process, some service providers made the mistake of paying insufficient attention to the kind of background (parent-led) support that would be needed to deliver services successfully. In order to address this problem, some services were either further altered (e.g., more synchronous contact with providers was added) or stopped. However, even within the altered services, parents were consistently being asked to take on new responsibilities in relation to their child's health care, from delivering exercises themselves to helping children stay on track with school work throughout the day. This was especially challenging since parents were faced with these demands in the face of competing responsibilities and without adequate training. When parents received adequate resources and training, as parents in our study described how they felt more confident in helping to facilitate care.

Thus, we argue that opportunities for one-to-one or small group parent training could better equip both children, parents and providers to sustain OT, ST, and behavioral therapy amidst disruption. Like Birnholtz [32, 31] emphasized, demonstration and practicing skills in specific situations is important to the reconstruction process and continuity of care for children. Yet, notable billing challenges remain in practice. Most importantly, there is no "clinical code" in the DSM-5 or International Classification of Diseases (ICD) for providers to bill for parent training. Additionally, each payer (i.e., insurance company) determines the frequency and modality (if at all) for which behavioral health care providers can bill insurance (i.e., be compensated) for services or parent training [168]. Thus, we advocate for the creation of a clinical code for parent training to become billable.

To support resilient care routines, we also argue that there is a need for continuous parent-provider digital communication and a plan for services to continue if face-to-face services are not possible. In the event of disruption, crucial coordination mechanisms need to be replaced right away. Doing so could mitigate the risk of negative impact on child well-being and maintain skills and rapport. Since digital communication served as a replacement coordination mechanism during routine recovery or reconstruction, we argue that it is critical to maintaining digital communication between parents and providers even outside of disruptions. Moreover, in line with Birnholz et al.'s [32, 31] observations about routine regeneration pro-

cesses, these digital channels facilitated communication in bursts and when needed. With opportunities to communicate, parents and providers can then iterate on reconstructed or replaced services until the right balance is found.

To further enhance care coordination when in-person services are impossible, we also recommend protocol revisions (e.g., the IEP) —articulating roles, tasks, and service delivery methods—be made collaboratively, documented, and shared in real-time. Collaborative documents housed in existing behavioral and classroom management software can streamline this documentation and provision of access effectively.

2.6.6 Strengths and Limitations

This paper describes technology's role in children's behavioral health services amidst disruption due to the COVID-19 pandemic. This work has several strengths and some limitations.

We studied the perspectives of parents of children with behavioral disabilities, a group that is often underrepresented in research. However, this study's sample is limited by demographics, with the parent participants being mostly white women who were highly-educated and relatively middle- to high-income. Lower-income families might not have participated in the follow-up interviews during June-July 2020 due to the amount of compensation ($25), timing (i.e., summer when school is out of session), and other ongoing challenges in 2020. Thus, findings may not generalize outside of these demographics.

Also, our sample could have been affected by self-selection, as we asked many participants who were communicative in the longitudinal surveys to participate in interviews. Therefore, the follow-up interviews may not have included those parents who had the most trouble reconstructing services via digital communication with professionals, or the parents whose providers lacked resources to reconstruct or replace services at all. Additionally, the study could have selection bias due to online recruitment methods (i.e., social media, the University Health Research portal) required amidst nationwide shutdowns in Summer 2020. Consequently, the sample may include only participants that are comfortable discussing their children's behavioral health and coordination practices.

Findings also represent the parent perspective only; yet there are questions raised that can only be addressed from the perspectives of children and clinicians. Accordingly, findings and design recommendations reflect parent interests and do not thoroughly account for the interests or capabilities of the service recipients themselves. We acknowledge parent participation without their children as a limitation of our study, and an opportunity for future work. We echo recent literature reviews on both tele-mental health for children [28] and behavioral health care services for children with disabilities [25, 75], which call for more

research that directly involves children to effectively innovate health care services and the associated technologies.

2.7 Conclusion

This study bears significant implications for the CSCW community, as it can guide the design of digital technology for virtual services for children with behavioral disabilities in the context of disruptions, as well as future research on the process of routine recovery.

Findings revealed that before the COVID-19 pandemic, the children in our study received numerous behavioral health services in schools and clinical settings. However, most routines were not recovered during this six-week study in April-July 2020. There was also a delay in recovering these services digitally. According to their parents, lack of services had negative emotional, psychological, and behavioral impacts on children. Pre-pandemic in-person coordination mechanisms were also disrupted, requiring parents and providers to re-establish their communication digitally. This appeared to be a critical first step in routine reconstruction, or replacement. Despite initial difficulties, some services were successfully reconstructed or replaced online, after parents and healthcare providers worked together to share information and adapt services over time. Digital technology was heavily utilized to maintain rapport, perform services, support adherence to routines, and supplant formal behavioral health services with videos and educational games.

The findings underscore the need for and potential benefits of creating more inclusive technology for children with behavioral disabilities, and resilient care routines that cater to the needs of children with disabilities, their parents, and providers. We contend that such resilience may be aided by less overstimulating video conferencing platforms, more support embedded into digital tools for children, a blended care model with parent training, continuous communication, and a recovery plan to withstand potential disruptions. Future CSCW research for children's behavioral health should explore visual and auditory changes in videoconferencing to reduce overstimulation, as well as new methods for more physically interactive engagement online.

2.8 Acknowledgements

We thank Tiffany Veinot, Allison Spiller, Carol Scott, Marcy Antonio, and the UM Health Informatics Research Group for their feedback on this manuscript. We thank Allison Spiller for her tireless data collection support. We thank Lu Xian, Iris Lin, and Minnie Sun for their contribution to the analysis of this data. We thank Gabi Marcu for her support in

shaping the study design and deployment, and for obtaining the financial support for this work. This research was funded by NSF under Grant No. IIS 1816319.

CHAPTER 3

"It's not healthy but it's fun": Children's and Parents' Perspectives on Screen Time's Impact on Children's Health

3.1 Abstract

Background: Screen time is increasingly a part of children's daily lives. Prior research shows that screen time can both positively and negatively impact children's health. Yet, little is known about children's perspectives on this issue, how they approach any concerns, and how this compares with their parents' perspectives.

Methods: Semi-structured interviews and surveys were conducted with 33 children (age 7-12) and one of their parents/grandparents. Children were diverse with respect to race and family income (51.5% low-income).

Results: Children shared mixed views on technology's influence on their health, which were encapsulated by the following themes: even beneficial screen time needs limits to avoid physical discomfort, screen time can produce both intentionally positive and unintentionally negative emotions, and joint media engagement strengthens relationships, but fighting over it does not. Family conflict over screen time was concentrated in sibling relationships, such as over shared devices and content choices. Parents employ various strategies to address their health-related concerns with their children's screen time, from minimal to stringent restrictions. Children intentionally manage their concerns by adhering to established screen time limits, listening to their bodies, deliberately engaging in digital content that makes them happy, and using technology to build or sustain relationships.

Discussion: Perspectives and strategies used by children and parents were largely in agreement. Children's agreement suggests that parents and children could establish mutually agreed-upon screen time guidelines with appropriate supports. Proactive management of sibling conflicts over screen time is recommended. Children's agency in managing their

screen time can be a resource for future interventions in child health.

3.2 Introduction

Screen time, activities involving digital technology [232], is a major part of children's lives in high-income countries like the US, touching on most major life domains, including entertainment, play, education, health care, and socializing with family and friends [57, 194, 239]. On the entertainment front, among US children aged 8-12, nearly 90% US watch TV or online videos daily, and 60% play video games daily [207]. The amount of time US children spend on digital media for entertainment is also rising, increasing from 4.73 to 5.55 hours daily from 2019 to 2021 [207]. For education, digital modalities became a necessity at the onset of the pandemic, with 93% of children experiencing online learning during that time [170]. In healthcare, children increasingly have telehealth consultations, and its expansion has persisted after the pandemic [135]. As for socializing, over 92% of US children (ages 6-12) in one sample increased their digital technology use to connect with peers since the pandemic [69].

Screen time should be defined as a type of health behavior, as it represents choices, actions, or practices that can impact health outcomes [39, 221]. For example, excess screen time can have negative impacts on sleep quality [110] and physical activity [13], and produce eye strain [178]. Moreover, screen time may influence children's emotional, social, intellectual, and spiritual health [233]. Increased screen time is associated with increased depression and anxiety symptoms in children [121, 195]. Negative social impacts can emerge from conflictual interactions and bullying online [35]. Emotionally and mentally, children can be exposed to developmentally inappropriate sexual or violent content [54, 197]. Despite this, there are potentially positive impacts of screen time on child health [141, 206, 92]. Screen time often fosters positive emotions in children [196, 35]. For instance, 61% and 48% of children ages 8-12 reported "enjoying" the following "a lot": watching online videos (e.g., TikTok, YouTube) and television (i.e., cable or streaming), respectively [207]. Some children also play computer games or listen to sounds or music to reduce their stress levels [254]. Playing social video games and communicating with peers online using digital media can reduce the number of conflicts in peer relationships [141]. Learning can also be fostered with educational apps, digital toys, and eBooks [29, 139, 68, 202].

While the previous research outlines objective health measures related to children's screen time, it is essential to understand parents' perspectives to determine how best to intervene. Parents largely acknowledge that screen time can have both positive and negative consequences on children's health [49, 226]. On the positive side, parents assert that time spent

using developmentally appropriate technology can bolster children's learning and creativity [205]. Parents also value the benefits of digital interactions with peers and family for their children's social health [78], as well as its use as a constructive distraction [88]. However, parent concerns remain regarding the negative impact(s) of over-use [205, 265] and exposure to inappropriate content on child well-being [41, 155].

In addition to understanding parents' perspectives, it is also essential to understand children's perspectives of screen time and health. Research on the relationship between children's screen time and health rarely presents children's perspectives, instead relying on adult interpretations [133]. One exception to this research inattention to child perspectives is Zulec and colleagues [265] who outlined child, adolescent, and parent perspectives regarding the positive and negative effects of screen time. However, this study does not consider their perspectives regarding screen time and health in particular. This is a critical gap since these perspectives are needed to provide authentic and effective parental advice and develop clinical and/or technological interventions that can support children's health in relation to screen time [133]. Furthermore, this prior research does not separate child and adolescent perspectives, therefore missing the critical views of children aged 7-12. Middle childhood is a critical age group to understand because it developmentally involves increasing self-regulation skills [200], in which technology-related-parenting strategies remain influential on children's screen time [215].

Parent and child viewpoints are also crucial in developing strategies that address health concerns while preserving the positive aspects of screen time. Some prior work shows that parents may try to manage the content and types of interactions to which their children are exposed. Some parents employ restrictive mediation practices [154, 241] by setting rules regarding the content allowed or the time spent viewing media and using tools such as timers and schedules [49**?**]. Parents also employ strategies to bolster the positive impacts of technology use [153, 117, 35], such as allowing minimal entertainment screen time, but unlimited time for educational content. Nevertheless, we know little about whether and how children themselves may attempt to navigate any personal concerns about screen time's effect on their health.

Given the aforementioned gaps in prior research, this study considers perspectives of children and parents to answer the following research questions:

1. What are children's and parents' perspectives on the relationship between screen time and children's health?

2. How do children and parents navigate any health-related concerns about screen time?

3.3 Design and Methods

There were 33 in-depth, semi-structured interviews with children (ages 7-12) and one of their parents or grandparents to obtain child and parent perspectives on the relationships between children's screen time and their health. Each child and parent also completed a survey, administered via Qualtrics. This study was reviewed and approved by the University Institutional Review Board.

3.3.1 Recruitment and Screening

Recruitment occurred via word of mouth, social media posts on Facebook and the University's Health Research website, paper flyers posted in local libraries, and snowball sampling.

Interested parents/grandparents filled out a brief screening survey online via Qualtrics to determine eligibility. Parents met inclusion criteria if they: (1) were at least 18 years old, (2) lived with their child age 7 to 12 years old (as verified by birth date), and (3) spoke English. We employed a purposive sampling strategy [97] to ensure age diversity across child participants and gender/role type across adult participants and to maximize variability in family structures, with the intention of a sample size greater than 25 dyads to follow recommendations from prior literature [97]. We intentionally sampled families of varying incomes (i.e., low, middle, and high), while emphasizing those of lower incomes since they are traditionally underrepresented in research about children's digital technology use.

A member of the study team invited qualifying parents to participate in the study, and shared a consent form, using their preferred method of contact (i.e., email or text). Parents consented to participate in the study and completed the parent survey via Qualtrics. Before each interview, the first author read the child assent script, answered their questions, and then asked for their assent. Each child completed an online survey via Qualtrics following their participation in the interview, in the presence of the researcher and their parent.

Both surveys included questions about demographics, children's technology use, and several standardized measures, including the Youth Physical Activity Questionnaire [52] and the perceived parent-child conflict questionnaire [182]. See appendix B.2 and B.3 for additional details.

3.3.2 Data Collection

Interviews took place in local libraries or online via Zoom and lasted 55-90 minutes. Parent-child dyads received $50 for their participation. The interviews were conducted using an interview guide by the first author who is trained in qualitative methodology (OKR). Open-

ended questions [55] were followed by more specific probes that focused on the role of screen time in children's daily lives and their perception of the impact on their health.

All interviews were audio-recorded, transcribed via Zoom, verified, and de-identified. Each family was assigned an ID number that linked parent (P) and child responses (C). For example, C1 and P1 are the child and parent of Family 1. Each participant received a pseudonym, generated and assigned by a research assistant.

3.3.3 Data Analysis

The first author wrote contact summaries to explore and reflect on what she learned and took note of remaining questions [214]. To assess data saturation, the first author used saturation tables similar to Aiyegbusi and colleagues [4] to identify the point at which new data becomes repetitive. Data collection continued until data saturation [216] was achieved. At this point, no new information relevant to the research questions was elicited from additional interviews.

The first author and a research assistant initially analyzed transcripts inductively using an open coding approach [214] to identify initial codes in conversation with part of the research team. Each coder reviewed each other's coding and compared their use of initial codes across three randomly selected interviews and then discussed the codes and disagreements in weekly meetings to generate, review, define, and finalize the codebook. Next, they deductively coded 7 randomly selected interviews in NVivo with the inductively generated codebook. Interrater reliability (IRR) between the two coders was substantial at 0.66. After this, the first author coded the remaining 26 interviews.

In a secondary round of analysis, the first author reviewed all coded data using structured data analysis forms that prompted reflection upon variation and patterns within each code. Then, the first author wrote memos related to the research questions.

Descriptive statistics were calculated for the survey data.

3.4 Results

3.4.1 Characteristics of participants

We conducted 33 semi-structured interviews with both parents/guardian(s) and their children (ages 7-12) in August and September 2022. All children engaged with video-based content once to several times daily on almost a daily basis (see Table 3.1). Families had a variety of structures, including single-, grand-, step-, and adoptive-parent-led households (see Table 3.2). Most families had a monthly household income under $5,000 (see Table 3.2).

Table 3.1: Participant characteristics

	Child		Parent	
Gender	**Count**	**Percent**	**Count**	**Percent**
Female	20	60.6%	27	81.8%
Male	12	36.4%	6	18.2%
Non-binary	1	3.0%		
Race				
White	17	51.5%	22	69.7%
Multiracial	8	36.4%	2	6.0 %
Black or African American	4	18.2%	5	15.1%
Asian	2	6.0 %	2	9.1%
American Indian	1	3.0%	1	3.0%
Prefer not to answer	1	3.0%	1	3.0%
Child Age				
Late Childhood (7-9 years)	17	51.5%		
Early Adolescence (10-12 years)	16	48.5%		
Frequency of Screen Time				
Several times per day	22	66.6%		
About once per day	4	18.2%		
3-5 days per week	1	3.0%		
1-2 days per week	2	6.0 %		
Every few weeks	4	12.0%		

Table 3.2: Family Characteristics

	Count	Percent
Cohabiting Family Structure		
Single parent	8	24.2%
Single parent and grandparent	2	6.1%
Two parents		
Biological	13	39.4%
Biological and Stepparent	8	24.2%
Adoptive	2	6.1%
Monthly Household Income		
Low 0-5k	17	51.5%
Middle 5k-9k	10	30.3%
High More than 9k	5	15.2%
Prefer not to answer	1	3.0%
Number of Siblings in Home		
Range: [0,6], mean: 1.5, median: 1; sd: 1.6		

Table 3.3: Children's Perspectives of the Impact of Screen Time on their Health

Perceived Impact	Mental Health	School Work	Sleep	TOTAL
Extremely good	0	3	0	3
Good	7	20	5	32
Neither good nor bad	21	7	11	39
Bad	5	2	16	23
Extremely bad	0	0	1	1

3.4.2 Children's Perspectives on the Impact of Screen Time on their Health

3.4.2.1 Overarching Views

Overall, children's perspectives presented a mix of views regarding relationships between their health and screen time. In the interviews, most children in our study (n=28, 85%) acknowledged both positive and negative implications of their screen time for their health. This was echoed in their majority neutral survey responses (see Table 3.3). For instance, regarding their mental health, defined as "how you think and feel about yourself", most children rated the impact of screen time as "neither good nor bad." Additionally, the preponderance of responses regarding other aspects of health was split: overall, it was "good" for their school work, and "bad" for their sleep.

These *mixed perspectives* were also evident in children's words in interviews (see Table 4). Many children indicated that the health implications of technology use fell in the middle of an unhealthy-healthy spectrum. For instance, one said that it is "*Kind of* [healthy], *kind of not*" (C33). Furthermore, some children described how their screen time is simultaneously beneficial for one aspect of their health and harmful to another. Most children (n=17) also mentioned how engaging in screen time for an extended period can cause them physical discomfort, such as eye strain, headaches, or stiffness. They shared concerns about worsened vision or the need for glasses, which they are reminded of by parents and teachers. For them, the sedentary behavior involved in most screen time also negatively influenced their health.

A few children (n=5) departed from this mixed perspective by expressing *strong negative or positive views* about the screen time-health link during interviews–especially regarding video games and streaming videos. For example, two children described such screen time as bad for their physical health due to resulting bodily discomfort (e.g., headache, eye strain; Table 3.4). Three children only expressed views that screen time positively supports their health.

Nevertheless, their perspectives were balanced by their experiences of digital video content

Table 3.4: Children's Perspectives of the Impact of Screen Time on their Health

Mixed Perspectives	Haley, C4, age 8: Probably screentime is not healthy for me because my vision is kind of messed up and I need glasses. But, I do like my screen time... they're every-day all-day glasses because my vision's just really messed up from home school. That's one of the reasons... we had to quit [home school].
	Interviewer, I: How do you feel when you play the football [video] game? Max, C21, age 7: I feel excited. I: Does it feel like playing the football game is healthy for you? Max: It's in between [healthy and not healthy]!... it's video game so...it's like unhealthy, but [it] makes me happy.
	Carson, C24, age 11: ...I know it's not [healthy]. Because I'm not spending time to workout or move my body around. I don't have much else to do. I would like to go outside, but the trampoline is broken. Interviewer, I: What are some of your favorite things to do to be unhealthy? Carson: Eat...go on electronics. Cause I'm not moving around... I: How does electronics make you feel? Carson: It makes me feel good.
Strong Negative or Positive Views	Reggie, C6, age 8: Sometimes [watching TV] will damage your head. Sometimes it can hurt your head. Eyes are gonna be drooping.
	Easton, C31, age 9: ...no [playing tablet games is not healthy] because you get headaches and it's bad for your brain.
Favorite Unhealthy Thing to Do	Camilla, C13, age 11: I feel like going on my phone makes me unhealthy sometimes. It doesn't really help your eyes that much. And then something that makes me get unhealthy is when I have to wake up really early, and I did not get that much sleep.

as highly enjoyable. Sixty-one percent of children shared in interviews that using technology was one of their favorite "unhealthy" things to do. Similarly, the same two children who complained about eye strain said that playing video games was their *favorite unhealthy thing to do* because they find it "fun" (see Table 3.4).

We will now discuss children's perspectives in depth, highlighting three themes: 1) even beneficial screen time needs limits to avoid physical discomfort, 2) screen time can produce both intentionally positive and unintentionally negative emotions, and 3) joint media engagement strengthens relationships, but fighting over it does not.

3.4.2.2 Even beneficial screen time needs limits to avoid physical discomfort

Study children stressed that *screen time is beneficial for their intellectual, social, and physical health.* Intellectual enrichment came from educational games and creative apps that promoted learning and stimulated imagination. Notably, platforms like DuoLingo, Prodigy, and Khan Academy, along with video games and YouTube tutorials, provided ways for children to acquire new skills and information (see Table 3.5). Socially, children saw multiplayer video games as helpful for their relationships with others, like teaching them how to be nice to others or to work in teams. Physically, some children also used technology that necessitated movement, like VR interfaces and exergames, or following online exercise videos.

Table 3.5: Even beneficial screen time needs limits to avoid physical discomfort.

Screen time is beneficial for their intellectual, social, and physical health	Nia, C29, age 7: I...really like doing hair and inventing new styles. [The game] helps me know what styles I could do when I grow up. [The hairstyling game is] somewhere in the middle [of healthy and unhealthy]... Sometimes I watch educational shows... you're learning a lot. It is not [unhealthy], because you're still learning how to do hair... when you want to be a hairstylist when you want to grow up.
	Interviewer: Do you feel it's healthy for your mind and body? Lance, C12, age 11: I would say so. It makes me feel happy. Creativity is probably the best part about Minecraft.
	Interviewer: Does it feel like you're gaming with friends is healthy for you? Rose, C19, age 11: ...sometimes...Teamwork. Yup.
Time limits permit healthy engagement	Hope, C30, age 9: ...it can still be healthy because I'm not always on it. Like all day [is unhealthy]. Miranda, P30: When she watches for too long, she gets a headache. Hope: Video games are very healthy cause I don't really play...for long.
	Chase, C7, age 7: I think [TV or tablet use] is healthy for my creativity, because I...watch Minecraft videos...that gives me inspiration for Lego...I don't think it's healthy for my brain after...2 hours. I don't like watching it over 2 hours, because that's when... I have a big headache... for 10 hours. Yeah, it really makes me happy.
	Lindsey, C11, age 9: Learning [online] is so healthy, [but] doing it for too long is not.
	Interviewer: Does it feel like playing the games on Lego is healthy for you? Ace, C32: In some ways. There's this one that I really like to play...it's called Bloom Busters, and you drive a car around and you go to people and you...cheer them up. It ...teaches you how to be nice. [The game] makes me happy. I don't really [play a lot], maybe...20 minutes a day...after school.
Time limits can reduce the negative impacts of sedentary screen time on their physical health	Camilla, C13, age 11: I see...a little blurry, so I just rub my eyes, and then it just comes back clear...I go on the phone mostly...at 10pm, and then I stay on to...2am.
	Lindsey, C11, age 9: ...if I put my eyes away from the screen and I suddenly feel very tired, and that's usually when I know I have been playing games for way too long.
	Vivica, P15, parent: [Gaming] has stopped by noon so for summer break. It's always been 9 to noon... if we did not put limits on it, he would stay on it from sun up until sundown. He would not get off and that's why we have to have limits. He's done this before, where he would just be really grumpy, only to realize he wasn't getting off to even like to eat or drink."
	Gabe, C26, age 7: I just sit on the couch and play games...as long as my hands aren't tired my eyes are still gonna be pumped up...looking at the screen just makes me...[gestures wide big eyes]... and then they just get bigger and bigger and bigger.
	Mia, C18, age 12: Maybe gaming too much [is unhealthy] when I'm....on the computer talking to my friends all day, and I realize it's 3 o'clock and I'm like 'Why am I so hungry?'
	Brooke, C9, age 11: I do sometimes get stiff after sitting in the chair [playing video games] for a while.

Notably, however, all screen time except such movement-based activities were sedentary. From children's perspectives, *time limits can reduce the negative impacts of sedentary screen time on their physical health.* Many children acknowledged their aforementioned physical limitations, and felt that screen time can negatively impact their physical health when they go on for "too long." Parents also shared concerns about the impact of extended exposure on their child's physical health. However, different from children, parents were also concerned about their child's self-regulation around screen time, like knowing when it was time to stop and being too distracted to tend to their bodily needs, such as when deferring eating or going to the bathroom or staying up "all night."

Limits were also central to children's perspective that screen time could be healthy when they used the intellectually, socially, or physically beneficial technologies mentioned above. Most children who said that screen time was healthy argued that this was possible because

time limits can reduce the negative impacts of sedentary screen time on their physical health. They believed this was the case regardless of what they used the technology for.

3.4.2.3 Screen time can produce both intentionally positive and unintentionally negative emotions

Study children utilized screen time to help manage their emotions. They actively chose to engage digital content that would help increase positive emotions, as screen time often brought them joy and happiness. They noted that these activities provide outlets for *relaxation and coping* and opportunities for *socializing with peers* (see Table 3.6). Children also deliberately used screen time to help cope with negative emotions, like loneliness, overstimulation, and frustration. In these cases, watching videos or playing games—whether alone or with peers— was a way of relaxing. Similarly, digital journaling and listening to music were not only relaxing but also offered a chance for self-reflection.

However, children's screen time could evoke negative emotions for them. For instance, attempts at emotion management could backfire with *distressing experiences online*, when content and interactions with others online produce unanticipated emotional consequences. One example of these consequences was the frustration, anger, and sadness that children felt when playing competitive video games with winners and losers. Parents shared concerns about the impact of distressing online experiences on their children's emotional lives, such as reactions to negative in-game outcomes. Additionally, children could become frightened or shocked by inappropriate content encountered during their online activities.

Children also described digital methods of managing their negative emotions that actually produced negative emotions in other children. For example, children described "griefing" in online multiplayer games, which involves players intentionally damaging others' virtual creations—for example, in the games Minecraft or Roblox. One child in the study used griefing as a strategy for *venting frustration and anger*, and another child did it unintentionally. However, other children expressed significant distress when they shared experiences of their virtual creations being destroyed by griefers. One child participant's brother committed the griefing towards her, yet most others did not know the griefers who damaged their virtual creations.

3.4.2.4 Joint media engagement strengthens relationships, but fighting over them does not

Children frequently engage in screen time with family members. For example, 22 and 21 children reported using either a computer or tablet with their family members, respectively,

Table 3.6: Screen time can produce both intentionally positive and unintentionally negative emotions.

Screen time produces positive emotional experiences	***Relaxation and Coping:*** Alice, C25, age 12: [Using apps] is not healthy but it's fun. It helps me relax. I have a game, called Feelsy... It has... a bunch of different ... songs on and sleep casts... that I can listen to to help me sleep ... it helps calm you down. It has calming music. There's....a journal. You can tell how you're feeling. Camilla, C13, age 11: Sometimes, if i'm doing like an all nighter, I just stay on [Google Meets] with [my friends] because I don't wanna be alone, cause I get this weird vision that Michael Jackson is in my room and he scares me... My mental health feels healthy because then I know that... when I'm all alone, and I don't have nothing to do... I feel like I have something to do. Leah, P27, parent: The wind down activity is usually TV. But it's using something sort of quiet.
	Socializing with Peers: Interviewer: does it feel like playing roblox or watching Youtube videos is healthy for you? Joy, C22, age 12: Yeah... [be]cause I get to talk to my friends [on Roblox] that I don't see because they don't live around me.
Screen time can evoke or intensify negative emotions	***Distressing interactions online:*** Interviewer: How do they make you feel when you're playing [Minecraft]? Lance, C12, age 11: Happy? Susan, P12, parent: Always happy? Lance: Sometimes I can get mad. Sometimes I break [virtual] stuff. Susan: I've heard you get really frustrated when others are... somehow sabotaging your stuff.
	Venting Frustration and Anger: Alex, C33, age 9: Some [Minecraft] worlds are educational and you can learn how to build stuff and that can make you happy. You can build if you're angry or mad. You can destroy whatever you want. You can burn down villages [laughs]. You can spawn a pet if you don't have a pet in your life and act like it's a real pet. You can make it educational. You could buy a classroom and then you can do classroom stuff in it, but that would be hard. Kendall, P33, parent: You were saying that sometimes when you are frustrated, you like to destroy things. Alex: A lot. Kendall: Does it make you feel better? Alex: Yes.

most of whom did so at least weekly. Additionally, 15 children reported playing video games with family members, and 11 reported playing at least once a week.

Some children thought that *joint use of digital technologies* strengthened family relationships (see Table 3.7). Indeed, children and parents reported both in-person and online interactions to keep in touch with family members with whom they did not live. A few study children played with cousins in online video games, and two children had regular video-calls with their grandparents in which they did activities together.

However, study children and parents reported that *sibling disputes over shared devices or content* was common. For example, some siblings argued before and during joint media

Table 3.7: Joint media engagement strengthens relationships, but fighting over technology use does not.

Joint use of digital technologies	Carter, C20, age 10: I play [video games] with my brothers... You make a better relationship with them, and you're not like fighting with them, which still does happen a little bit but... I would say it's more fun to play with your brothers...
	Gabe, C26, age 7: [My mom] tries to play Mario Party, which I do really like to play... we both like to play Cuphead.
	Ashlyn, P17, parent: [My daughter] FaceTimes my mom 3 times a week, and then they play... little games, where they'll draw things and show it to each other, or my mom will read to her or she'll read to my mom... Amelia, C17, age 9: My family is far away. It's some way to see them.
Sibling disputes over devices or content	Zariea, P20, parent: ... with her younger brother, who's 7... Zelda [video game]... that game has just caused some issues where they're yelling at each other, because one person can't do something, and so the other person gets frustrated... because of that as an issue, they really migrated away from playing those types of games... Carter, C20, age 10: Mom would tell us to be quiet but it wasn't really because of that it was just because nobody could play with each other on [the Zelda] game. We still play it... a little bit, but not as much as we used to, because we know we can't play together so it's not fun.
	Alex, C33, age 9: One time [my brother]... set TNT in my [Roblox] house that took really, really long to build and killed my [virtual] cats.
	Michael, P2, parent: Do we have arguments over when you use the iPad? Anna, C2, age 7: Sometimes. Michael, P2, parent: Well you argue with your sister... about who gets the switch, who gets the ipad... there are never arguments on [content]...
	Ethan, C10, age 9: We'll sometimes take turns picking shows... usually one of us wants to watch our show, but the other kid wants to watch their show. Sometimes we'll try to take the remote from each other. Sometimes we'll just argue about it so like one of us just picks one and the other kids have to get along with it.... If we play two-player [games]... there's this one player that we both really like, and we'll want to be him. If we don't agree, our mom and dad will tell us to shut it off.
Parent-child conflict related to transitions away from screen time	Susan, P12: Yeah. Sometimes there's a challenge to transition at all from whatever it is... going to eat, going to bed.. but I think there's less of a challenge when it's to go outside and play something different.
	Interviewer: You said you know when it's time to stop when your mom tells you? Joy, C22, age 12: Yeah, but it takes me like three tries to get off it [laughter]... Because I don't wanna get off it and then my mom [yells] 'Go outside!'... [I'm] mad and then I'm happy when I go outside because I actually get to see my friends for once in a lifetime.
	Zariea, P20, parent: Usually... they're saying, 'Okay, just a minute just another minute!'.... if they know we have somewhere to go or they know we're eating dinner... right when the timer goes off they're good about stopping... they... string it out longer if we don't have anything to do or anywhere to go afterwards. They push the limit sometimes. Carter, C20: Usually, it's me who is like, 'Okay, I'm gonna turn it off'. And then sometimes mom and dad have to turn off the TV. Zariea: Yeah, we'll say, 'Alexa [voice assistant], turn off the TV!'

engagement. They did this when collectively choosing which games they played or videos they watched, or which device each child could use. In some cases, one child got frustrated over a sibling's skill level when playing video games.

Conflict also occurred between children and parents. Indeed, most parents in the study (n=27, 82%) reported that they have disputes with their children about their screen time, and 19 (58%) of them reported conflicts at least weekly. Video-game-related disputes were quite common: 17 (52%) parents reported having conflict with their child at least weekly over video game use. Children's arguments with parents primarily focused on managing disputes between their children who were siblings, and when asking children to *transitions away from screen time.*

Table 3.8: **Digital Rules or Time Limits on Children's Screen Time by Activity Type.** N/A means the child does not perform the activity.

Rules or Time Limits	**Screen-based Activity**							
	Video Games		TV or streaming		Browsing the Internet		Texting or Messaging	
Yes	29	88%	21	64%	13	40%	10	30%
No	2	6%	10	30%	8	24%	9	27%
N/A	2	6%	2	6%	12	36%	14	42%

3.4.3 How do children and parents navigate any health-related concerns about screen time?

3.4.3.1 Parents' Navigation Methods

To navigate their health-related concerns, parents used several restrictive or mediatory strategies, while a few intentionally trusted their child's judgment. Regarding restrictions, most study parents used restrictive mediation to control the content and/or duration of their child's online activity. Almost all parents in our study (n=32) set rules or time limits on their child's screen time, including limits on: streaming, video games, texting/messaging, and internet browsing (see Table 3.8). However, the restrictions varied in intensity from low to high. Low levels of restriction included trusting their child to follow family rules and expectations, such as avoiding inappropriate content and doing daily physical activity (see Table 3.9). Moderate levels of restriction included deleting certain apps or games. Other parents physically restricted usage by turning off devices, or by taking them away. High levels of restriction entailed using parent control settings or content blocks, or password-based restrictions. For example, a handful of parents reported "banning" content because of the disputes connected to the content or because of the negative emotional and behavioral results from that content.

To support their children's health away from screens, parents reported *setting goals*. These included getting enough screen breaks, physical activity, and outdoor time. To do this, parents encouraged the performance of health behaviors and supported self-regulation, especially in following healthcare provider's guidance. They did so by offering *reminders and warnings before transitions from screen time* and to perform healthy behaviors, like sleep, eating, or physical activity, and *supporting screen time that they believed positively influenced health* (e.g., journaling, connecting with friends). Parents also provided warnings to prepare their children for transitions from screen time and to help manage their children's emotional response to transitions.

Table 3.9: **Parents' Strategies for Navigating their Screen-Related Health Concerns**

Low levels of restriction: parents trust their child to follow family rules and expectations.	Crystal, P25, parent: I think sometimes she's pretty good at what she watches like... filtering... I don't think much comes up that's inappropriate for her but .. does it? on YouTube? Alice, C25, age 12: It shows up. Yeah, that's a reason you said I watch inappropriate stuff which I don't really. Sometimes it's like a short, and then it has... inappropriate music... I can't control it Crystal: I don't like that. April, P19, parent: [Screen time] is a part of the world, you need to know... what to do and how to be smart about it, but it's dangerous. There's terrible things on the Internet and unless I sit there and look all the time, which I don't have the interest, the skill... I need to be able to trust her but I don't really... some of it's not really her fault but I have tried several times to get help with parent controls... It was so hard to get in.
Moderate levels of restriction: passive monitoring, deleting certain apps or games, and physically restricting usage through turning off or taking devices away.	Passive Monitoring and Full Access Grant, P4, parent: Yeah, she's connected to my wife's iCloud... my wife can see and read everything that she's doing... We were not going to give her free... rein to... do whatever she wants... We don't keep a log of how long she's on. It's more like... a feel[ing]..like... she's kind of wasting the day here, it's time to get off....we try not to let her go over a certain time or....you've used it.... three days in a row... we're gonna take a couple days off here and do something else instead. Taking the device away Ashlyn, P17, parent: [It's challenging]... knowing when to turn [the Kindle] off at night, because having to remind her: it's pretty late let's turn that off now...]I don't mind her reading at night to fall asleep. But that's why we also have the restriction on the ipad... it... reminds them... t's time to start your bedtime routine. because when it's off it's off, and they're like okay I know it's time for bed now. [...] I keep all of the devices in my bedroom, all plugged in. So I have i'm the only one that has access to them

Table 3.9 continued from previous page

High levels of restriction: parental control settings, content blocks, or password-based restrictions.	Kayte, P16, parent: I control everybody with a Microsoft family account. You send me requests [for more time] and sometimes I answer them, and sometimes I don't... there's limits on the amount of time they can actually be on the computer... on Minecraft and on other things so like they might have two hours on the computer. But they can only be on Google Chrome for an hour so... They have to do something a little bit more productive like minecraft, because they're actually building something and thinking and processing. so I set limits that way. Taylor, P26, parent: Roblox is banned permanently...people are...spinning around endlessly and destroying things...I didn't like it as a parent, because it...is not the same as a game with a beginning and end. Gabe, C26: Roblox is a game where you make stuff. We have people come online. You friend people, and then they try to kill you... Taylor, P26, parent: Yes, he'd get frustrated...A lot of times he was getting killed in the game, and he's been frustrated...At least with CupHead or Animal Crossing...you play a level, and then you're done. There's a way to stop playing like I can say, 'When you're done with this level, please stop playing.' ...But, Roblox...it never ends...
Setting goals	Kayte, P16, parent: His pediatrician wanted him to try different [sports] [...] she's happy....that they're in soccer because that's getting them active... they're not just home all the time watching TV or sitting on their computers... I....try to keep us going. Zariea, P20, parent: My goal is... for all of our kids to stay active and get time outside every day... we really don't like our kids to just come home and be idle[...] A lot of kids in the neighborhood used to all play together after school... [but]more of them...are not playing outside... for a while, there was... a pushback like, 'Wait, Mom, so and so's playing inside video games after school, why can't I?'... but I think we've...instilled in them that's not what we do, especially on weekdays.

Table 3.9 continued from previous page

Reminders and Warnings before transitions from screen time	Crystal, P25, parent: I. . . .like when she gets outside. . . I try to encourage that. [Grandmother] tries to get Alice to come outside with her. . . taking a break from the phone or. . . doing something else. . . like drawing. Lance, C12: When I probably get too mad at something [it's time to stop playing]...probably [when I] lose Susan, P12, parent: Sometimes when we hear him getting really frustrated [playing video games], we make sure to get him moved on to something different. He doesn't always self regulate. . . So we're trying to let him, but it usually fails, and we. . . have to come and get him off. . . . Taylor, P26, parent: It's easier to transition the activity if I've already given him a warning in advance that we're doing something later. Then, I can give him a timeframe. I have a visual timer. . . .I f I. . . give him an outline of what's happening for the day, it's much easier to get him to get off the switch or the tablet or any of the devices actually. . . those are things that he abides by, whether he likes it or not because he already gotten that warning, but the other way around it seems like it's pulling the rug out from under his feet.

Table 3.9 continued from previous page

Supporting screen time that they believed positively influenced health	Tabitha, P13, parent: There's no kids in our neighborhood, and we moved from the area where our school is... her way of staying connected with her friends is...on the video chats...so I try to keep that for her, because I know friendships are health...I try to help her to maintain friendships and I think it's very important. April, P19, parent: Unfortunately, as much as I absolutely [hate] the technology thing. It is a way for her to connect with other kids. But that is...it, because it's not healthy. Crystal, P25, parent: ...she does [the relax app] for like 5 min before she goes to bed. So it's not like the activity itself is not very long. But any of those types of things...when she says...'I'm drawing' or something. I know that that's something that's relaxing for her and helps her clear her head. It helps her concentrate and so those are things that I don't really have a limit on...I can kind of recognize when she's doing something like that versus.... texting or or looking at YouTube.

3.4.3.2 Children's Navigation Methods

Children navigate their health-related screen time concerns by actively making decisions that they envision as healthy. Primarily, children accepted and followed the guidance of their parents, thus *adhering to established screen time limits* (see Table 3.10) to ensure healthy engagement that is not excessive or harmful. Children also described other intentional strategies of their own to navigate their health-related concerns. In response to physical discomfort such as aches or eye strain, children described *listening to their bodies*. Several children interpret these physical signs as cues to stop, take breaks, or change their current activity to mitigate discomfort. Some older children also incorporated movement into screen time to reduce negative physical effects. Hence, these children made decisions to stop playing games when they experienced discomfort. Additionally, study children described *deliberately engaging content that makes them happy* and *using screen time to build or sustain relationships* with friends or family members, such as those who live far away.

Table 3.10: **Children's Strategies for Navigating their Screen-related Concerns**

Adhering to established screen time limits	Abigail, C28, age 7: I use [screens] for 2 or 3, mostly 2 [hours...]. I like a few hours of screen time. I like a lot of hours on screens, but I don't wanna get unhealthy. Vivica, P15, parent: [My son is] agreeable to [the video game limit], because he knows that he does [emotionally] better when he's got a limitation of time.
Listening to their bodies	Camilla, C13, age 11: I don't play video games so much. . . sometimes I just know that I need to...stand up, take a step of water, stretch. . . [I started reading recently] because I just wanted to do it for my mind, because. . . sometimes I would get these little headaches. So when I have a headache, I would just read a book. I don't want to go on my electronics if I have a headache, cause I was gonna hurt it even more. Interviewer: How do you know when it's time to stop playing video games or watching a movie? Alex, C33, age 9: When my eyes hurt. . . or when I get tired.
Deliberately engaging content that makes them happy	Haley, C4, age 8: I really love to draw. . . There's a YouTube channel called Art for kids Hub, and. . . I love that channel. . . that's one of the things that makes me feel happy and relaxed. Erin, C23, age 11: I have this game called Unblock Me, where you. . . solve these little puzzles. It's. . . relaxing. . . little blocks and there's like so many different themes. It's relaxing . . . There's this mode called Relax Mode, where there's no timer it just lets you take your time. . . there is this Roblox game that helps me relax a bit. . . it's for people who have like slight anxiety issues like me . . . they use that game to help them like online therapy. Alex, C33, age 9: I like movies. They are usually calm after you do school since I just lay down and relax.
Using technology to build or sustain relationships	Lance, C12, age 11: I use FaceTime on my iPad every so often Susan, P12, parent: Sometimes his little cousin will try to get him to play [Roblox], so he'll try to email or text him. . . usually you would be on FaceTime together. And then you would be playing [Roblox]. Lance, C12: Sometimes when he calls me. Camilla, C13, age 11: I use my phone to call people to see how they're doing. . . all my grandparents or my great aunt, because I really love my great aunt. She's like my third grandma. . .

3.5 Discussion

We conducted interviews with 33 children and their parents to understand their perspectives on screen time's impact on children's health. Findings revealed that children hold nuanced views of screen time's impact on their health, acknowledging both positive and negative effects (RQ1). Their mixed views were encapsulated by the following themes: *even beneficial screen time needs limits to avoid physical discomfort, screen time can produce both intentionally positive and unintentionally negative emotions,* and *joint media engagement strengthens relationships, but fighting over it does not.* Parents and children largely agreed upon the upsides and downsides of screen time for children's health. Parents addressed these concerns using restrictive and mediational approaches, and by actively encouraging healthy behaviors and transitions away from screen time (RQ2). Children also navigated these concerns by *adhering to established screen time limits*, *listening to their bodies*, *deliberately engaging content that makes them happy*, and *using screen time to build or sustain relationships.*

Study children identified screen time as beneficial to their social, emotional, and intellectual health. In particular, they used screen time to practice kindness, strengthen relationships, exercise their creativity, and learn new languages and skills. While much research has demonstrated the negative impacts of screen time [46, 224, 265], less evidence suggests potential health benefits for children [57, 226]. Past work has been especially silent concerning children's perspectives–a gap that this research fills. This fresh perspective revealed novel findings regarding children's intentional use of screen time to manage their mood, enhance calm, and alleviate distress. This resonates with and extends previous research showing that "fun" screen time can elicit positive mood changes in both children [183] and adolescents [64]. Our findings add the perspective of youth in middle childhood (ages 7-12) to the growing body of literature that identifies adolescent's utilization of screen time as a self-care strategy for navigating and regulating emotions such as boredom or anxiety [90, 220, 254].

Echoing children's perspectives, several parents in our study encouraged their children to participate in screen time that was beneficial for their health. Some work has identified the parental perspective that all screen time is not created equal [226, 49], but this is an under-researched perspective in need of additional attention. Thus, additional study in larger samples is an important future research direction to understand how adults and pediatricians can encourage healthy engagement with screen time.

Children in our study also acknowledged negative impacts of their screen time on their bodies and emotions. Physically, children mentioned concerns about the sedentary nature of screen time, and the potential for eye strain. Our work builds on the literature by including children's perspectives, as earlier findings that primarily captured parental observations in

terms of the impacts of sedentary behavior [145] and the prevalence of eye strain [178]. Emotionally, children described how their screen time can unintentionally trigger negative feelings, as online interactions and exposure to distressing content can lead to frustration, anger, or fear. One such online interaction was griefing, by which griefers cause harm to other players' online creations. For example, several children encountered griefing in online video games that negatively impacted their emotional health. Whether it is healthy or not, one study child reported deliberately griefing to manage her anger and frustration, and likely caused distress for other players. Similarly, previous research has described how children use video games for mood management [79].

Griefing is a potential area for intervention. Children may 'grief' others to manage their emotions online, spaces that are free from 'real-life' consequences. For instance, a child may destroy the online creations of peers online, in an environment without a justice system, to manage their anger instead of causing harm in real life, as a healthier coping mechanism. However, findings suggest that griefing does have a negative impact on other children. Yet, parents may not be aware of their children's griefing or able to intervene. For example, one study parent was unaware of the extent of her child's griefing online. This suggests that improved game moderation could reduce or intervene in this behavior. SDT [60, 212] could inform strategies and interventions to address griefing. For example, timely interventions could respond to griefers by suggesting they perform a prosocial behavior or reminding them of community guidelines, both of which could appeal to children's needs for competence and relatedness. Alternatively, describing how griefing behaviors can negatively impact peers could appeal to their relatedness. Offering children resources or suggesting healthy off-screen breaks could help children who perform such behaviors manage their emotions.

While past work has identified the occurrence of griefing amongst adults [91] and children [131, 234], to the best of our knowledge, our research is the first to identify how griefing impacts children's emotional health. Parents and pediatric practitioners should be aware of this type of behavior in online multiplayer video games and its negative impacts to provide alternative coping strategies for negative emotions and/or discourage aggressive online behaviors. Future research should investigate how children want technology design to better support their physical and emotional health, if at all.

Although previous research emphasizes parent-child conflict related to screen time, such as children resisting transitions away from screen time [120], we found little evidence of such conflict. Instead, parents and children agreed about the need for digital rules, limits, and content, and children's perspectives on "screen time" were similar to their parents. Study children felt they should be allowed screen time with limits. Thus, many study children adhered to parental screen time limits which may be especially possible in middle childhood

as children move toward independence and autonomy [72, 90]. Children's receptivity to limits suggests that families who typically do not make or enforce rules could consider implementing them and that pediatricians should advocate for such limit-making. Children's agreement also presents an opportunity for further studies to investigate collaborative strategies by which parents and children can establish mutually agreed-upon screen time guidelines. We hold that this proactive and cooperative approach, which can be promising with younger children ages 4-6 [116], merits investigation in middle childhood.

Rather than parental conflict, study findings revealed that screen time-related conflicts among sibling relationships were a concern. This suggests that introducing strategies such as pre-planning screen time with shared devices or developing tools for home use could help ease these family conflicts. Future research should investigate how family-based interventions can help reduce disputes between siblings.

3.5.1 Parent and Child Navigation Methods

Parents in our study addressed their health-related concerns using a variety of strategies, including goal setting, restrictive mediation, and various active interventions, including warnings, reminders, and encouragement of screen time beneficial for their health. These findings add to existing evidence of restrictive parental mediation strategies in children's screen time [53, 117]. We add to this literature on restriction mediation an understanding of more low-intervention parent approaches, which may fit the style of autonomy-supportive mediation [241]. These included parents setting health-related goals and digital rules and expectations for their child to follow, without strict limits or restrictions in place (e.g., content blocks). Existing research [120, 117] emphasized parent's use of warnings and episode boundaries for transitions, and how limits enforced by technology can be more effective than limits enforced by parents. However, the most popular gaming and streaming platforms typically do not incorporate such restrictions without a parent setting them up. Thus, opportunities remain for future exploration to reduce the burden on parents. To navigate their health-related concerns, study children described adhering to established screen time limits, listening to their bodies, and deliberately engaging content that makes them feel happy. These findings amongst children 7-12 complement existing literature on teenagers' strategies for gaining control over their digital lives by muting or unfollowing certain accounts on social media, turning off notifications, or putting their phone in a different room while they sleep or study [250]. Children's mindful approach to managing their screen time demonstrated their agency, which could be a resource that informs advice that pediatricians may provide and interventions on child health.

3.5.2 Limitations

The study had some limitations. The generalizability of findings may be limited due our sample's demographics. However, the sample was large and diverse for a qualitative study, representing variation in child race, and family socioeconomic status and structure. The recruitment methods might have introduced self-selection bias, potentially excluding families in which parents are not monitoring child technology use or have extreme disagreement regarding technology use. Future population surveys in which screen time is not the sole focus might help to determine how widespread the perspectives represented here are. Additionally, this study was designed to include both parents and children to prompt detailed responses and witness parent-child dialogue first-hand. However, this design choice could have affected the freedom with which some children shared their opinions. Despite this, we did witness disagreements or points of tension between parents and children during the interviews, especially among older children and their parents. Future research could seek children's insights on technology use without adult involvement.

3.6 Conclusion

This study sheds light on children's nuanced views of the impact of screen time on their health, revealing that they are active participants in their screen time. Study children (ages 7-12) actively engage content that benefits their social, intellectual, and emotional health while managing negative impacts by adhering to established limits and listening to their bodies. Parents also recognize the positive and negative impacts of screen time on their child's health, and balance their restrictive mediation strategies with their encouragement of beneficial screen time.

The alignment of children's and parents' perspectives and strategies concerning screen time, coupled with the children's demonstrated capability to actively manage their screen time, indicates promise for the development of collaborative screen time guidelines that respect and integrate children's agency. These insights inform pediatricians, parents, and designers in creating guidelines and digital products that respect children's perspectives and promote their health. Such collaborative guidelines should recognize the multifaceted impact of screen time, moving beyond the oversimplified narrative of its inherent detriment to child health. This research also prompts further investigation with families into desired modifications to technology design to promote beneficial screen time and positive sibling interactions. These findings underscore the need to consider and value the perspectives of users, no matter their age.

CHAPTER 4

"*I don't want to watch grown-up stuff*": Children's and Parents' Perspectives and Recommendations for Health-Centered Digital Media Design

4.1 Abstract

Screen time is ubiquitous in children's everyday lives and has positive and negative impacts on their health. Increasing attention has been drawn to manipulative design children face digital media platforms, and calls have been made to make design more developmentally appropriate. Yet, children's and parents' perspectives have not been obtained. This research uses design workshops with children and focus groups with their parents to elicit perspectives on how digital media should be more health-centered, if at all. Participants shared various concerns about manipulative design inhibiting children's screen time limits and transitions away, and presenting inappropriate content. Children and parents made various design recommendations for health-centered digital media to become more age-appropriate and less manipulative. Children's designs included various nudges to help limit the negative impacts of screen time and prompt positive behaviors. Children's and parents suggested the need for improved content information and controls to help them make choices about age-appropriate content and screen time. The alignment in child and parent perspectives suggests that digital design should prioritize age-appropriateness and children's health to align with children's needs.

4.2 Introduction

Screen time is an integral part of children's daily lives. Screen-based digital technologies significantly influence children's socialization, learning, play, and entertainment ([57, 194, 239]. Engagement with video-based content is particularly common: 90% of United States US children watch TV or online videos daily, and 60% play video games daily [207]. Children's digital screen time is also increasing, rising to over 5.5 hours per day in 2021 [207].

Alongside positive digital engagement–such as for learning–problematic use is also increasing. Accordingly, digital media has both positive and negative impacts on children's health [133, 265]. These implications depend on the content, frequency, and type of interactions children have with technology and with whom they engage while using the technology [154]. While positive impacts often come from educational or social interactions [133, 265], negative consequences can emerge from conflictual interactions and bullying online [35, 174], developmentally inappropriate sexual or violent content [54, 197, 199], and increased sedentary behavior and eye strain [132, 145, 178]. Negative emotional impacts can also result from conflict between siblings related to content choices and sharing [Chapter 3] and between children and their parent(s) amidst necessary transitions away from screens [92, 120]

Parents use various strategies to mitigate screen time's potential negative health and emotional impacts. Parents' primary concern for their children's health lies in the adverse effect (s) of over-use [205, 265] and the potential for exposure to inappropriate content [41, 155]. To address these concerns, parents may employ parental controls that block certain apps or content types, turn off features within specific platforms, or limit the amount of time children can spend on particular apps, necessitating a request to parents for additional screen time [53, 154, 241]. Parents often use limits on screen time to break children's prolonged engagement with screens [49]. Tools like timers, schedules, and verbal cues are used to aid in limit enforcement [49, 120]. Rules are also employed in families to informally restrict children's behaviors to avoid inappropriate contact or incidents of online bullying [174, 35]; these often include chat functions, online gaming with strangers, or social media platforms. Parents may also try to maximize the positive aspects of screen time for their children, such as by allowing limited time for entertainment but more flexible use for educational content [117, 35, 153]. Parents are responsible for this careful balancing act and for addressing health concerns associated with screen time.

Many argue that existing digital media design is largely inappropriate for children and needs reform [106, 198, 57]. In particular, researchers and parents express concerns about the age-appropriateness of content and manipulative features known as "dark design patterns." While age-appropriate design refers to digital media that aligns with children's developmental

needs and capacities [106], manipulative designs are design elements that compel continued engagement [198]. These elements include recommender algorithms, autoplay features, and infinite gameplay. Manipulative design challenge children's developing self-regulation abilities by incentivizing them to remain passively engrossed in content, potentially fostering addictive behaviors [65, 89].

Manipulative design patterns place a significant burden on parents to navigate and modify device settings to safeguard their children's digital activities [198]. In addition to the potential negative impacts of the digital activities themselves, there can be secondary adverse effects like familial conflict [57, 117, 120], further suggesting the need for reform of design to mitigate potential harm.

Multiple stakeholders, including researchers [198, 106], advocacy organizations [207], and US and United Kingdom (UK) lawmakers [252, 125], have called on companies to redesign digital media platforms to address the concerns above. Prior work suggests that positive design changes could include break or bedtime suggestions and the removal of autoplay [57, 106, 198]. An essential element of these proposed solutions is that they should decrease the negative health impacts of screen time and reduce burdens upon parents to manage their children's digital experiences while mediating conflicts between siblings (see Chapter 3, section 3.4.2.4). Yet, the perspectives of children and parents regarding design alternatives to manipulative design in digital media have yet to be considered.

To improve interventions to support healthy digital media use in children, we must understand parents' perspectives because they typically purchase devices brought into the home and, often, arrange permissions or controls [35, 117]. Notably, parents may not fully understand their children's experiences or concerns. Thus, it is essential to gain both child and parent perspectives and interests in changes to the design of children's digital media.

Using multiple qualitative methods, we conducted design workshops with 16 children and focus groups with their parents to gather such perspectives. The following research questions guided data collection:

1. What are children's and parents' perceptions of manipulative design patterns in digital media?

2. Do children and parents want digital media design to change to support children's health? If so, how?

    (a) From children's and parents' perspectives, how can interventions effectively incorporate age-appropriate nudges to promote healthy screen time amongst children?

Findings revealed that children and parents agree that manipulative design patterns in children's digital media challenge their adherence to healthy limits and inadvertently expose

children to age-inappropriate content. Children and parents highlighted the potential role of digital nudges —subtle design elements encouraging specific choices—as a path to health-centered digital media design that can support children's autonomy and reduce their exposure to inappropriate content. Children intuitively designed nudge-based controls and blocking features that aim to decrease the negative health impacts of screen time. Parents supported the idea of nudge-based design and articulated a need for more streamlined parental controls to reduce the burden of managing their children's screen time. Our findings have important implications for future research, the design of technology for children, and the approaches taken by families to managing screen time, as there is more agreement than meets the eye. This contribution will help guide the design of health-centered digital media for children.

4.3 Related Work

4.3.1 Design Patterns in Children's Digital Media

4.3.1.1 Age-Appropriate Design

Researchers have described "ideal" age-appropriate digital media activities as self-directed and community-supported experiences [57, 198]. Digital activities can be designed as self-directed if children have opportunities to self-pace, maintain control, and exercise digital autonomy through self-regulation [57, 198]. Community support can come from parents, household members, or other caring adults [57].

One way that children have demonstrated an interest in digital autonomy support through design is through filters and nudges in digital media to protect their privacy [255]. However, children's and parents' perspectives regarding manipulative design patterns and how digital media design could protect their health have not been elicited.

4.3.1.2 Manipulative Design Patterns in Children's Digital Media

Although findings regarding the impacts of digital media use on children's health are equivocal [265], the growing prevalence of "manipulative design patterns" in technology design may be tipping children's interactions with technology towards the unhealthy. Research indicates that children frequently use general audience apps containing manipulative design patterns, which extend usage [198, 89]. Features like infinite scroll, autoplay on streaming sites and social media, and limitless gameplay in video games can excessively captivate and hold children's attention [45, 133]. In addition to autoplay and infinite scroll, for-profit mobile apps show advertisements, encourage in-app purchases, recommend additional apps or games, and

pressure children to prolong engagement [198]. In contrast, children use e-books, PBS KIDS apps, educational apps, and early childhood games less frequently, with fewer manipulative design patterns than general audience apps [198]. For example, in a recent evaluation [198], apps made by PBS KIDS, a nonprofit organization, only had one manipulative design feature: autoplay.

Manipulative design patterns require users to *actively* decide to stop, which can be difficult for anyone, especially children whose self-regulation and emotional regulation skills are developing. Such manipulative design patterns encourage unhealthy and excessive digital media consumption and can foster *addictive* behaviors in children [65]. Manipulative design can undermine children's ability to make decisions independently [57], at a time when self-regulation abilities are developing [38, 60, 212]. Thus, manipulative design can make it more difficult for children to easily transition from screen time, necessitating parental involvement or conflict [57, 120].

Manipulative design patterns can also negatively impact parents. Since manipulative design patterns are the default setting in many platforms and video games [198], a great deal of responsibility to mediate children's screen time is on parents. Parental intervention involves screen time and the interpersonal family dynamics around use, sharing among siblings, and transitions. Parents must learn the potentially negative impacts and how to moderate them to mediate screen time. To mediate, parents need to change the settings of each device, website, or app their child regularly uses, which can be incredibly taxing. Additionally, parents may have to mediate interpersonal conflict and potentially challenging transitions related to screen time.

In light of these negative impacts on children, many stakeholders have argued for the need to replace manipulative design patterns, which prioritize engagement over child autonomy and well-being [57], with design choices that give children decision-making autonomy about their screen time [247].

4.3.2 Interventions in Children's Screen Time

Existing interventions in children's screen time are primarily parent-led. Active parental mediation involves collaboration and interaction between parents and children regarding media consumption, while restrictive mediation involves setting limits and restrictions, often using parental controls or informal rules [40, 153, 117]. Other proposed interventions involving children's input have rarely been created commercially or backed by behavioral science theory.

4.3.2.1 Commercially Available Interventions in Children's Screen Time

Mobile apps are an increasingly popular commercially available digital intervention that allows parents to control the content, frequency, and quantity of children's screen time. However, most parental control or screen time apps do not engage children, request input, or support co-use [248]. Very few commercial tools involve children in intervention. One review indicated that most (54% of 58) apps reviewed offer no opportunity for children to negotiate screen time limits or content filters with their parents [248]. Another large study of teen's views of parent control apps found them to be "overly restrictive" and "invasive," and negatively impacted their relationship with their parents [98].

Despite this, children ages 8-12 typically have the developmental capacity to be involved in tracking and planning their behaviors [219, 248, 118], such as setting time limits for individual activities with the help of restrictive digital interventions [116, 118, 257, 10]. Accordingly, a small set of commercially available apps (e.g., Jiminy, Kaspersky Safe Kids, and Screentime Labs) allow children to provide input by providing structure for discussions of screen time. Wang and colleagues [248] found that children felt more respected with the use of such parenting apps, and parents perceived the apps as supportive of, instead of enacting parenting. Yet, it remains unclear how digital media design can better meet children's and parents' needs for control.

4.3.2.2 Proposed Screen Time Interventions Involving Children

Several screen time mediation interventions have been proposed to involve children directly. Mediation systems like Romi [257], Watch with Joy [10], Play and Plan [116], and Coco's Video's [118] are designed to integrate with children's screen time, encouraging balance and smoother transitions between screen time and other activities. These tools prioritize a supportive environment for children to participate in screen time management rather than strict parent-led controls [98]. The incorporation of children into mediation by setting timers for screen time [257], planning screen[116] and post-screen activities [10], and setting filters and controls [113] are approaches that can be more beneficial and autonomy supportive in the long term than restrictive mediation alone. However, the designs incorporated into these systems largely lack theoretical grounding in behavioral science. This grounding is essential because health-related digital interventions based on theory tend to be more effective [263].

4.3.3 Theoretical Framework: Nudges

Nudges are aspects of choice architecture that encourage or make it more likely that individuals will make a particular decision [235]. Nudges are based on understanding human

decision-making and status quo bias in behavioral economics [235, 208]. Indeed, individuals often choose the default option or the path of least resistance rather than taking the time to consider alternatives other than the default, even if this is against our best interests [235, 208]. Nudges are commonly used to alter users' decisions predictably [112] towards more desirable or beneficial options without taking away the freedom of choice [147, 235]. Nudges can be used for good to make it easier for people to act in their self-acknowledged best interests, often in situations where there is a significant discrepancy between what people say they want and what they do. However, nudges can also negatively affect users when design does not suit one's best interest.

In technology design, nudging involves altering information displayed, providing new information, or highlighting risks [235, 42]. Caraban et al. [42] conducted a systematic review of the use of nudging in HCI design and categorized nudging mechanisms into six categories, including *facilitate, confront, deceive, social influence, fear*, and *reinforce*. Nudges can *facilitate* decision-making by reducing the physical or cognitive resources an individual needs to use to make an optimal decision with features such as defaults, opt-in policies, or suggesting alternatives [42]. Nudges that *confront* a user and encourage reflective decision-making include those that throttle mindless activity, remind people of consequences, create friction, and provide multiple viewpoints [42]. Nudges can *reinforce* decision-making by increasing the presence of the decision in the individual's mind through the provision of information [42, 247]. Less relevant to our context, yet notable, are nudges that *deceive*, provide *social influence*, or elicit *fear* to motivate behaviors [42].

Within each of these categories of nudges outlined by Caraban and colleagues [42], specific design mechanisms can be used that may support children's autonomy and self-regulation concerning their digital behaviors [247]. In particular, positive nudges can encourage healthier digital media consumption [247, 118, 116, 57, 106]. Wang and colleagues classified nudging as one of five types of design mechanisms that support children's autonomy. Various types of nudges include default options (i.e., a *facilitate* nudge [42]), creating friction (i.e., a *confront* nudge [42]), fear alert (i.e., a *fear* nudge [42]), and social feedback (i.e., a *social influence* nudge [42]). Wang and colleagues [247] also described how scaffolding can support child decision-making, similar to the function of reinforce nudges [42] through the provision of external information inputs. For example, just-in-time prompts or weekly screen time reports could help children make decisions [247].

Confirming the importance of nudges in this space, major technology companies like Meta and Google already use facilitate and confront nudges to protect teenager's privacy and well-being. Meta has introduced features that prevent adults from messaging teens who don't follow them, enhancing privacy protection for teenagers [126]. Platforms have also

revised their confront nudges to be more beneficial for teenager's health (ages 13-17), such as reminders to take breaks from watching YouTube videos [259]. Notably, these changes do not affect users under age 13 who may inaccurately report their age.

Although several proposed interventions with nudge-based designs have been deployed with children, and some have posited that such nudges may support child autonomy [247], the designs of nudges present a unique opportunity to intervene in children's screen time that has been underexplored with families directly. Children's opinions on nudge design have not been elicited, yet this may help develop concrete recommendations grounded in their perspectives and nudge theory. Thus, this research aims to understand how to design age-appropriate nudges from the perspectives of children ages 8-12 and their parents.

4.4 Methods

This study involved two qualitative methods, including three, 90-minute design workshops with children (ages 8-12) and simultaneous parent focus groups.

4.4.1 Recruitment

We recruited participants in three Midwestern cities. Communication channels used to recruit participants included: 1) a university participant recruitment website, 2) social media (i.e., Facebook groups), 3) virtual and paper flyers posted at family-focused organizations (e.g., libraries, churches, sports centers), and 4) emails to families who have previously shown interest or participated in our research studies and indicated an interest in participating in future research.

Interested parents were screened via Qualtrics survey. Eligible study participants met the following criteria: (1) parent or guardian at least 18 years old, (2) child ages 8 to 12 years old (as verified by month and year of birth), and (3) cohabiting. We employed a purposive sampling strategy [97] to ensure age diversity across child participants and gender/role type diversity across adult participants and to maximize variability in family perspectives.

4.4.2 Screening and Consent Procedures

Study candidates who were parents and responded to study recruitment communications were invited to fill out a 5-minute screening survey online to determine eligibility. The first author contacted select qualifying parents/grandparents using their preferred method of contact (i.e., email or text) to invite them to participate in the study. We then obtained parental consent via Qualtrics.

While parents and children enjoyed a meal provided in a group with all families before the start of the session, the first author provided a paper copy of the Child Assent form to read, reviewed it out loud, asked the child(ren) if they had any questions, and answered their questions. We asked each child to verbally indicate that they would like to participate. One female child declined to participate in the design workshop during the Assent process and was excluded from the sample, but her mother and sibling still participated. After obtaining each child's assent, parents moved into a separate room for the data collection. This separation helped obtain perspectives without the bias of the other.

4.4.3 Study Design

We simultaneously engaged children in 90-minute design workshops and their parents in a focus group. We organized three workshops in three cities of varying sizes and demographics to obtain a diverse set of perspectives.

4.4.3.1 Child Design Workshop

The first author was the lead facilitator for the children's sessions and has experience running design workshops with children. Two other research assistants helped facilitate small-group discussions and asked children questions as they participated in the workshop. Each facilitator was also required to complete a background check.

A workshop agenda (see Appendix C.1) was used to organize the child design workshop. It is described in Table 4.1. We focused the session on the digital media used daily by most children, according to the pre-submitted parent survey, including study child participants, which was video-based apps such as YouTube, streaming services, and video games. These were chosen as a focus because previous work has identified how these both create conflict in the families in our studies and are known for being age-inappropriate for children due to manipulative design patterns[198, 57].

The design activities were inspired by Cooperative Inquiry, a participatory research method developed by Allison Druin [70] for designing technology *for children, with children.* To encourage reflection in the design workshops, the guide had open-ended [55] questions for small-group discussions with children.

We used line judging [246], a cooperative inquiry method, to assess children's perspectives of nudge-based technologies. The lead facilitator began a line judging exercise to obtain children's opinions on nudge-based screen time interventions. We asked children to quickly indicate their opinions and express their thoughts on their choice. The process involved a demonstration by facilitators (i.e., people stand along a line of tape on the floor to show that

Table 4.1: **Child Design Workshop Agenda**

Design Activity	Goal	Description
1. Circle Time (warm-up)	Engaging children in an inclusive, balanced discussion to set the stage for the workshop on the design of video-based digital media as it relates to their health.	Facilitators initiated the workshop by sitting in a circle. Participants described their preferred screen time activities and how they impact their health. Then, the group split into two smaller circles based on their preferred digital media (streaming vs. video games) to discuss autoplay, recommended content, and endless gameplay. The facilitator used a set of prompts to stimulate children's conversation (see Appendix C.1).
2. Design Session (Paper Prototyping)	Allowing children to creatively think about how video-based digital media can be redesigned to support health.	Children were prompted to initially think out loud and ideate on how their preferred digital media can be designed differently to be helpful for their health. Then, children used simple paper supplies to prototype health-supportive changes to their preferred digital media.
3. Line Judging	Obtaining children's perspectives on potential designs changes to support health.	Facilitators conducted a Line Judging activity [246] with a practice round and then prompted children to express their opinions on the design of different nudges to confront screen time.
4. Show-and -Tell and Reflection (wrap-up)	Showcasing children's designs to their parents and gathering feedback on the designs and workshop experience.	Children presented their crafted designs to their parents. Meanwhile, both parents and children completed a reflection worksheet to capture insights on the designs and the overall workshop experience.

each side of a wall means one extreme of opinion), and a non-technical warm-up with the children before presenting the nudge-based interventions. For each intervention presented, we asked children why they voted the way they did.
Instructions for researchers:

- Create a 3-meter line on the floor in masking tape.
- Tape signs on the wall near the two ends and the middle of the wall to designate opinions (e.g., Like, Unsure, Dislike).
- Take photos or videos of the children to preserve the data.

4.4.3.2 Parent Focus Group

The parent focus group facilitator, a doctoral student trained in qualitative research, led all three parent focus groups using a semi-structured discussion guide (see Appendix C.2). This guide included nine open-ended questions [55] to elicit responses about participants' behavior, experiences, opinions/values, feelings, and knowledge [192]. Questions posed to parents explored what content their children engage, boundaries on child screen time, how it affects their health, and how they perceive manipulative design patterns. We also asked parents about how digital design could be modified to support children's health and what types of nudges parents would like their children to receive, if any. There was also a discussion on the potential impact of digital video content on children's health, autonomy, and the effectiveness of screen breaks and parental control features.

4.4.3.3 Parent Survey

Parent participants at that time were also provided with a link to the parent survey on Qualtrics where they provided consent to participate in the study. The parent survey (see Appendix C.3) includes demographic questions and questions about their child's screen time.

4.4.3.4 Field Notes

Following each session, each facilitator individually took field notes to reflect on their interactions from the session. Then, the facilitators discussed their initial takeaways in a small research team meeting.

4.4.4 Data Analysis

Data from this study include recorded audio and video from the line judging activity, photographs of the children's designs (i.e., low-fidelity paper prototypes and drawings), field notes, and demographic survey data. We used descriptive statistics to describe our sample.

We prepared the design session and focus group transcripts for analysis, and a research assistant facilitator verified the transcripts. The research assistant replayed the videos of the Line Judging activities to note children's opinions on potential nudges based on where they stood on the line.

4.4.4.1 Transcripts: Child Design Workshops and Parent Focus Groups

The first author analyzed transcripts inductively using an open coding approach [214] to identify and stay open to new codes. In a second round of analysis, the first author wrote analytical memos based on each code to develop themes, which were discussed in weekly team meetings to generate, review, define, and finalize insights from the data. These themes were then organized by research question, including perspectives and types of designs, including nudges. We grounded our organization of the design recommendations by type of nudge according to the theory [247, 42] and the health-related purpose of the nudge.

4.4.4.2 Designs: Children's Paper Prototypes

The first author (OKR) and a research assistant (JB) began analyzing the prototypes that children created by initially taking notes related to our research questions and generating initial codes [214]. Then, we developed a codebook to analyze the artifacts' content systematically. This analysis involved a binary identification of the design features children included in their artifacts, such as timers, buttons, switches, and alternate interface design.

Few inferences needed to be made. Thus, it was unnecessary to calculate IRR [169], and the research assistant coded independently. The first author later reviewed this analysis.

4.5 Results

We begin by presenting the characteristics of our participants (see Table 4.2). Then, in the findings presented below, we show that children's and parents' perspectives of manipulative design patterns (RQ1) aligned with three major themes. Children and parents believe that (1) video autoplay, infinite scroll, and endless video games extend children's screen time and inhibit transitions, which can contribute to negative emotions, and (2) recommended content can be age-inappropriate, and content descriptions can be misleading.

Three significant themes encompass participants' proposed health-centered design recommendations (RQ2): (1) incorporate nudges to help children limit, and transition from, screen time; (2) improve appropriateness of recommended content by revising content controls; and (3) incorporate nudges for health supports and incentivize health behaviors. For each theme, we highlight children's and parents' perspectives, as well as their concerns and hopes, with the help of quotes from the transcriptions and photos of the children's designs.

4.5.1 Characteristics of Participants

Participant demographics are displayed in Table 4.2. Family household size ranged from two to six people, with an average of four people. Most families had a monthly household income under $7,000. Four children have documented emotional or behavioral needs, including diagnoses of ADHD (n=3) or autism (n=2).

Regarding the video-based content children in our study engage in, almost all (n=15) children regularly watch YouTube videos. Twelve play video games and stream TV and movies, respectively.

4.5.2 Child and Parent Perspectives of Manipulative Design Patterns

4.5.2.1 Children and parents perceive video autoplay, infinite scroll, and endless video games as extending children's screen time and inhibiting transitions, which can contribute to negative emotions.

Children and parents described how the video games, social media, and streaming content children engage in seem continuous and unstoppable. For example, one child characterized

Table 4.2: Participant Demographics

	Children	**Parents**
Gender		
Male	6	4
Female	10	9
Race / Ethnicity		
White	9	8
Asian	3	3
Black or African American	2	1
Bi-racial	1	
American Indian or Alaska Native	1	1
Mexican, Mexican American, or Chicano/a	3	3
Age		
8 years	2	
9 years	3	
10 years	4	
11 years	4	
12 years	3	
Mean	10	43
Range	4	28
Standard Deviation	1.33	7.79
Family Structure		
Nuclear family		7
Single Parent Family		4
Stepfamily/blended		2
Gross Monthly Income		
$1,000- $3,999		4
$4,000- $6,999		3
$7,000- $10,999		3
Over $11,000		3

the infinite scroll found in social media as "*a never-ending roll*" (Jean, C6, Age 10). Similarly, a parent described how "*It's just going like topic, topic, topic. You can scroll, scroll, scroll*" (P7).

The manipulative design patterns that encourage continued engagement are *autoplay* (e.g., on streaming platforms like Netflix or YouTube), *infinite scroll* (e.g., on TikTok, YouTube Shorts, or Instagram), and *infinite games* (e.g., video games without an end, set rules, or a winner). Both children and parents described how these design elements contribute to extended screen time and retain children's attention.

> *I like* [autoplay]. *I can keep watching* [Netflix] *until I'm done with the whole series* (Izzy, C7, Age 11).
>
> *There's no hard stop* [on] *the video games... there's no end to it, and that's purposeful. I get it like they're trying to get you hooked. And I think things like* [a hard stop] *would help our kids* (P12).
>
> *My daughter... has ADHD. The hyperfocus... being sucked all the way in, and she can just do it for hours, which is problematic* (P5).

Several study children described becoming frustrated with autoplay on YouTube. For example, Emma described how being encouraged to "watch more" and that the recommendations are for unwanted content is *annoying*:

> *If I'm watching a video... they want me to watch more... I think it's annoying if... autoplay is giving you stuff you don't even want to watch* (Emma, C11, Age 11).

Both children and parents described how manipulative design patterns can make transitions difficult, contributing to negative emotions. One parent hypothesized that the endless amount of content makes disengaging from screen time difficult: *"kids have trouble transitioning because there's just so many options"* (P3).

Children such as Jean described how transitions from video games can be tricky since there is no ability to pause the game. Jean (C6, Age 10) drew Figure 4.1 to convey her frustration, yelling with her arms up that she had to stop the game to go to sports practice. Jean described how transitions can be frustrating, especially if she has to lose her progress.

Children described how the ability to pause or take breaks varies across games:

> Jean, Age 10: [S]*ometimes it depends which game it is... if it's Sonic... you can pause it... if it's Roblox... you need to complete it in a certain time, or you get kicked out...*

Figure 4.1: **Pauses make transitions easier for some children.** One study child conveyed two children playing video games, with one frustrated that she needed to stop playing to attend sports practice. The game design only allows her to stop the game, which would forfeit her progress.

> Peter, Age 9: *It's good when there's a pause button so it's easy and the time stops too.*
>
> Facilitator: *Do you all like having pauses in video games?*
>
> Child Participants: *Yes* [unanimous]
>
> Peter, Age 9: [Otherwise]... *You just have to quit the game. That's the only way... You can't pause* [Roblox].

Several parents with children with ADHD or autism described how these designs make transitions difficult, necessitating parental involvement. In particular, this occurs because they impact their child's underlying tendency towards hyperfocus.

My kid already has a problem with transitions, so if the game doesn't end, he's just gonna sit there and play it for 8 hours, or he would like to. He doesn't actually, because I'm not gonna sit in the library for 8 hours hunched over an iPad... My kid is really prone to hyperfocus. He is on the [autism] *spectrum... and has ADHD. When he does something, he does that* (P4).

My son is autistic... he becomes addicted to anything. If he likes something a lot, it's probably going to be hard to pull him away from it. So, I have to really monitor everything that he watches (P8).

4.5.2.2 Children and parents perceive recommended content to be age-inappropriate and content descriptions misleading.

Children and parents in our study encountered issues with inappropriate content across digital platforms, prompting them to call for changes to how content is suggested and presented to children.

Children are typically protected from inappropriate content when they engage with child-targeted versions of platforms, such as YouTube Kids or a child Netflix profile. However, all children in our study (ages 8-12) reported using digital media for general audiences, such as YouTube, instead of those targeted to children. Participants described child-friendly platforms as targeted to younger children, blocking the content that study children wanted to watch–even if it was age-appropriate. As P11 describes:

... my kids didn't like YouTube Kids... there's not a lot on there. A lot of stuff is blocked that doesn't really need to be blocked, and also we found stuff that should be blocked and wasn't (P11).

Children like Izzy (C7, Age 11), described YouTube Kids as "*kiddy. There is not anything that I'd like to watch on there. It's all Mickey Mouse and Nick.*" Mariah (C10, Age 10) agreed, sharing that she likes to watch *"cute cat videos"* which are unavailable on YouTube Kids.

Additionally, children are often exposed to inappropriate and unwanted content on mainstream digital media platforms via recommended videos via autoplay. Serena (C13, Age 12) reported that this happens frequently: "[U]*sually when I'm watching one of my shows on YouTube... inappropriate content... is all coming up on autoplay.*" When asked whether autoplay is a good design for kids, children thought it was inappropriate due to these unwanted recommendations. For example, Francisco (C12, Age 12) thought autoplay was not suitable for children because "*autoplay will sometimes bring you to really weird places.*"

Another way that children described experiencing inappropriate content was due to deceptive content descriptions, another form of manipulative design. Some children described choosing to engage suggested content from advertisements or based on viewing the game cover, with an incomplete understanding of what it was. Children in Session 2 described this phenomenon:

> Peter, C9, Age 9: *Sometimes they try to attract you, but they make the cover something different from the* [game]. *It attracts younger kids.*
> Mariah, C10, Age 10: *There's this Roblox game called 'Rainbow Friends'. I'm like 'Oh that sounds cute and catchy.' But, they're these rainbow colored monster thingies that hunt you down.*
> Arthur, C8, Age 12: *That* [information about scary content] should be in the bio.
> [...]
> Peter, C9, Age 9: *I want Roblox to change the trick that makes it seem appropriate with the covers when it's not.*

Children described how experiencing inappropriate content can contribute to negative emotions, including fear, discomfort, or unhappiness.

> [Inappropriate content] *changes your body and attitude sometimes... it makes your feelings hurt, or makes you more like the people in the video* (Peter, C9, Age 9).

Parents similarly argued that autoplay, the recommendation system, and parent controls are flawed:

> *Mediation systems on YouTube and other apps are not working as intended or wanted. Sometimes they... propose or suggest things that we think are not appropriate for kids. Even though they promise and we make a lot of different* [parent control] *selections... they suggest* [inappropriate] *things to kids when they are watching alone* (P9).
>
> *I would love for* [autoplay] *to go away... My son has a thing with excavators... he just likes to watch them dig. So you cannot see them on the kids YouTube. It has to be on the actual YouTube page, but then you have all this other content that comes right behind it that makes no sense. So definitely if that autoplay feature will go away, it will not be this other extra stuff that you wouldn't want them to watch* (P13).

4.5.3 Children's and Parents' Design Recommendations

Children and parents proposed various nudges and controls to assist in balancing screen time with children's health needs and foster more appropriate digital media experiences. Additionally, they recommended that these interventions be jointly influenced by parent control and child input. Their recommendations are summarized in Table 4.3.

Table 4.3: **Children's and Parents' Design Recommendations for Health-Centered Digital Media**.

Design Recommendations	**Purpose**	**Health Implications**	**Design Type**	**Types of Nudges Recommended**
Reduce Content	Limit Screen Time and Facilitate Transitions	Reduce the Negative Impacts	Nudge	Facilitate
Change Defaults			Nudge	Facilitate
Add Time-related Feedback			Nudge	Reinforce; Confront
Incorporate Pause Capabilities			Nudge	*Remove* Fear
Streamline Parental Control	Reduce exposure to inappropriate content		Control	
Improve Content Descriptions and Moderation			Moderation	
Incorporate Shared Content Controls			Control	
Add Physical Engagement Inputs	Prompt Positive Health Behaviors	Increase the Positive Impacts	Nudge	Facilitate
Incentivize Positive Health Behaviors			Nudge	Facilitate
Suggest Alternative Activities			Nudge	Facilitate; Confront

4.5.3.1 Incorporate nudges to reduce the negative health impacts of digital media use.

Limiting screen time and facilitating transitions. Children and parents shared similar wishes for design changes in this area. Without prompting, they proposed and described various nudge-based design changes. These included the following:

Reduce Content. Participants suggested that platforms should **reduce the amount of suggested video content visible** for children ages 8-12. Several parents, such as P3, opined that the amount of content presented to children on digital media platforms could be limited to reduce overstimulation and discourage continued engagement:

> *They're looking at an app, and it's... an endless list of options. There's always something else... something new they want to explore. So maybe there could just be fewer things on the screen* (P3).

Many children redesigned platforms to position content differently and reduce the amount of video content presented. For example, Francisco (C12, Age 12) redesigned Netflix to include fewer suggested videos and more text descriptions (Figure 4.2).

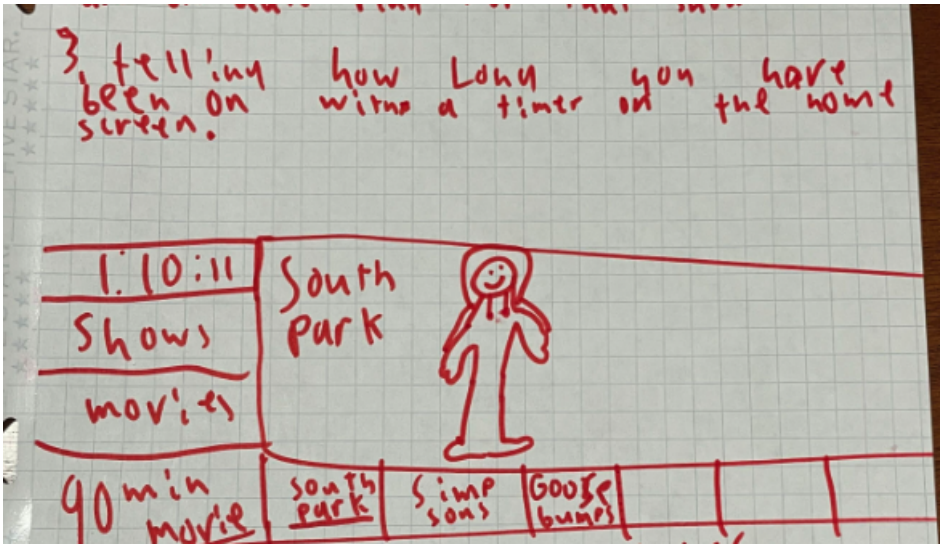


Figure 4.2: **Reduce Content**. Francisco (C12, Age 12) redesigned Netflix to include fewer suggested videos children see, which can extend screen time. His design also featured *time-related feedback* in the form of a running timer.

Change Defaults. Child participants also changed defaults to be more health-centered. Some children wanted revised default settings to help limit engagement. Many children, like Serena (C13, Age 12), set the default for autoplay to off or disabled the feature to help limit engagement (Figure 4.3, Image 1). Parents advocated for this change as well.

To reduce the impact of screen time on eye health, several children changed the default screen setting to dark mode or added a visible button to change to dark mode to the platform. For example, Amy (C2a, Age 12) suggested adding a "*nightlight button* to YouTube *so your eyes don't hurt.*" Amy's brother Dane (C2b, Age 9) created a *color inversion mode* for YouTube that would stay on once clicked to create a new default setting for dark mode(see Figure 4.4).

Add Time-related Feedback. The children's designs also included ambient **time-related feedback** (n=7) to encourage reflection on the amount of time they have used it for. For example, Francisco's redesign of Netflix included a running activity timer (see Figure 4.2.

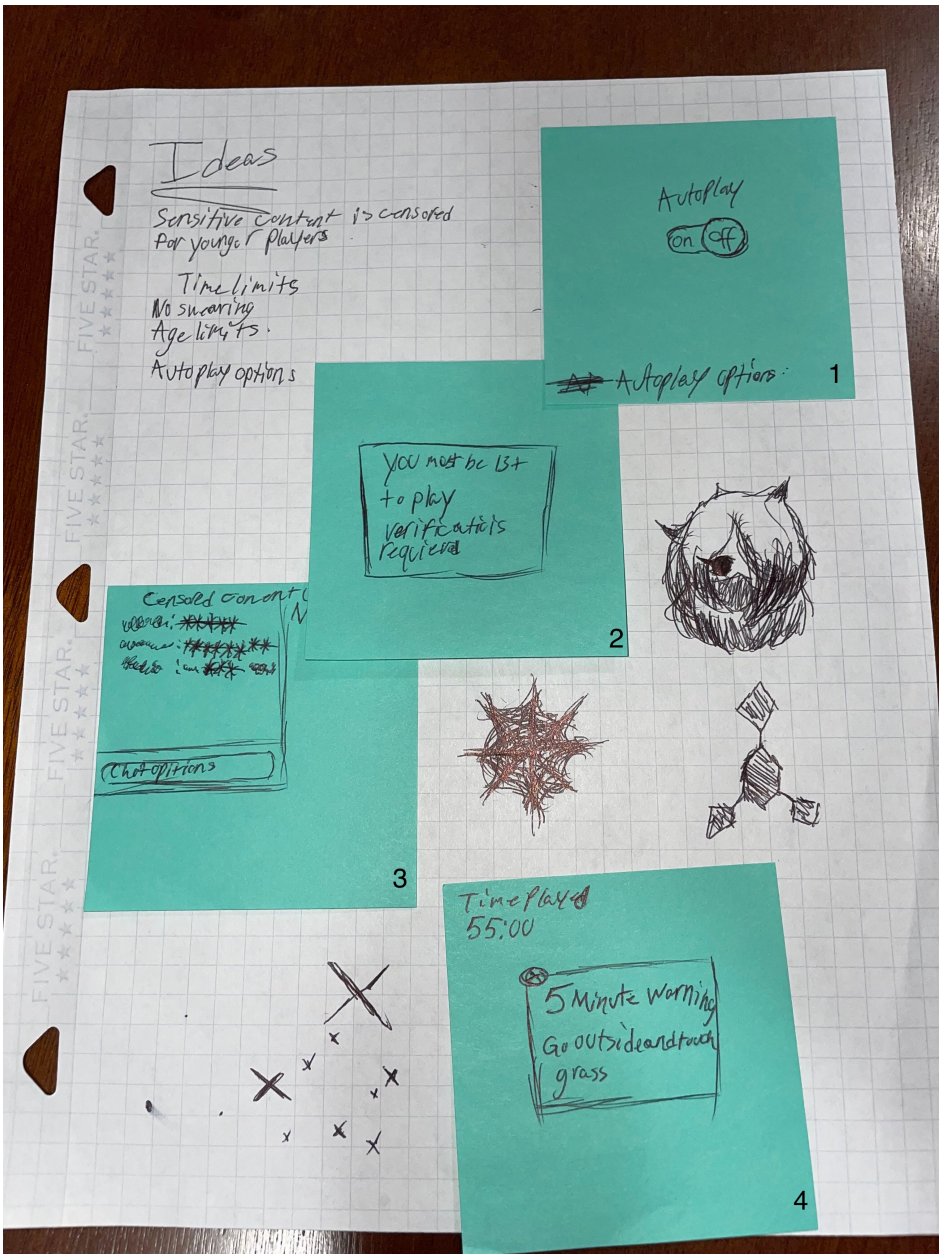


Figure 4.3: **Change Defaults: Autoplay off.** Figure 1 in Serena's (C13, Age 12) collection of drawings features autoplay default set to off on YouTube to help children limit their screen time. Her drawings also include an *age-verification* (Image 2), censored content (Image 3), and *time-related feedback* (Image 4).

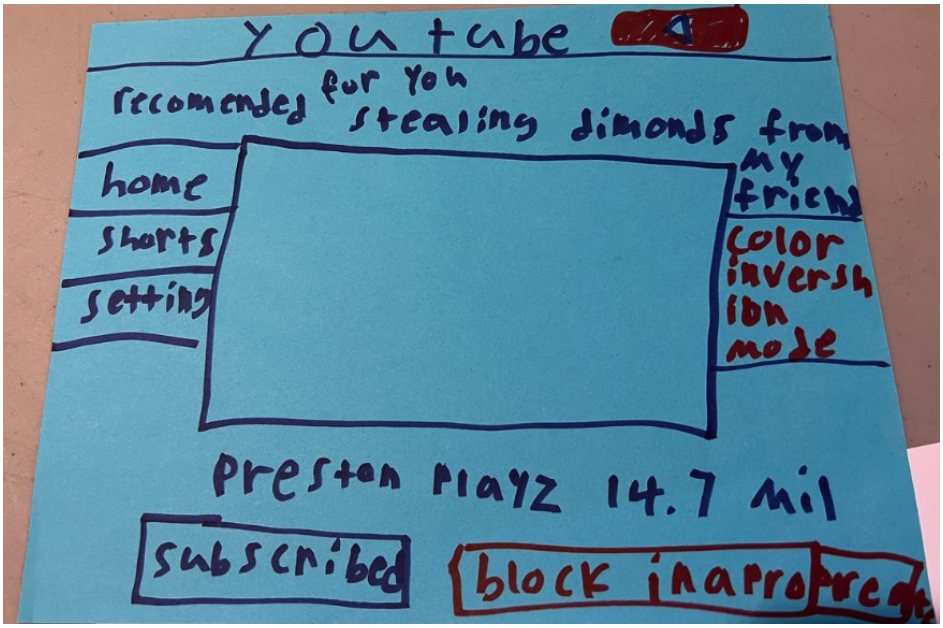


Figure 4.4: **Change Defaults: Dark Mode** Dane (C2b, Age 9) added a *Color Inversion Mode* button to the YouTube home screen for children to easily change YouTube from a bright white screen to a dark screen that would remain a default setting. Dane's design also featured a button to *block inappropriate content*.

Several children with screen time limits suggested making visible clocks that count down and provide **limit-related notifications** to avoid the surprise of abruptly meeting screen time limits. For example, Serena's (C13, Age 12) game (Figure 4.3, image 4) featured a 5-minute warning pop-up before her 60-minute screen time limit was up. Children thought these design elements could help them be conscious of their emotional health, increase the ease of transitions, and reduce negative emotions or conflict.

Equipping video games with pause capabilities. Other children, such as Jean (C6, Age 10, Figure 4.5) incorporated a pause button in video games (n=4) to make taking screen breaks more simple and less frustrating. Jean and Peter agreed thought this feature, which would pause their game progress could relieve the sometimes distressing disengagement from games (see Figures 4.1).

4.5.3.2 Incorporate nudges to prompt positive health behaviors.

Children and parents identified the mixed impacts of screen time on children's health. Participants were interested in the use of nudges, and especially defaults, that could prompt positive health behaviors.

Add Physical Engagement Inputs. Several children incorporated movement as an input

Figure 4.5: **Equip video games with pause capabilities.** Jean (C6, Age 10) added a *pause button* to her video game so children could more easily transition from their activity to take a break and return to their progress in the game.

modality into their video game designs. Some children designed physically interactive video games, including DanceBlox, an alternative to Roblox, where children learn to dance, and another child created hologram mixed-reality experiences. Parents, such as P12, also suggested video games involve more physical activity: "*I think there should be more Wii. We can't get Wii anymore. My kids loved Wii. They could bowl... It was silly, but it still got them active*" (P12).

Incentivize Positive Health Behaviors. Children and parents suggested that positive health behaviors, such as educational or physically intensive screen time, could be incentivized through in-app rewards or points, or additional screen time. For example, one parent (P8) argued for incentives because he felt that "*children today work off of a barter system. You have to reward them for the things they do.*" Another parent suggested that physical activity could earn children in-game incentives for taking screen breaks that got children active: *earn additional tokens for what...* you *want to buy... if you move for a minute... I don't know if there's some video proof that you're doing it, like 'Let's do full jumping jacks!', then you can earn more points.*

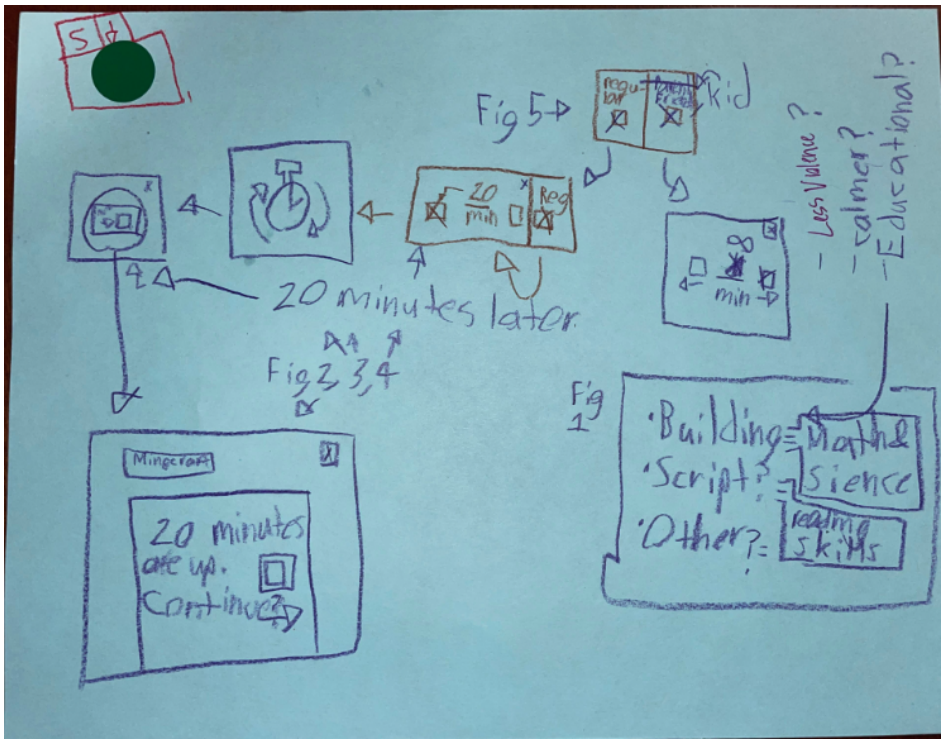


Figure 4.6: ***Incentivize Positive Health Behaviors***. Sam (C4, Age 11) depicted his Minecraft redesign as including kid-friendly or regular modes. The kid-friendly mode was health-centered, with less violence and educational content, and did not have a time limit. He thought unlimited screen time with beneficial content would incentivize children to choose it.

A few children thought additional screen time for engaging in positive health behaviors could also incentivize children. Interestingly, Sam (C4) redesigned Minecraft to have two modes: kid-friendly (which he originally called parent-friendly but then crossed out, see Figure 4.6) or regular. The kid-friendly did not have a time limit and offered options to control violence, calm, or educational content. The regular mode had a 20-minute timer with a pop-up prompt that asked the child if they would like to stop or continue playing. Sam's redesign was grounded in the idea that providing unlimited screen time in the kid-friendly mode will make children more inclined to opt for this non-violent, educational version of the game over the regular one.

Suggested Alternative Activities. Children and parents were asked their perspectives on suggested alternative off-screen activities. Children responded to prompts in the line judging exercise about existing and potential nudges that prompt health behaviors, including suggested alternative off-screen health behaviors (see Table 4.4).

Table 4.4: Children's Feedback from Line Judging on Types of Nudges

Imagine you ran out of screen time. Would you want a pop-up to...	**Type of Nudge [42]**	**Child Response (n=16)**		
		Yes	**Unsure**	**No**
lock you out of the device?	Facilitate: Suggesting Alternatives	2	**9**	5
recommend that you stretch, go outside, or do exercise?	Facilitate: Suggesting Alternatives	**14**	2	0
share facts about how screen breaks can be helpful or why children should limit their screen time?	Confront: Reminding of the Consequences	6	5	5

Almost all participants thought suggestions to perform health behaviors would be a helpful design. Some children, such as Serena, incorporated suggested breaks into their designs. Serena's warning before her screen time limit was up featured an activity suggestion to *Go outside and touch grass* (Figure 4.3, Image 4).

While children were primarily interested in receiving a suggestion that "*recommend that you stretch, go outside, or do exercise*" (n=14), most children were unsure (n=9) or did not want (n=5) meeting a screen time limit to "*lock you out of the device*" (see Table 4.4). Peter (C9, Age 9) described that if he got locked out of a game, he would be "*not so happy. I would be mad at the game... mad at my parents.*"

Children and parents described how the suggested alternative activities should be preferred or child-controlled. Children's rationale for screen breaks was based on receiving suggestions to perform a preferred off-screen activity. For example, Jean (C6, Age 10) thoroughly preferred the suggestion of exercise, while Izzy (C7, Age 11) preferred something less

active like reading.

> Jean, C6, Age 10: *I think it'd be good because I would do the exercise.... I'd go out and shoot some hoops.*
>
> Izzy, C7, Age 11: *I wouldn't want* [Roblox or YouTube] *telling me to do exercise ... I think I'd want it to tell me to take a* [screen] *break... to just read, anything. It doesn't have to be active.*

Parents such as P1 and P4 described how they often have smooth transitions when they verbally suggest that their children perform preferred activities, such as eating or drawing.

> *The screen breaks....My daughter likes doing other things. She likes drawing...playing with dolls...Legos...playing outside... Sometimes I'll say 'Hey, why don't you go play with your Legos?' You're bringing up something that you know she likes, and then she'll play with that all day because she forgot about it* (P1).
>
> *I can always get my kid to* [stop playing Roblox] *to go eat...* [my kid is] *very food motivated* (P4).

Additionally, parents, such as P3, also suggested that their child would be more likely to comply with screen-based suggestions to perform health behaviors if they were involved in creating them: I think if the child has control over it they are more likely to do it (P3).

In the second session, children discussed their preferences for whether a platform or device required screen breaks. They also discussed the implications of whether breaks are enforced via lockouts, meaning they would get locked out of the device or not. Several children thought that suggestions should be optional, while others were concerned that children would not make the healthy choice to disengage.

> Izzy, Age 11: *I think a suggestion would be good but not telling you you have to do it.*
>
> Mariah, C10, Age 10: *I think if it's optional, people can just ignore it.*
>
> Arthur, C8, Age 12: *That's true. We want to have the option to, and some people maybe already did their exercise.*

As part of the line judging exercise, children responded to prompts about a potential confront nudge to prompt children to a screen break. Most children also expressed mixed opinions about receiving information about *"why screen breaks can be helpful"*or*"why children*

should limit their screen time" (see Table 4.4). Ayanna (C5, Age 11) shared that she did not want information about how screen breaks can be helpful as she wants to decide to take breaks, saying "*I'm my own independent woman.*"

4.5.3.3 Improved age-related information and controls to inform children's and parents' content-related decisions.

Overall, children and parents encourage changes to the design of digital media platforms to allow both of them to make choices about age-appropriate content and screen time.

Children and parents expressed various design ideas to prevent children's potential exposure to inappropriate content and implement more robust content censorship. These strategies involved: streamlining parental control, improving platform controls, and expanding shared content controls.

Streamline parental control to reduce parent burden and emotional impacts.

Children and parents acknowledged the need for parental control and how it can be challenging. Most children expressed a desire for parental control over screen time limits and content to varying degrees:

> *I don't really know how long I should play* (Lily, C1).
>
> *I'm definite that it would be a good thing if your parents could set a limit. Not full control, but a good amount of control* (Adam, C3).

However, both children and parents described how each platform has its own parental control, and the ability to restrict inappropriate content can vary across platforms. Children identified how this variation negatively impacts parents' ability to block inappropriate content:

> Adam, C3: *Parents can easily prevent inappropriate videos on Amazon or Netflix with a passcode.*
>
> Sam, C4: *But, not on YouTube, Snapchat, and TikTok.*

Parents described their frustration at the difficulty of blocking inappropriate content. They cited errors in blocking features. For example, one parent described attempting to block the same content or content creators repeatedly. Across sessions, parents described how it is difficult to block content in the adult profiles:

> *In kids' profiles, you can restrict everything... but, in adult profiles, you can't. If there's a certain channel, or a person that you don't want to watch, you can't*

> *get rid of it completely... from what I figured out, but with the kids profile, you can... there are times when you might see several different versions of the same* [YouTube] *channel. And then you're like, how? Where? I thought I blocked that one... and then I block it again. It can be a little tricky* (P5).

Because of these challenges, parents emphasized the need for centralized parental controls into a singular interface that consolidates various management tools for ease of oversight and allows for nuance in controls by both children and parents. Parents acknowledged how parental control is becoming more challenging with the rapid technological changes. One parent described how more centralized parent control could help improve the ease at which parents can manage their children's screen time:

> *I think it should be one master setting for everything, just like iPhone has it as a master setting for their apps. It should be on gaming limits for all of them. Whereas, we don't have to go and do it for every game that we have available* (P13).

> *I haven't tried any specialized apps that you could buy in addition, for iPads that might do some of that stuff. But the easiest would be within [the device]* (P1).

Improve platform control. A common sentiment among children and parents was the need to increase the age-appropriateness of suggested content and the moderation of children's experiences in online games. They would like the quality of suggested content to improve and be more age-appropriate. Parents described appropriate content as engaging and without violence or vulgar language.

Accurate Game Descriptions. Children suggested that more accurate descriptions of online games could help them make choices to avoid negative emotional impacts of online experiences. Children proposed requirements for more accurate and honest information in content descriptions and on game covers. For example, Peter (C9, Age 9, see Figure 4.7) created a drawing that illustrates the adverse effects that arise when the artwork on a game's cover misrepresents its actual content. He captures the emotional distress that children his age might experience when they select a game they believe to be child-friendly, only to discover it contains unsettling or frightening material. Peter's drawing serves as an appeal for accurate depictions of game content to safeguard the children's emotional health.

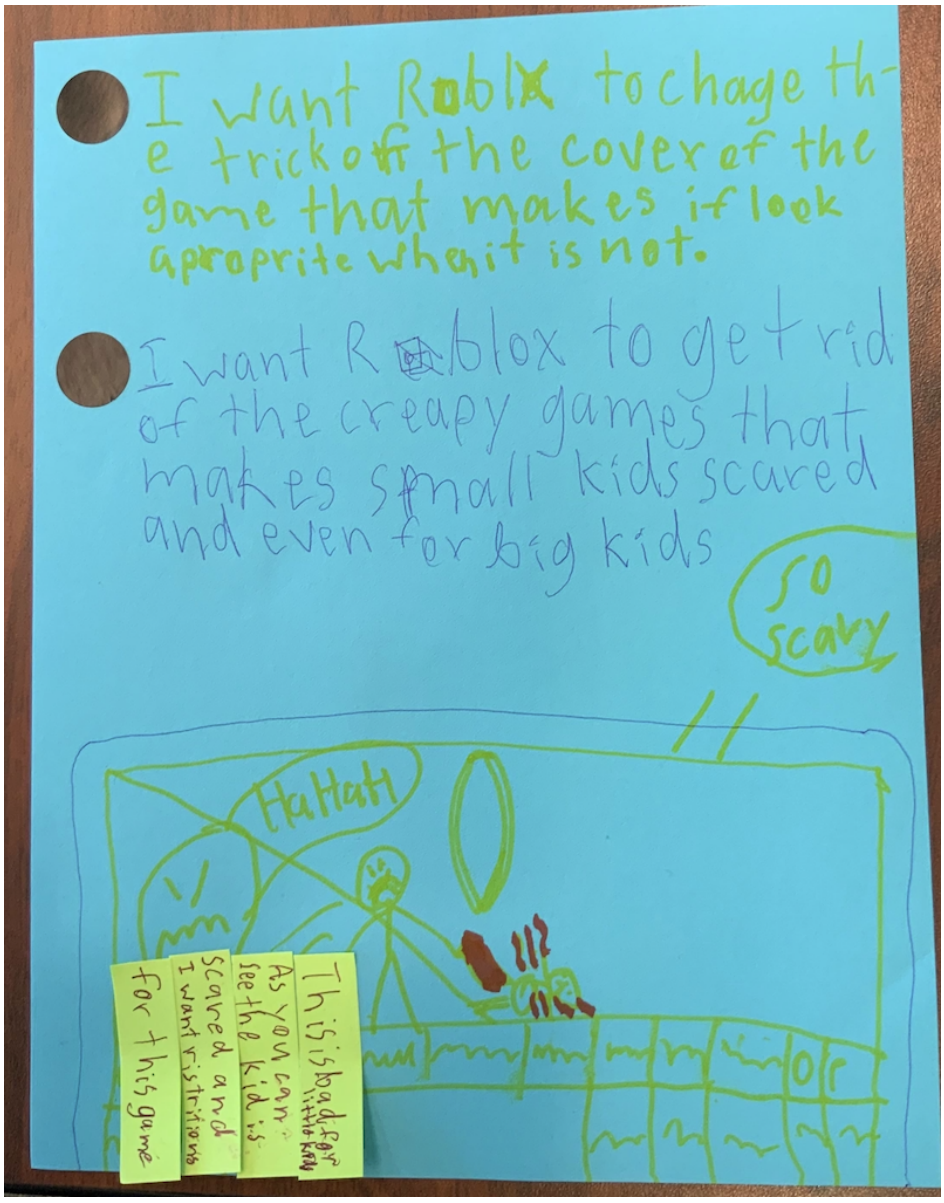


Figure 4.7: **Improve platform control: *Accurate Game Descriptions.*** Peter (C6, Age 10) depicted a scenario of the impacts of *the trick* of the cover of games being different from the content. This emphasizes the need for accurate content descriptions to protect children's emotional health. He does not want children to become scared after choosing to play a *creepy game* based on a deceptive content description. His drawing also depicts his design for age-restrictions.

Online Video Game Moderation. Several children wanted improved content moderation to make game experiences more positive and fair. Participants described how unfair experiences can result in negative emotions. Kiley (C11b, Age 10) said that better moderation would make her "less mad". Children such as Francisco (C12, Age 12) proposed a "toxic-policy"

in online games to make games more fair and reduce negative emotions:

> *When people are really mean or annoying to people or unfair, I get really angry. So it really annoys me. Because then I have to get off because I get mad at them. If you report somebody... they* [the reporter/user] *decide how long the person needs to get banned* (Francisco, C12, Age 12).

Several children also described how consequences can be unfairly applied to gamers who cause harm to others. Emma (C11a, Age 11) suggested that Roblox needs more effective and appropriate consequences for players who cause harm to others online, such as scamming other players in unfair virtual trades. Other children, such as Francisco, reported being inaccurately reported and banned for inappropriate behaviors in massive online games.

To inform players of problematic behaviors, Suzie (C11c, Age 8) suggested adding indicators (i.e., a red dot) as a *"warning for the game"* to alert players of *"what not to do...* [like] *be mean to other people on the game.*"

Expand shared content controls. Parents and children alike suggested the need for proactive content information and controls to inform their decisions about what is age-appropriate.

Filters. Children and parents also proposed that they could customize and choose what they find appropriate according to the content type, rating, and length of the video or game. Parents suggested that they could filter and restrict the content using these filters in parent control settings.

> *It'd be good to have more filter options... on or off for what they can or can't watch... age ranges or what the content is... not just kids... that's too limited... It doesn't narrow it down enough to what you think is okay for your kid* (P1).

Parents described how they would like to control the length of content their children could watch. P7 felt as though continuous short-form videos, which can be less than 30 seconds, were too stimulating for her child:

> *I'd like things to be longer. I said, "No TikToks", but now there's YouTube Shorts, and they are 30 seconds....I tried to restrict how long each video is supposed to be. I want her to be engaged for something longer than 30 seconds. It's like constant stimulation* (P7).

Both children and parents described how adding age-related ratings for all content across platforms could help control the content they watch. Unlike movies and TV shows, short-form videos on platforms like YouTube and TikTok are not rated and cannot be filtered.

> *I think that some of those* [YouTube Shorts videos] *clips should be rated just like a movie. So it has a bad word... rated as a PG 13, or rated R... it has domestic violence, R* (P13).
>
> *On YouTube,* [content filters] *would be nice. On Amazon Prime, you can filter* [content] *by the ratings... G, PG* (P4).

Age recommendations. In conversation and design, many study children suggested that content could be organized by accurately aligning with their specific age group. Serena (C13, Age 12) and parent P6 proposed nearly the exact design change for YouTube based on the child's age, and parent P6 added that content for specific age groups could be oriented by categories.

> [U]*sually when I'm watching one of my shows on YouTube... inappropriate content... is all coming up on autoplay. So, I want to make options where age is required, so that way it knows what to tell you to watch... what is recommended* (Serena, C13, Age 12).
>
> *Being able to set up... my kid is in the 7-9 year old range...* [YouTube should] *recommend the next video that is at the 7-9 range.... but you* [the parent] *have the control* (P6).

Children such as Izzy (C7, Age 11) thought Netflix could provide settings for parents to choose the ratings that their children can watch (see Figure 4.8), and that this would help protect her emotionally. She thought this additional control could reduce the risk of exposure to inappropriate content.

> *I think* [Netflix] *should have better restrictions. The parents could put what your kids are watching.* [I have PG-13 blocked] *but there's R stuff on there still so I almost watched something on accident because I thought it was okay ... it was not. It still allows me to play it.* [I want age restrictions because...] *I don't want to watch grown-up stuff. I'll feel uncomfortable* (*Izzy*, C7, Age 11).

Similarly, some children wanted more control over video games, including the level of violence, the age of players, and whether chat was enabled.

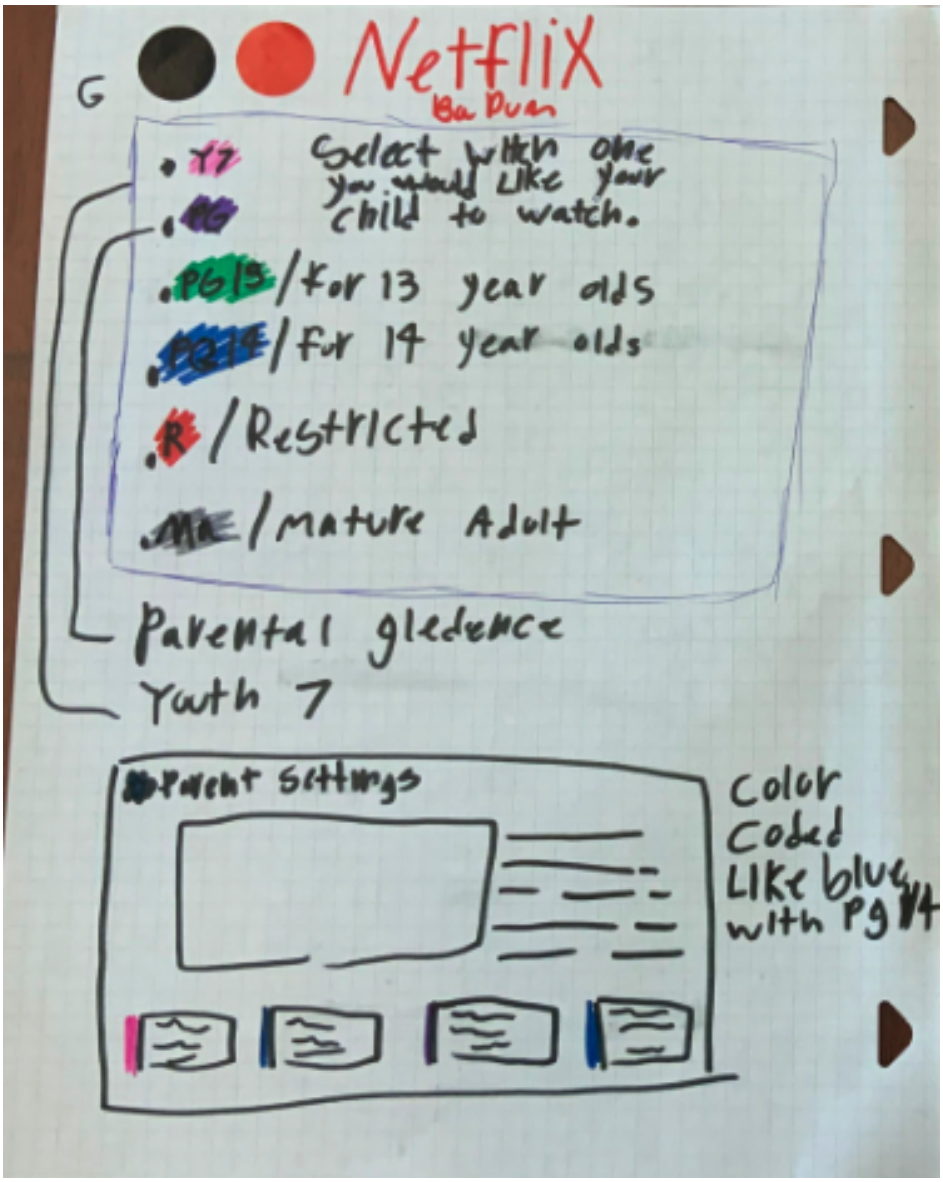


Figure 4.8: **Expand shared content controls: *Age recommendations.*** Izzy (C7, Age 11) expanded the age-relevant content ratings so that parents could choose the types of content that should be visible to their child.

> *In younger kid games,* [older people] *talk about weird* [age-inappropriate] *stuff... I want that stuff to be censored. If it's like a multiplayer game... there's chat options like in Roblox... kids don't want to be thrown into all this crazy stuff at a young age... It would cause stress* (Serena, C13, Age 12).

For example, Arthur (C8, Age 12) designed a feature where children can only choose to play video games with other children to avoid inappropriate experiences. His design featured a list of players in the video game, with their names and ages.

> *The age restriction can separate younger and older players. Also have names So that way also if they're not your friends you can kick them out of your game...there might be players on there that are a little bit too old for younger players... there could be predators on there who try to get personal... it doesn't happen that much but it does happen* (Arthur, C8, Age 12).

Incorporate age verification. Several children admitted to lying about their age on various platforms.

> Francisco, C12, Age 12: *You're not allowed to have an account if you are underage, so that is why some people might lie about it. ... players log on younger than 13 saying they're 13... sometimes I've lied about my age to play a game which sucks because they don't know your actual age* [...]
>
> Serena, C13, Age 12: *I've done that on Discord... I lied about my age.*

Kiley (C11b, Age 10) thought age-verification would make Roblox "*safer*" and "*a better game for little kids*" and suggested removing content for kids age 17+ like blood and romance.

Across sessions, children suggested that digital technology can request photo IDs from children or help parents keep kids honest and safe by verifying their child's age via push notification or parent control settings.

Simplified mechanism to block inappropriate content and experiences.

Children primarily mentioned the need to reduce violence, such as gore, sexual content, and vulgarity. Children expressed a desire for a simplified mechanism to easily block content they do not want to experience, such as violence, bullying, griefing, and inappropriate conversations. Examples included being able to easily block a channel or player in a game, report inappropriate content or player behavior, or reduce the amount of violence in a game.

> *Violent stuff I'm good with... see there's violence stuff and there's gory stuff... blood... like in this Star Wars game ... when he cuts something, you don't see gore. I don't think it should be there unless the parents let it happen* (Adam, C3).

Some children designed an ability to change the level of violence in a game into the settings. For example, Emma (C11a, Age 11) described how, in Minecraft, children should be able to *"turn off Creepers"*, which are non-player creatures in the game that destroy players' buildings:

> *It would make* [kids] *more happy...They could be more creative with their builds because ... they don't have to worry about their builds being destroyed* (Emma, C11a, Age 11).

Many children described how adding a button to block inappropriate content easily would be helpful. For example, Dane (C2b, Age 9) added a red button to his redesign of YouTube to block inappropriate videos that are recommended to him (see Figure 4.4).

4.6 Discussion

Through three design workshops with 16 children and three focus groups with 17 parents, we investigated how children and parents perceive manipulative design patterns in children's digital media (RQ1). Children and parents had concerns regarding manipulative design. Specifically, they believe that (1.1) video autoplay, infinite scroll, and endless video games extend children's screen time and inhibit transitions, and (1.2) recommended content can be age-inappropriate and content descriptions can be misleading.

Children and parents made various design recommendations (RQ2) for health-centered digital experiences for children. Children intuitively designed features that align with nudge theory despite not introducing the concept of nudges. They wanted nudge-based designs to reduce the negative health impacts of screen time, such as by changing default autoplay settings to off. Participants also wanted nudge-based designs to prompt children's positive health behaviors by suggesting alternative (off-screen) activities. To improve the age-appropriateness of digital experiences, they wanted improved age-related information to inform their content-related decisions, including streamlined parental controls and expanded shared controls, including filters and age recommendations. Findings reveal critical needs and design opportunities to promote age-appropriate digital experiences and support children's healthy (dis-)engagement from digital media.

4.6.1 Perspectives of Manipulative Design Patterns

Children in this study encountered manipulative design patterns like autoplay, deceptive content descriptions, and insufficient content moderation, often enough to raise concerns about their extended use, inappropriate digital experiences, and associated health implications.

Children in our study used platforms primarily designed for general audiences instead of children, which may have contributed to the extent to which they encountered manipulative design patterns. Our study of children ages 8-12 confirms survey findings [198] that identified the increasing prevalence of manipulative design patterns in the digital media that children (ages 3-5) consume daily. Like Radesky and colleagues [198], we found that navigation constraints (e.g., infinite gameplay and autoplay) and lures were key manipulative design patterns for participants. However, our participants reported additional navigation constraints, such as infinite scroll in digital media, and children reported misleading content descriptions as luring them to play inappropriate new games. Participants did not report some manipulative design patterns reported by Radesky [198], including parasocial or time-related pressures. To the best of our knowledge, our study is the first to note children's and parents' perceptions of manipulative design patterns.

Study parents and children identified negative impacts of manipulative design patterns and various negative implications. Most prominently, they argued that manipulative design patterns, including autoplay, **extend children's screen time and inhibit their transitions**. This is perhaps unsurprising because these manipulative design patterns are developed to maximize and prolong engagement, which makes transitions difficult and often requires parental intervention to disengage [198, 57, 119]. However, this may be particularly concerning among children because children need autonomy to play and explore, developmentally appropriate content, and support(s) to help them self-regulate and transition from digital media [198, 57]. Indeed, we confirm previous literature identifying how manipulative design patterns do not promote child autonomy or self-regulation [65, 89]. However, promoting child autonomy and positive disengagement experiences could increase user satisfaction [119] and reduce the risk of abandonment due to perceived addicting qualities [24].

Notably, this study offered the novel insight that *children can experience manipulative design patterns negatively.* Specifically, children shared annoyance and frustrations about the inability to pause games for a different activity. Children also reported that misleading content descriptions deceived them by encouraging them to play seemingly appropriate games that were scary and contributed to negative emotions. Accordingly, we hold that negative emotions may motivate children to seek changes in their digital activities; this could be tapped to facilitate the use of interventions like turning off autoplay or hitting pause on games–two of the children's recommended interventions.

This research identified a negative impact of manipulative design patterns like autoplay, deceptive content descriptions, and insufficient moderation that has received scant attention in previous research: involuntary exposure to age-inappropriate content. Although age-inappropriate content is a well-documented concern in children's use of digital media, our

findings show that recommended content through autoplay is a novel pathway through which this occurs for children ages 8-12 on YouTube Kids and YouTube. We add to past work identifying how disturbing videos surface as recommendations for toddlers (ages 1-5) on YouTube [190]. Papadamou [190] found that malicious users uploaded disturbing content containing popular characters, such as Elsa from Frozen, and violence or gore. Future research could validate this concern by exploring the prevalence of age-inappropriate content recommendations on platforms such as YouTube and other social media sites. Researchers could also approach other stakeholders, such as platform engineers and designers, to more fully understand the opportunities for change regarding manipulative design patterns in children's technology.

4.6.2 Nudges as a Health-centered Design Mechanism

While scholars have posited that digital media design should change to be more child-centered [198], children's and parents' perspectives demonstrate how health-centered design should be achieved by incorporating a variety of nudges. This study reveals that negative situations like inappropriate content and difficult transitions leading to family conflict might motivate children and parents to use media with nudge-based designs to help manage their challenges.

The usefulness of nudges resonated with study children and parents of varying demographics and ages. To the best of our knowledge, this is the first study to clarify the applicability of nudge-related design for children ages 8-12. Children expressed familiarity with various nudge-based designs with which they already interact regularly and revealed a relatively deep understanding of nudge features, which was evident in their designs without being described or prompted. Parents expressed familiarity with autoplay and confront nudges interrupting extended use, such as Netflix's "Are you still watching?" pop-up.

Our findings complement existing research with children outside of middle childhood, showing the promise of nudge designs to support healthy digital behaviors. Research with preschool-aged children and their parents found that children particularly liked Coco's Videos, an interface with embedded time-related feedback and confront nudges to help children adhere to screen time limits via timers and limits and to plan transitions to suggested alternative activities [118]. Alternatively, teenagers were interested in social feedback and confront nudges that would help them in privacy-supportive behaviors [166]. We add the perspectives of children in middle childhood and their parents to this literature in the context of managing screen time, with an understanding that they are interested in nudge designs and have specific ideas for how they can positively impact children's digital experiences.

Study children and parents thought that nudges could help reduce the negative physical

health impacts of inappropriate content and extended use and potentially help children self-regulate their screen usage.

To help limit screen time and facilitate transitions, children incorporated various facilitating and confronting nudges into their designs, including changed defaults, time-related feedback, and pause capabilities in video games. Participant recommendations for changed defaults confirm similar suggestions from Hiniker and colleagues [118] to avoid autoplay for children ages (4-6) by removing it or setting the default to off. Additional research should be conducted to test these changes through experiments or home-deployment studies to assess the promise of suggested design changes and approaches. Indeed, healthier default decisions could positively impact user's health [93].

To increase the positive health impacts of children's screen time, children and parents suggested that nudges could prompt positive health behaviors by incorporating *physical engagement inputs* in games, *incentivizing positive health behaviors*, and *suggesting alternative activities* after screen time. Our findings also complement that of other scholars, such as Silva and colleagues [222] who recommended digital smartwatch or tablet-based nudges for children (ages 8-15) with ADHD to nudge positive health behaviors. Since digital media tends to foster hyperfocus in children with behavioral disabilities such as ADHD according to parents in our study, interventions that avoid such patterns could be supportive of both children with and without disabilities for both groups. Moreover, evidence from line-judging exercises in this study also emphasizes children's interest in being offered nudges that prompt opportunities to make decisions to perform positive health behaviors. Rather than just following external rules (such as time limits imposed by parents), children could be given decision-making opportunities that foster awareness of the benefits of balanced screen time.

Participants both suggested that nudges could prompt positive health behaviors, such as screen breaks, but children revealed particular preferences for framing prompts. Children in our study responded favorably to positively framed suggestions like 'facts about how breaks from technology can be helpful,' and they did not like the idea of negatively framed messages such as 'facts about the potential effects on a child's body and mind from looking at a screen for too long.' Children's preferences suggest that gain framing may be less acceptable than loss framing. Gain-framed messages emphasize either the benefits of engaging in a particular behavior (e.g., taking a break), while loss-framed messages emphasize the consequence(s) of failing to engage in a behavior (e.g., continued screen use) [95, 210]. Loss-framed messaging may use fear appeals, remind people of the consequences [42, 247] to encourage users to take a particular action. This preference aligns with past research showing that positive gain-framed messaging appears to be more effective at improving children's positive health behaviors than

loss-framed messaging [30, 83, 249]. However, our findings conflict with those of Masaki and colleagues [166], who studied adolescents' perspectives of privacy-oriented nudges and found that participants were more likely to avoid risky behavior following negatively framed social feedback nudges. Our findings could conflict since their social feedback intervention was quantitative, with the percentage of adolescents who would not make a risky choice. Opportunities exist for future research to explore the use of various nudges among different age groups of children to assess the effectiveness of positive or negatively framed health-related screen break suggestions (a type of nudge that facilitates behavior) in influencing children's screen time and health.

Nudge-based designs are one opportunity for technology designs to help children gain autonomy over their screen time. Autonomy support in the context of children's screen time would promote self-regulation, motivate them internally, and respect their individual needs and preferences while still providing necessary guidance and boundaries [60]. However, it is essential to note that industry monetization strategies and engagement structures based on views and clicks do not align with children's needs for digital autonomy, developmentally appropriate content, and regulation support(s) [57]. Thus, our findings suggest that various nudges resonate with children in middle childhood and their parents, while other nudges that nudges that *deceive*, provide *social influence*, or elicit *fear* to motivate behaviors were not of interest. Future work should explore children's perspectives of these other nudges to clarify that they are inappropriate.

Finally, parents and children had somewhat conflicting ideas on how incentives, a form of confront nudge, could encourage children's healthy behaviors. Parents thought their children would be motivated to perform health behaviors by extrinsic rewards, such as in-app benefits. However, children in our study did not mention rewards or include them in their designs as a way for digital media to better support their health besides receiving additional screen time as a reward for taking breaks. Yet, recent recommendations on self-regulation support from the perspectives of children with ADHD are similar to parents in our study. Silva and colleagues [222] found that ADHD children wanted to receive in-game rewards, such as new Pokemon characters, in exchange for healthy behaviors like chores. Thus, future work may explore the potential for digital rewards in exchange for health behaviors and whether using screen time as a reward influences a child's attraction to screen time.

Nudges are central to various technology company's responses to these issues. Meta and Google have recently made changes to default design to protect children. For example, YouTube has changed default nudges by turning autoplay off and break reminders on for users ages 13-17. The Google Play Store prevents users under 18 from viewing and downloading apps rated as adult-only. However, there are shortcomings of these changes with respect

to age assurance among children ages 8-12. Indeed, the changes will not apply to children under the age of 13 who inaccurately report their age.

Technology companies may not fully address the need for protections of children's health online. Our findings suggest the need for US policy to require all US digital media platforms to make changes to protect children's health. While UK legislation has remained[125] in effect, recent California legislation [252] has been blocked by appeals from technology lobbies. Existing and drafted legislation largely aims to protects children's privacy, but not their health online. Thus, policy is needed to restrict manipulative design for all users in order to be visible children ages 8-12.

4.6.3 Parent and Child Controls

Study children and parents emphasized the need for a greater variety of parent and shared controls, including age-related restrictions for content in apps, books, TV shows, and movies, or limits for specific apps. Parents and children held the perspective that the use of both parent and child controls could reduce the negative emotional health impacts due to experiencing age-inappropriate content. To improve the appropriateness of content, participants envision parental controls with both proactive and reactive supports. They expressed a desire for more nuanced controls, especially on social media platforms, to filter the type of content a child can view. However, these design suggestions would require additional content moderation and review to create recommended age ranges, ratings, and content categories. Platforms could require content creators to tag their content via self-rating upon upload. For example, uploaded tags could facilitate a participant-desired filter for vulgar language and another for violence. The accuracy of said content ratings could be assessed via crowdsourced question replies that pop-up to general audience adult users to obtain feedback. For example, a user could receive a prompt to optionally respond to a question that would verify the accuracy of ratings (e.g., Does this video include vulgar language?).

Study parents suggested streamlining the currently separate parental controls of various apps into a singular interface could ease the burden of control on parents through proactive content filters and restrictions. We build upon previous non-health-focused research documenting extensive parental burden and information needs concerning content filters for their children [49, 57]. Similarly, parents in our study also identified information needs regarding establishing parental controls across apps and platforms. Further supporting this point, one meta-review of studies of children's screen time [49] also identified the need for evidence-based parental educational materials and programs to ensure children view appropriate content.

Notably, child participants (ages 8-12) were interested in additional control over the con-

tent they watch and the games they play. They incorporated buttons offering simplified reporting mechanisms into their designs to easily block content, content creators, or players in online games. Their suggestions could foster increased autonomy, specifically by providing their input into identifying age-inappropriate content. Our findings complement previous research with older children ages 11-14 [50] who similarly wanted help keeping track of time on their devices and shared controls with parents, which would balance children's and parents' input in decisions. Similarly, Hashish and colleagues [113] app for younger children (ages 6-8) called "We-Choose" allowed children and parents to collaboratively discuss and set appropriate content filters, thus providing both child and parental involvement. Future work should verify the design preferences of children of varying age groups because this literature varies in age from our study; in particular, exploring age differences in preferences for levels of child-parent involvement in content control could offer valuable insight into methods of fostering autonomy support and parental roles.

4.6.4 Need for Improved Moderation in Online Games

Children also expressed a desire for improved moderation in massive online multiplayer games, showing how distressing online interactions can lead to frustration, anger, or fear. One such online interaction was scamming or banning other players within games. Children described how scams occurred in unfair trades in online games, while bans happened when children were inaccurately reported and banned for inappropriate or illegal behaviors they did not perform. While previous research has identified the occurrence of this behavior amongst children [131, 234], our study is the first to detail these forms of online behavior and the associated health implications from children's perspectives. Parents and pediatricians should be aware of this type of behavior in online multiplayer video games and its negative impacts to provide alternative coping strategies for negative emotions and discourage inappropriate online behaviors. Designers should review existing moderation mechanisms for effectiveness. Future research should more deeply investigate how children want moderation to change to support their emotional health, if at all.

4.6.5 Limitations

The study did have some limitations. The findings might not be generalizable due to the demographics of our sample not being representative of the broader population. The sample included fewer adult and child males than females. Despite this, our sample of children and families was notably diverse for a qualitative study, with a range of child racial backgrounds and parent incomes and structures. Another potential limitation is that our recruitment

methods could have led to self-selection bias, possibly excluding families where parents either lack awareness of their children's screen time or children would not be interested in design activities with other children. This bias could exclude children's perspectives with varying interests in changing digital media design. Additionally, we designed the study to have parents and children participate in separate focus groups to encourage more sincere expressions of opinion and suggestions for improvement. However, this separation might have influenced how comfortable children or parents were sharing their thoughts in a group setting. Finally, as this was a formative research study, our findings should be translated into low- and high-fidelity prototypes to clarify design choices. Future work should then use field studies to examine how children and parents use said prototypes.

4.7 Conclusion

These research findings identify children's and parents' perceptions of manipulative design patterns, revealing that they view these patterns as inhibiting limits and transitions and contributing to children viewing inappropriate content. Study children and parents identified through conversation and designs that digital media design could be more health-centered if it were more age-appropriate and less manipulative. Children designed various types of nudges to help limit the negative impacts of screen time and prompt positive behaviors. Children's and parents' perspectives suggested improved content information and controls to make choices about age-appropriate content and screen time. The alignment of children's and parents' perspectives and approaches to design changes can inform designers in creating digital products that respect children's desire for health-centered digital media with nudges and controls. This research also prompts further investigation and changes to digital media design. These findings underscore the need to review industry design guidelines with an eye for age-appropriateness and healthy screen time for children.

CHAPTER 5

Conclusion

This dissertation deeply explores the health-related consequences of children's digital technology use, highlighting mismatches in design that fail to meet their needs. With three multi-method studies involving either parents or both children and parents, this research revealed the harmful health impacts of inappropriate digital media design on children and the particularly acute impact on children with disabilities.

In this chapter, I provide a comprehensive summary of the key findings from my dissertation and then offer broader reflections on the contributions of this research. I discuss the implications for the multiple research areas I used as a foundation for my work, ideas about design directions that seem particularly promising, and opportunities for future research.

The research in Chapter 2 investigated the implications of the surge in digital technology use due to the COVID-19 pandemic on the health of children with behavioral disabilities. This study highlighted how the sudden shift to telehealth posed significant challenges; inappropriate technology design exacerbated difficulties in children's self-regulation and service accessibility. While some parents managed their children's digital activities by working with providers to modify services and independently seeking resources, the burden of managing telehealth services fell heavily on parents. Despite these challenges, modifications that increased autonomy and aligned with children's preferences showed promise in enhancing engagement and self-regulation in telehealth environments. Nevertheless, the research underscores the urgent need for a more nuanced understanding of technology's impact on children, suggesting further investigation is needed into the needs of a broader sample of children.

The research in Chapter 3 expanded to study the health impacts of screen time from the perspectives of children with and without disabilities and their parents. Through surveys and interviews with 33 child-parent dyads of diverse family structures and socioeconomic backgrounds, the study found consensus on the positive and negative effects of digital activities on health. Key themes suggested a need for balance to prevent physical discomfort

and emotional distress while recognizing that screen time with limits could foster positive emotions and enhance family and peer relationships. Parents employed strategies ranging from restriction to mediation, whereas children were proactive in adhering to limits, listening to their bodies, and choosing content beneficial to their health. These insights highlighted the call for technological design improvements to minimize the negatives and maximize the positives of screen time on child health and autonomy, setting the stage for the subsequent study's focus.

I followed this research with Chapter 4, a qualitative study that included design workshops with 16 children across three Midwestern cities and focus groups with their parents. The research engaged a diverse cohort of families, including children with and without disabilities and across socioeconomic statuses, to gather insights on digital media design as it relates to children's health. Findings uncovered their perspectives on the manipulative design patterns that challenge adherence to healthy limits and inadvertently expose children to age-inappropriate content. Children and parents highlighted the potential role of digital nudges —subtle design elements encouraging specific choices—as a way for digital media design to be more health-centered, by supporting children's autonomy and exposure to inappropriate content. Children intuitively crafted nudge-based features in their design solutions, aiming to decrease screen time's negative health impacts. Parents supported the idea of nudge-based design and articulated a need for more streamlined parental controls to reduce the burden of managing their children's screen time.

This work underscores the necessity for a collaborative effort among researchers, designers, and policymakers to revise practice and policy, update screen time guidelines, and reshape technology design to prioritize children's health in the digital age.

5.1 Screen Time Has Both Positive and Negative Health Implications for Children

Participants identified a variety of ways that screen time is beneficial for children's health. Overall, the findings of this dissertation indicate alignment between parent and child participants concerning screen time health concerns and navigation strategies.

In terms of the positive health impacts, children with and without disabilities engaged digital tools such as Khan Academy and DuoLingo to supplant their classroom learning during COVID-19 pandemic shutdowns (Chapter 2) and beyond as a way to learn and foster their creativity (Chapter 3). Socially and emotionally, parents and children expressed views that children can benefit from virtual interactions with peers (Chapters 2 and 3) and family

members (Chapter 3), as well as behavioral healthcare providers (Chapter 2). These findings confirm past research with pre-adolescents (ages 10-13) who perceive online socialization as meaningful [92]. However, the beneficial impacts of children's use of technology, from both children's and parents' perspectives contrast with the overwhelmingly negative narrative on children's screen time. Indeed, much of the research examining the relationship between screen time and technology use has demonstrated negative impacts [46, 224, 265], and the evidence of positive benefits of screen time for children are less common and from parents' perspectives [57, 226, 145, 178]. Findings also show that the intentional use of screen time as a reward given by parents (Chapter 2) or in preferred ways that make children happy (Chapter 3) can enhance children's emotions. This confirms past work that clarifies the effectiveness of interventions that appeal to children's strengths and interests [183, 64, 90, 220, 254] and reinforce positive behaviors [225].

Children and parents acknowledged various adverse health impacts of screen time across these studies, especially for their physical and emotional health. A novel finding was that children mentioned concerns about their bodies, citing the sedentary nature of screen time and the potential for eye strain. Participants detailed specific influential uses of digital technology that were inappropriate for a child's age or developmental needs. Another new finding was that children described how online interactions can negatively influence their emotions, which adds to the literature on parents' perspectives. Clarifying children's awareness of negative physical and emotional health impacts of screen time fills a critical gap in knowledge and by adding children's point of view to a previous body of literature focused largely on parents' perspectives [145, 178]. These perspectives revealed concerns that, to my knowledge, have not been documented in previous literature. Specifically, children identified the negative emotional impacts of viewing inappropriate content on social media and YouTube, and "griefing" in online video games (see Section 3.4.2.3). The depth of this concern was amplified by child participants' desires to improve content moderation in Chapter 4. Furthermore, this research is the first to note children's intense concerns about the emotional impacts of "griefing" online, which involves players intentionally damaging others' virtual creations. While past work has outlined the prevalence of griefing amongst adult [91] and child gaming communities [131, 234], these dissertation studies uniquely show that children see this as negatively impacting their emotional health and want it to change.

5.2 Technology Design Issues Negatively Affect Children's Health and Inhibit their Autonomy and Self-Regulation

Analysis from the perspectives of both children and parents reveals that technology is currently designed without attention to the physical and emotional health impacts on children. Children's use of digital media for general audiences, instead of platforms designed for children, may have contributed to the extent to which they encountered content that was age-inappropriate. In terms of middle childhood, digital media generally lacks support for children's exploration and self-regulation, and does not align with their developmental need for free exploration and community support [57]. Both children and their parents reported issues with the appropriateness of digital content, which was either unsuitable for a child's age or developmental level, and digital content delivery and presentation, such as through manipulative design patterns.

Participants described various types of content presented to children that were **inappropriate for their age**. This occurred when content to which they were exposed was violent, scary, vulgar, or too childish. These findings suggest that age-inappropriateness stems from their exposure to content catered to adults or very young children. For instance, children in our studies used platforms primarily designed for general audiences, instead of platforms designed for children like YouTube Kids. Participants reported that the platforms designed for children are inappropriate for their age as it is childish and catered to early childhood, while the general audience content is often age-inappropriate because it is meant for adults. While existing literature has established this usage pattern and related difficulties [198], the resulting health impacts from children's perspectives in this dissertation extend this fresh understanding of its implications. Findings also suggest that middle childhood could potentially be an underserved audience in digital media design.

Parents also described how some content was **developmentally inappropriate** for their children, which had a negative impact on their health. Content was also inappropriate for their developmental stage when it was intellectually too easy or difficult. In study 1, parents described how children reacted negatively when virtual behavioral health activities were inappropriate for their abilities, needs, or skill levels. It was overwhelming when digital experiences were over- or under-stimulating (Chapter 2). Children also reacted negatively when too much was asked of them without appropriate structure or support. For example, some children were provided lists of activities without instructions on how to complete them (see Chapter 2). Parents also described overstimulating digital media experiences as including

brightly colored online school activities and visually distracting content. Parents described video calls used for special education classes and group therapy to also be overstimulating, as well as chaotic and overwhelming. Multiple people talking at once and gallery view on Zoom made it challenging to focus on their behavioral health provider (e.g., the speaker). We found that it was difficult for children to adhere to synchronous behavioral health services, which confirm past work from providers' perspectives on their difficulty in implementing virtual services for children with short attention spans [260]. Regardless of the appropriateness of the content, the design of the interface impeded on most children's ability to perform reconstructed behavioral health services. This has implications for both health care providers and parents, in terms of recognizing and addressing the ways in which digital technology use might interact with or impact a child's developmental needs.

The dissertation confirmed that children regularly encounter **manipulative design patterns** which children and parents perceive as negatively impactful on children's autonomy and ability to self-regulate. This confirms past work that identified the increasing prevalence of manipulative design patterns in the digital media that children consume daily [198]). Children and parents perceive video autoplay, infinite scroll, and endless video games as extending children's screen time and inhibiting activity transitions, which can contribute to negative emotions and conflict between family members. They also perceived automatically-suggested content to be age-inappropriate and content descriptions misleading (Chapter 4).

Manipulative design patterns, inherently aimed at retaining user's attention, do not meet children's developmental needs for self-directed experiences. Instead, these design patterns place inappropriate demands on children to independently engage and disengage (Chapters 2 and 4), as their self-regulation is still developing. Indeed, issues around managing limits and navigating transitions were amplified for families of children with disabilities. For example, parents of children with autism and ADHD reported issues around limits and transitions due to this design "sucking their child in" and impacting their child's underlying tendency towards hyper focus. They described how this typically requires more intervention and involvement in transitions and content controls (see Chapter 4). Thus, this dissertation argues that technology design should align with children's specific needs by developmental stage, as opposed to blanket child vs. adult design.

Moreover, a handful of scholars and many policymakers have drawn attention to various platforms and the need for more age- and developmentally-appropriate design. Developmentally-appropriate digital media for children has been described by researchers as self-directed and community-supported [198, 57]. Digital activities can be self-directed if the structure is self-paced and children can maintain control and exercise digital autonomy with an opportunity to self-regulate [198, 57]. Community support from parents, household

members, or other caring adults can support this self-regulation and digital exploration [57]. This dissertation holds that digital design that is health-centered should be appropriate for a child's age and developmental stage.

5.3 Parental Burden in Managing Children's Technology Use

This dissertation has shown that the responsibility of parents for managing children's technology use is burdensome for them. Parental burden was evident in these research studies in terms of the time and resources expected of parents to manage their children's digital activities. This was observed in both the contexts of children's virtual behavioral health services due to the COVID-19 pandemic (Chapter 2), as well as their screen time more broadly (Chapters 3-4).

Children's virtual behavioral health services often required a parent nearby to facilitate activities with children with disabilities (Chapter 2). However, it was difficult and unrealistic for many parent participants as they were typically working from home, attending to other children, and/or lacked the necessary skills and training. Many parents worked with their children's behavioral health providers to help improve their child's experiences, including requesting adjustments to the services and finding resources. As a result, services that demanded parent or child involvement beyond their capacity or those that induced strong negative responses from children were largely unsuccessful, while cases in which parents could adjust or spend additional time were successful.

Managing children's screen time can also be quite burdensome for parents due to screen time management being a parent's responsibility. In particular, parents have to intervene to manage the content, quantity, and bounds of children's screen time. Parents' concerns from this dissertation align with existing data from a 2021 global survey showing that 87% of parents perceive regulating their children's screen time as their responsibility [136]. Relatedly, the American Academy of Pediatrics recommends parents help develop a family media use plan [7] and set parental controls [6] with healthy limits.

Since screen time management is largely left to parents, participants described using various restrictive and mediatory strategies. Parental controls and time warnings helped reduce the negative impacts of their children's screen time on their health. Parental control apps are one path for which some parent participants manage screen time. Indeed, about 50% of parents use parental control apps [136]. However, screen time management is indeed complex. Complexity is defined as being "made up of complicated or interrelated parts" where

the relationships between the parts are broken or unclear [173]. Indeed, study children used multiple apps and devices with their own settings and controls which are not well connected. Although parental control apps can control the time a child can spend on them and lock the child out via the device parental control itself, these apps cannot control the content visible as each app has third-party owners. Indeed, parents mentioned how content controls are dispersed across applications which makes parental controls especially time consuming (Chapter 4). For example, changing the settings on Roblox to disable chat features does not affect any other online video games the child plays. They also alluded to how digital media is rapidly changing which makes keeping up challenges.

Another aspect of parental burden is the mediation of conflicts related to screen time. Chapter 3 and 4 findings show manipulative design patterns as contributing to extended screen time, difficult transitions, and family conflict, most of which was between siblings. Our findings confirm past scholarship that emphasizes the interpersonal challenge of family screen time management for parents in terms of relationship conflict and miscommunication about device use [34, 63, 48], as well as the burden of content-filtering [113]. We particularly add evidence that while screen time transition conflict was between children and parents, most conflicts related to sharing devices or selecting content occurred between siblings.

This parental burden can be experienced differently amongst parents, especially across advantaged and disadvantaged populations with varying levels of resources and time to spend managing their children's online behavior. Indeed, some parent participants with less time and/or resources did little to intervene in their children's screen time, which could potentially increase children's screen time and/or exposure to inappropriate content without filtering. The diverse samples that supported this dissertation data collection provide unique insights on these burdens, offering more reason for additional embedded digital supports that may alleviate some parental burden.

Overall, this type of parental burden due to inappropriate digital design could be interpreted as another form of invisible work [229]. Inappropriate design could be another way that invisible work arises and this likely emerges due to a lack of user feedback in the design of existing, widely used digital technologies. Thus, additional user testing or feedback through surveys is necessary to ensure that technology designed for children aligns with the needs of families.

5.4 Opportunities for Health-centered, Autonomy-supportive Technology Design for Children

There are immense opportunities for digital technology design to be more health-centered for children. The perspectives of children and parents in this dissertation revealed that health-centered digital technology for children should be autonomy supportive. Indeed, autonomy support in Chapter 2 looked like 1) improved usability in the form of default changes, and 2) the addition of direct and embedded supports, such as one-to-one support and check-ins. Both of which involved various forms of nudging and scaffolding. However, for screen time management more broadly, Chapters 3 and 4 highlight how nudges and controls could help meet these needs. Overall, such changes could center children's health in digital design and potentially lighten caregivers' loads.

This dissertation reveals autonomy support as one mechanism for making digital technology more health-centered, from children's and parents' perspectives. Other HCI scholars have recommended forms of autonomy support for children through various interventions that directly involve children in managing their screen time [257, 113, 118, 10], without acknowledging the broader need for autonomy support for children. To the best of our knowledge, only one other paper has acknowledged this pattern of specific designs that encourage children's autonomy and described it as digital autonomy for children [247]. Wang and colleagues [247] also classified and categorized specific design mechanisms as supportive of children's digital autonomy, including: scaffolding, decomposing, nudging, peer support, and digital playground. Scaffolding and nudging particularly can support children's decision-making in their screen time.

5.4.0.1 Incorporate nudges to reduce the negative health impacts of digital media use and prompt health behaviors

Despite a lack of introduction of the concept of nudges to child participants in Chapter 4, children intuitively designed features that align with nudge theory. This dissertation reveals a need for further study and testing of nudges as a form of autonomy support for children to remind them of their choices. Specific nudges recommended in Chapter 2 involved changed defaults to reduce overstimulation, and the incorporation on-screen prompts for children and providers amidst telehealth sessions to assess comfort. Nudges that children designed in Chapter 4 to facilitate healthy behavior included changed defaults and suggested alternative activity pop-ups to suggest breaks. Children were receptive to nudge designs and had concrete suggestions for enhancing their digital experiences.

These findings on nudge-based designs add the perspective, and interest in nudges, of children in middle childhood to existing work demonstrating the children's acceptability of nudge designs. Adolescents have expressed interest in confront nudges that promote privacy-conscious behaviors [166]. Similarly, research on preschoolers and their parents highlighted the popularity of Coco's Videos, an interface using nudges like timers and activity suggestions to help manage screen time and facilitate offline transitions [118]. Additionally, Silva et al. [222] suggested smartwatch or tablet-based nudges for children with ADHD to help track mood and support self-regulation via reminders and prompts. This dissertation extends this literature to show how nudge-based design should be implemented in design, based on their own perspectives.

Another nudge related design need from this research is the opportunity to offer a greater array of available engagement modalities to encourage health behaviors. For example, Chapter 2 identified how children with behavioral disabilities were limited to engage by speaking and typing, which was not physically interactive. Additionally, children and parents highlighted that more health-centered digital media should incorporate physical activity as a way to engage in video games, with more physical and educational-based content (Chapter 3 and 4).

This work also clarifies the need for digital technology design, including nudges, to appeal to children's strengths, interests, and preferences. Nudges should also appeal to children's strengths, interests, and preferences, as findings from each study convey. In Chapter 2, providers tailored activities to children's interests to make digital activities more engaging. Parents also implemented incentives of additional screen time as a reward for positive behaviors. This confirms past work on the effectiveness of screen time as a reward to positively reinforce children's behaviors [225]. Additionally, parents in Chapter 4 suggested the incorporation of digital incentives that are appealing to children's preferences (e.g., in-game rewards) and children suggested additional screen time. Participants also suggested that alternative off-screen activities should either be selected by children or suggested based on children's preferences.

5.4.0.2 Incorporate Improved Content Controls

Participants in Chapter 3 and 4 also called attention to the need for improved digital media controls of various kinds. Parents thought parental control should be made more centralized and simplified to ease the burden of screen time management. However, these dissertation findings suggest that screen time management is an information problem for parents and children. More specifically, children and parents lack the appropriate information to make age-appropriate content decisions and easily take action.

To help with this problem, participants identified the need for additional information about content that is easy to interpret, such as category tags or age-related content ratings (see Chapter 4). Children and parents agreed that improved content controls with visible and simplified buttons and features, such as a block button or age-related content tags, could help families craft age-appropriate digital media experiences. Child participants largely wanted parental control and wanted to provide input in content-related decision-making in addition to their parents (see Chapter 4). Our findings explain why one existing prototype "We-Choose" for shared content control could be an appropriate mechanism for children in middle childhood to provide input [113]. This prototype was used by children and parents to set content controls by configuring restrictions and filters collaboratively.

Participants also emphasized the need for additional controls in video games to reduce the negative emotional impacts of gaming. Children identified the need for improved platform control in the form of video game moderation due to the negative emotional impacts of griefing in online video games (see Chapter 3). This dissertation highlights children's belief that platforms are responsible for this change. Moreover, children in this research were interested in improved policies around fair player behavior, player reminders of rules from moderators, and consequences for inappropriate behavior. These findings are in conversation with past exploratory research [84] showing that children's interest in automated embodied moderation in virtual reality games to safeguard children's emotions health in virtual spaces. In that work [84], children wanted to customize the appearance of their automated embodied moderator, help with setting rules, and/or to have a say in the decision making, all of which appeals to children's need for competence, relatedness, and autonomy. Thus, additional content controls show promise at reducing negative emotional health implications from screen time.

5.5 Implications for Pediatrics, Policy, and Research

This dissertation has identified that digital technology, designed for adults, often does not meet the needs of children. This poor fit has implications for children's health that require the attention of researchers, technology designers, and policymakers. This dissertation can also inform pediatric screen time recommendations (Chapter 3) and technology policy (Chapter 4) that meet the needs, and acknowledge the perspectives, of children. Findings from this research can influence future research in the domain of children's screen time.

5.5.1 Pediatrics: *Recommendations for Children's Screen Time*

This research provides a nuanced understanding of children's and parents' perspectives of both the negatives and positives associated with children's digital technology use for health. It suggests that existing pediatric screen time guidelines should be updated to reflect the dual nature of digital technology's positive and negative impacts on children's health. For example, playing a video game with peers can positively impact a child's emotional health while simultaneously having a negative impact on their physical health by remaining sedentary.

One way that children and parents recommend managing their concerns is using limits. Children's receptivity to limits suggests that pediatricians should emphasize limit-making, either via parental control or less formal methods like setting timers, for children to begin to self-regulate their screen time. Thus, pediatricians could discuss how to strike a balance in terms of screen time limits, as well as content control.

Additionally, the impacts of content can vary based on a child's age and development. Children and parents described many instances of negative emotional impacts children experience online, from exposure to inappropriate content such as vulgar or violent videos to griefing in video games. To mitigate these risks, pediatricians could emphasize the need for children and parents to discuss the content they interact with online. Developmentally, these studies emphasized the variance in appropriateness. For instance, a Zoom call with a health care provider could be overstimulating for one child and beneficial for another. These findings underpin the necessity for tailored approaches to screen time facilitation and management.

5.5.2 Policy: *The Need for Federal Legislation Protecting Children's Health Online*

The insights provided by this dissertation into the perspectives of children and parents add to a growing chorus [106, 205, 198, 57] indicating the need for robust legislation that centers children's health in digital environments. Participants perceived manipulative design patterns as negatively influencing children's health. They shared various recommendations for reformed digital media design to protect child health. Their nudge-based designs provide insights that could enrich policy in this area.

Existing legislation does not meet the needs of study children and parents who want health-centered digital media design and restrictions on manipulative design *by default.* Furthermore, in contrast to study participants' concerns, most legislation addresses children's privacy, which will be discussed in the next section. While critical, this leaves manipulative design, a major area with implications for child health, left untouched. Some companies

have implemented policies and initiatives to safeguard children's health and privacy online, yet these efforts alone are insufficient. Thus, there is a need for expanded legislation that advocates for health-centered design for children to address participant concerns.

Both company policies and comprehensive legislation should ensure age-appropriate digital experiences and restrict manipulative design practices that negatively impact children. Legislation could begin to address participants' needs by **defining age-appropriate in digital media, restricting manipulative design, and addressing age assurance and verification**. In parallel, technology companies need to implement age-appropriate design policies, protections, and practices. Such actions would mark a significant step forward in centering children's health and privacy online.

In the following sections, I discuss these results alongside proposed and existing policy in the US, the UK, and the European Union (EU), and various technology company initiatives.

In the US, relevant legislation includes the Age-Appropriate Design Code (AADC) in California (CA), Vermont, and Maryland, and the Kids Online Safety Act (KOSA) proposed in the US Senate [238, 252]. The CA AADC was signed into law in September 2022 but put on hold when NetChoice, a tech lobby group, challenged its constitutionality, claiming it infringed on First Amendment rights [8]. Due to these allegations, a judge blocked the law in the Fall of 2023, and it remains under appeal as of the Summer of 2024. The UK's Age Appropriate Design Code has been active since September 2020. UK legislation requires companies to prioritize children's best interests and provide high privacy settings by default. While broad in scope, the EU's Digital Services Act (DSA) was recently enacted in February 2024 with several protections for children online [77].

5.5.2.1 Defining age-appropriate in digital media

Current state-based US policy efforts towards more child-friendly digital spaces have begun with strong principles but appear to stumble in practice. Proposed state-based UK legislation in the US and existing law in the UK do not define or require that technology companies adhere to standards for age-appropriateness. The proposed CA AADC requires online platforms to consider the best interest of children and to set default privacy and safety settings that protect children's health. However, the best interests of children are left to the interpretation of companies. The AADC does acknowledge that digital needs between age groups should vary, but it does not outline what companies can and cannot do. For example, to protect children, the CA AADC suggests that *"businesses should take into account the unique needs of different age ranges, including the following developmental stages: 0 to 5 years of age or "preliterate and early literacy"; 6 to 9 years of age or "core primary school years"; 10 to 12 years of age or "transition years"; 13 to 15 years of age or "early teens"; and*

16 to 17 years of age or "approaching adulthood." However, there is no outline of age-based restrictions for companies to follow.

Similarly, UK legislation leaves companies to interpret how they should prioritize the best interests of children, which makes implementation challenging. Thus, public policy may be necessary to address participants' needs. US policy could encourage age-appropriate and autonomy-supportive design by regulating the types and styles of content delivery and controls that are accessible and understandable by parents and children.

Some technology companies have identified how the age-appropriateness of content varies across age and development, similar to the CA AADC. For example, Google recently announced a policy framework with actions defined to protect "the best interests of young users" [102]. They described the need to create age-appropriate products, provide flexible family management tools that respect children's autonomy and well-being, and implement safety measures across its products [102], including YouTube [258]. Google broadly supports legislation that protects based on age and promotes well-being. For example, the YouTube CEO emphasized the importance of creating a safe and enriching online experience for children and teens that prioritizes their "privacy and well-being" and recognizes "developmental differences" [258]. While Google has advocated for age-appropriate digital media based on age and developmental stage, few others have taken a stance.

5.5.2.2 Restricting Manipulative Design

Study participants believe manipulative design extends use and inhibits transitions from screens. They described the need to reduce the manipulative design patterns facing children on both general audience and child-targeted applications.

Examination of the CA AADC reveals that its approach to design is primarily concerned with data processing or companies' use of children's personal data in ways detrimental to their well-being. The only reference to manipulative design is a stipulation against dark patterns aimed at children. The guidance states that platforms cannot *"(7) Use dark patterns to lead or encourage children to provide personal information beyond what is reasonably expected...to forego privacy protections, or to take any action that the business knows, or has reason to know, is materially detrimental to the child's physical health, mental health, or well-being"* [252]. However, the broader interpretation of negative child impacts from designs encouraging excessive purchases or extended use remains unclear, especially since the law is inactive. Like California, the Age-Appropriate Design Codes in Vermont and Maryland limit design discussions to manipulative design patterns associated with data sharing.

Although proposed state-based legislation addresses data privacy, there is a need for legislation that advocates for health-centered design for children. The most promising existing

bill under consideration in US Congress is the Kids Online Safety Act (KOSA). The KOSA aims to protect the safety of children under 13 online. There is a Dark Patterns Prohibition under Section 4, Article 2, in which it "*shall be unlawful for any covered platform to design, modify, or manipulate a user interface of a covered platform with the purpose or substantial effect of subverting or impairing user autonomy, decision-making, or choice concerning safeguards or parental controls*" [238]. Implementation mechanisms would be necessary to hold platforms accountable for KOSA violations. Overall, the prohibition of manipulative design in KOSA aligns with both the findings of this dissertation (Chapter 4) as well as calls from health leaders [23]. For example, the US Surgeon General just called for technology companies to restrict manipulative designs like auto-play and infinite scroll for children, which he says *"prey on developing brains and contribute to excessive use"* [23].

Like the US, the UK AADC is mainly concerned with data processing. The UK AADC does acknowledge that manipulative designs can extend use, but only *recommends* that technology companies *"recognise a precautionary approach in developing structures and remove addictive capabilities'* [124]. Without a formal position on the impact of manipulative design on children's health and well-being, the UK does not restrict many forms of manipulative design. The UK AADC only prohibits recommendations based on user data *"which make it difficult for children to disengage with your service"*[125]. However, this leaves a gaping hole regarding content displays that extend use, including the endless aspect of video games and infinite scroll, both of which my dissertation research participants found harmful.

While broader in scope, the EU's Digital Services Act (DSA) restricts manipulative design but remains to be enforced. Article 25 of the DSA is promising in terms of intervention in manipulative design as it seeks to prevent online platforms from creating interfaces that "*deceives or manipulates the recipients of their service... or impairs the ability of the recipients of their service to make free and informed decisions* [77]. Yet, this policy does not consider user's ages or highlight the differences between children's and adults' freedom to make decisions.

To address age-appropriate design needs and restrict manipulative design patterns from negatively impacting youth, Google has recently made many changes to protect child well-being online. YouTube implemented additional protections for users under 18 on YouTube and YouTube Kids. These include setting the default upload settings to private for users aged 13-17 [103], with options to change this setting and reminders about visibility. Digital well-being features like "take a break," "bedtime reminders," and turning off autoplay were enabled by default for these users, with the option to turn autoplay back on [101, 103]. Autoplay was also added to YouTube Kids but turned off by default, with new parental controls to lock the setting or turn it on. Additionally, YouTube Kids will remove overly

commercial content, and YouTube will enhance disclosures for paid promotions in content made for kids [101]. Notably, study children reportedly did not experience these nudges on Google products in September or October 2023, likely due to their use of false birth dates or parent profiles. Few other companies have made necessary changes in this space.

5.5.2.3 Addressing age assurance and verification

Although most platforms require that users are 13 years or older to access their application for general audiences, study children mentioned using these applications by entering a false birth date or using their parent's profile. As recommended by child participants, strategies for age assurance and age verification are enormous opportunities for the effective implementation of age-based protections. Age assurance relates to how technology companies estimate or verify a platform user's age.

Age assurance and verification suggestions and requirements vary across global legislation. In the US, the Age-Appropriate Design Codes in CA, VT, and MD omit obligations for platforms related to age assurance. The EU's DSA requires online platforms to implement *"appropriate...measures"* to ensure a high level of *"data protection and safety"* for children, but does not prescribe specific methods of age assurance that must be adopted or situations in which age verification may be necessary. The UK AADC, however, promotes age assurance and provides guidance on various appropriate measures that may be used to establish the age of users, such as simple declaration in low-risk situations or third-party or AI-based tools in high-risk situations [127]. However, the UK AADC does not require age verification.

In light of these issues with implementation, both the US and the UK have identified the need for research and evaluation to address age assurance. If it becomes law, the US KOSA will require various government organizations to study the state of age verification technology and create a report on the most feasible options within one year of the legislation passing. The EU also created a Task Force on Age Verification in January 2024 to study the issue and prescribe steps forward [76]. Global legislation bills will falter in practice without prescribed standards for age assurance.

While existing legislation does not hold technology companies accountable for age verification, some companies have identified the importance of age assurance. For example, Google's recent policy announcement aims to prioritize *"the best interests of young users"* by employing risk-conscious age assurance [102]. For age verification, Meta has implemented new video-based technology to assess users' age when they attempt to change their age on Instagram [175]. To help provide age-appropriate experiences, Meta partnered with Yoti, a company specializing in privacy-preserving ways to verify the age [175].

5.5.3 Research

This dissertation research suggests the need for additional design research with children in middle childhood. Our findings related to nudge-based features and expanded controls should be translated into low- and high-fidelity prototypes to clarify design choices appropriate for implementation. Future work should then use field studies to examine children and parents use the prototypes.

Another important finding is that nearly all child participants in Chapters 3 and 4 believed screen time should involve limits and child and parent controls. Given that middle childhood is a period marked by a shift toward independence [72, 90], children's openness to parental involvement suggests an opportunity for establishing healthy screen time habits. These dissertation findings with children in middle childhood contrast with existing narratives on the prevalence of screen time conflict between children and their parents with tantrums in early childhood [120] and conflict in adolescence [66**?**]. Notably, little research has been conducted in the middle childhood stage on parent-child screen-related conflict. Thus, future studies explore this phenomenon with other diverse groups of children to assess the potential for middle childhood as an appropriate stage for intervention in children's screen time.

Further research should explore how exisiting AI-based interventions used to address technology overuse in adults could also be effective when adapted for use with children and families. While children do not want to be forced to disengage, they are open to receiving suggestions based on their behavior. Thus, children and families are likely to be receptive to adaptive screen time interventions that are tailored to their behavior, similar to *Time2Stop*, a just-in-time adaptive intervention (JITAI) addressing smartphone overuse in adults [188]. A JITAI uses real-time behavioral data to offer timely and contextually appropriate prompts or suggestions. These interventions are 'just-in-time' because they are delivered at moments when they are likely to be most effective. A JITAI could push nudge-based notifications to encourage movement breaks, based in past data. A child's past behavior could be used to personalize the timing and content of the interventions. For example, if a child spends long periods sitting and playing video games, the JITAI could suggest a movement break at strategic times informed by this behavior pattern. However, more research is necessary to fully understand how effective a JITAI and similar interventions could be for children and their families in managing technology children's overuse.

Further study is needed into children's preferences on additional social elements in health-centered digital media. While children described social screen time as having positive emotional health impacts in Chapter 3, child participants did not discuss or add social components to their designs (Chapter 4) to make them more health-centered. The participants were different children who could be satisfied with their social interactions, but this finding

is notable. Their designs for health-centered digital media could have been influenced by children's interpretation of the definition of health or the design prompt presented by the researcher. Regardless, further research could explore whether or not this is an appropriate intervention in children's screen time.

5.6 Strengths and Limitations

My dissertation represents several methodologies used in three studies to evaluate the relationship between technology and children's health from multiple perspectives. This research has several strengths and some limitations.

One strength of this dissertation is its intentional approach to diversity in the perspectives gathered. Specifically, I focus on the perspectives of both children and their caregivers, including parents and non-nuclear families such as those headed by grandparents. Studies also include children with disabilities as a focus (study 1) and the direct participation of children as part of larger samples (studies 2 and 3). The samples also included socioeconomically diverse families. These groups were intentionally included because participants' perspectives likely vary by demographics and family contextual factors (e.g., a healthy routine for an affluent family could be very different from those of a lower-income family). Together, these sampling decisions mean that study findings are potentially applicable in various contexts.

Moreover, they overcome frequent limitations of prevailing research in which such families are often underrepresented. One constraint on the diversity of these samples is the extent to which parents experiencing low income participated in Chapter 2, potentially due to inadequate compensation ($25). To address this, I raised the compensation to $40 in Chapter 4, as it involved in-person participation, successfully improving lower-income families' representation. This compensation change was further justified since children and in-person participation were required. Indeed, the representation of lower-income families increased. Overall, diverse family perspectives offered unique insights into how technology can better suit family needs. Thus, we recommend that future work over-samples the perspectives of socioeconomically diverse families to ensure their experiences are studied.

The dissertation's recruitment methods could have added selection bias with participants who are either comfortable discussing their family's routines and digital activities and/or potentially need compensation. In Study 1 (Chapter 2), our sample of interviewees could have skewed toward those who are more communicative in open-ended survey responses and may not have included parents who have the most trouble communicating with behavioral health providers. Second, my Chapter 2 findings represent the parent perspective, yet there are questions raised that can only be addressed from the perspective of children. Accord-

ingly, my findings and design recommendations from Chapter 2 reflect parent interests and do not thoroughly account for the interests or capabilities of the child care recipients. I worked to mitigate this limitation by eliciting the perspectives of children in both Chapter 3 and Chapter 4 through child-parent dyad interviews and children's design workshops. Finally, self-selection also limited the demographic makeup of non-nuclear families in study 2 (Chapter 3). We enrolled a few grandparents but did not recruit any aunts-, uncles-, or multi-generationally-led households. I did not have access to communities in which multi-generational families cohabiting is more common. Finally, fathers' perspectives are present in both Chapter 3 and 4, yet incomparable to mothers' voices. Chapter 3 taught me more about how to access fathers. Snowball sampling and posting flyers in local children's sports centers supported the recruitment of fathers. We recommend that future research aims to over-sample fathers, using both online (i.e., social media, the university's participant recruitment website) and offline recruitment methods.

5.7 Concluding Remarks

This dissertation investigates the health implications of digital technology use among children in middle childhood, identifying how existing digital designs align or conflict with children's needs. The research highlights the adverse health impacts of such designs, emphasizing the unique challenges faced by children with and without disabilities and the prevalence of manipulative design patterns that contribute to excessive screen time, expose children to age-inappropriate content, and restrict their autonomy. The studies leverage the valuable perspectives of children and their parents to understand these phenomena and propose practical solutions such as nudge-based controls and more effective parental monitoring tools. The findings underscore the need for attention from researchers, technology designers, and policymakers to reformulate practices, revise policies, and develop health-centered technology designs that prioritize children's autonomy and self-regulation. This dissertation emphasizes the impacts technology has on children's health and the importance of autonomy-supportive design to support their self-regulation of screen time, advocating for the inclusion of children's voices in the design process to create technology conducive to their needs.

APPENDIX A

Chapter 2 Appendix

A.1 Participant Questionnaire

Thank you for your participation in this online survey study. All of your responses are confidential and will only be viewed by the research team. Please answer all questions to the best of your ability and provide as much detail as possible in your responses. If you have any questions or concerns, please reach out to the study team.

1. What is your first and last name?
    - **Options:** Fill-in
2. Is your child's school currently open?
    - **Options:** Yes, No, Prefer not to answer
3. In the last few days, how would you describe your child's behavior or behavioral needs?
    - **Options:** Fill-in, Prefer not to answer
4. In the last few days, has your child received any in-person behavioral services?
    - **Options:** Yes, No, Prefer not to answer
    - If yes: What in-person behavioral services has your child received in the last few days?
        - **Options:** Fill-in, Prefer not to answer
    - If fill-in complete: In the last few days, what has been most helpful about these services?
        - **Options:** Fill-in, Prefer not to answer

- If fill-in complete: In the last few days, what has been most challenging about these services?
  - **Options:** Fill-in, Prefer not to answer

5. In the last few days has your child received any remote behavioral services (online, telehealth, etc.)?
   - **Options:** Yes, No, Prefer not to answer
   - If Yes: What remote behavioral services is your child receiving?
     - **Options:** Fill-in, Prefer not to answer
   - If fill-in complete: In the last few days, what has been most helpful about these services?
     - **Options:** Fill-in, Prefer not to answer
   - If fill-in complete: In the last few days, what has been most challenging about these services?
     - **Options:** Fill-in, Prefer not to answer
6. In the last few days, have you had any communication with your child's school about your child's behavior or behavioral needs?
   - **Options:** Yes, No, Prefer not to answer
   - If Yes: Who initiated this communication?
     - **Options:** Someone on behalf of the school (fill-in), myself, other (fill-in), Prefer not to answer
     - Please explain what happened during this communication by including the details that were most important to you (for example, what was said, who was involved, how you felt about it).
   - If No: In the last few days, would you have liked to communicate with the school about your child's behavior or behavioral needs?
     - **Options:** Yes, No, Prefer not to answer
     - If Yes: What would you have liked to talk about with the school?
       - **Options:** Fill-in, Prefer not to answer
7. In the past few days, have you looked for advice online to help with your child's behaviors or behavioral needs while they are at home (e.g. advice forums, online groups, social media, etc)?

- **Options:** Yes, No, Prefer not to answer
- If Yes: What type of advice have you looked for online?
  - How helpful or informative did you find the advice available online?

8. In the past few days, has your child participated in any of the following online activities?
   - Format: Select all that apply
   - **Options:** School work, Educational activities (not assigned by school), online games, Other, None of the above
   - You indicated your child has recently participated in some online activities, what effect have these online activities had on your child's behavior? Please describe.
     - **Options:** Fill-in, Prefer not to answer
9. In the past few days, is there anything else you wish had been available to you or your child, to help with their behavioral needs?
   - **Options:** Fill-in, Prefer not to answer
10. Is there anything else that you'd like to share with us? You may also email our team photos or audio files if they would help you explain how you or your child are feeling.
    - **Options:** Fill-in

A.2 Parent Interview

Personal Background

1. Tell us about yourself and your kiddo.
   (a) Is it okay if we use your child's first name during this interview?
   (b) What behavioral struggles does your child have?
2. Can you briefly describe a typical weekday during quarantine for you and your child?
   (a) How does this compare/contrast to before quarantine?
3. In general, how would you describe your child's behavior during quarantine?
   (a) What has been the most challenging part for you?
   (b) What has been the most challenging part for your child?
   (c) What positives have come out of this experience for you and your child?

Communication/Accommodations

1. You mentioned in previous surveys that you have felt (**Data from Questionnaires:** satisfied, dissatisfied, etc.) with communication with your child's school. How would you describe this communication during quarantine?
   (a) How often did it occur?
   (b) Who did it occur with?
   (c) Formal vs informal communication?
   (d) How helpful was it?
2. How does this compare to your communication pre-quarantine?
3. Based on your recent experiences, how would you change the communication that occurred with your child's school during quarantine? [frequency, type, etc.]
4. You said your child received (**Data from Questionnaires:**) services at school...
   (a) How often did your child receive these services?
   (b) How many of these practitioners did you personally communicate with while your child was receiving them in school?
   (c) How did you communicate with them?
   (d) How often did you communicate with them?
5. Have any of your child's services (both in school and out of school) continued during quarantine for your child?
   (a) Yes - How did these services change to adapt to quarantine? (How often? How did it change?)
   (b) How did you and/or your child communicate with these practitioners?
   (c) How often did you communicate with these practitioners? What did you discuss? Was it helpful? (Frequency- more/less?)
   (d) No - Have you communicated with these practitioners at all? What impact has this stoppage of services impacted your child?

Resources

1. Did you have a need for any resources or support to help with your child's behaviors at home?
   (a) What kind of support did you need?
   (b) Did you look for support / resources online or from friends?
   (c) Where did you look? (i.e. online, friends, support group)
   (d) Did you find anything?
   (e) Yes - What did you find? How helpful was this information?
   (f) What [if any] challenges did you have searching for resources?
2. No - What challenges did you have searching for resources?
3. What [if any] resources did your child's school provide you during quarantine?
   (a) Yes - Behavioral? Technology? Did you ask for these resources? How did you receive them? How helpful were they? What resources do you wish you received from your child's school?
   (b) No - What resources do you wish you received from your child's school?

Reflection

1. What strategies [if any] have you started using to help your child during quarantine?
   (a) Why this strategy?
   (b) Has this helped your child's behavior?
2. What has quarantine taught you about your child?
   (a) How will you use this new information in the future? (i.e. decisions, interactions, strategies, etc.)
3. What has quarantine taught you about yourself (with regards to your child and their behavioral needs)?
   (a) How will you use this new information in the future? (i.e. decisions, interactions, strategies, etc.)
4. What has quarantine taught you about your child's school?

(a) How will this information impact your future interactions with them? (i.e. communications, decisions, needs, etc.)

(b) Moving forward, what information would you like to receive regularly from your child's school?

(c) How would you like to receive this information? From whom?

5. What has completing the questionnaires taught you about you or your child?

6. How will you use this information in the future?

APPENDIX B

Chapter 3 Appendix

B.1 Interview Guide: Parent/Child Dyad

Child Questions

Child Introduction and Rapport-Building

1. How old are you? What grade are you in? Did you have a good summer?
2. Who do you live with? Do you have any other family members that you spend time with but don't live with?

Daily Routines

3. Tell me what you did yesterday (e.g., before school, after school).
   (a) What time did you wake up in the morning? What did you do after you wake up? Do you do this most days?
   (b) What activities did you do last night?
   (c) What did you do before you went to bed last night? What time did you go to bed last night? Do you do this most days?
4. Do you do anything differently on weekends?
5. Do you do anything differently during the summer?

Digital Media Use

(Adapt content as needed) Your parent mentioned that you often use [insert technology]...

6. When do you get to use it? How long do you spend on each?

7. Who do you use it with?
8. Do you talk to friends using [insert technology]?
9. How do you know when it's time to stop?
10. Does it feel like this is healthy for you? Does it make you happy?
11. Do you have rules or limits on how long you can use it?
12. If tracking/smartwatch or parent control, when did this start? How did it make you feel?

Child Health Routines

13. Do you do anything to try to be healthy? If so, what?
    (a) When did you start doing this? Who's idea was it for you to do this?
    (b) How do you feel when you do this? Do you have any fun?
    (c) What is your favorite thing to do to be healthy?
    (d) What is your least favorite thing to do to be healthy? Do you think there is anything that could make you like this more? If so, what?
14. What are some of your favorite things to do to be unhealthy? When do you do this?

Future Technology

15. Imagine you had endless money and help to create a device or technology to help your body and mind be healthy. What would it be?
16. Imagine you had a robot or voice assistant like Alexa at home that could help you with your mental health- how you think and feel. What would it do?
17. Imagine your video games (if applicable) could help your mind and body be healthy. What would it do?
18. What if it could start conversations about activities or help you make decisions on routines? Would you want to try it?

Parent Questions

Family routines and their challenges

1. Since the pandemic, have you started any new health-related activities or routines? Have you ended any old health-related activities or routines?
2. Can you tell me about the last time you both developed a new routine (i.e., physical activity, sleep, technology use)?
   (a) Who created this routine? Why was it created?
   (b) Did you use any tools or technologies to make this routine (e.g., reminders, calendars, internet)?
   (c) How do you both stick to this routine?
   (d) Child: Do you like this routine? Did you help decide to do this activity?
3. You mentioned ___ routines in the survey (i.e. Family Routines Inventory). When did you develop this routine? Why was it created?
   (a) Did you use any tools or technologies to make this routine (e.g., reminders, calendars, internet)?
   (b) Could you describe what makes these activities easier for you?
   (c) Could you describe what makes these activities more challenging for you?
   (d) Do any of these routines involve technology?
   (e) Do you track or write down anything about any of your healthy activities or your child's (e.g. pen/paper, whiteboard,calendar, smartwatch)?

Philosophy on child health/wellness routines, conversations, and negotiation

1. Do you and your child talk about mental health or wellness? If so, how often?
   (a) Are any other family members a part of the conversation?
   (b) When do these conversations occur (e.g., regularly or only if there are problems/changes)? Are there distractions?
2. Do you have any health or wellness goals for your [child]? Does tech help at all?
   (a) Who set these goals?
   (b) What do you do to meet these goals? Who decided on these activities?

(c) Have you tried any strategies to change your child's health behaviors?

(d) Have you seen progress towards your child's goals?

B.2 Child Survey

1. When is your birthday (month and year)?
   Format: Fill In
   Options: Fill in, Prefer not to answer

2. What grade were you in this school year (ending June 2022)?
   Format: Multiple choice
   Options:: 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, Other, Prefer not to answer

3. How do you identify your gender?
   Format: Multiple choice
   Options:

   - Girl
   - Boy
   - Nonbinary
   - I use a different term. I am a: _____
   - I am not sure yet
   - I don't know what this question is asking
   - Prefer not to answer

4. What kinds of technological devices do you use at home?
   Format: Fill-in.
   Options:

   - A cell phone or iPhone, Android, or other device that is also a cell phone
   - Tablet Computer (e.g., iPad, Android, etc.)
   - Desktop Computer
   - Laptop Computer
   - Video Game Console (e.g., Xbox, Switch, etc.)

- Voice assistant/digital assistant
- Smartwatch (e.g., Apple Watch)
- An electronic book device or e-book reader (e.g., Kindle or Sony Digital Book)
- Other: _____
- None
- Prefer not to answer

5. How often do you use each of the devices (from question above)?
   Options:

   (a) Several times a day

   (b) About once a day

   (c) 3-5 days a week

   (d) 1-2 days a week

   (e) Every few weeks

   (f) Less often or never

6. Do your parents/caregivers have rules or limits about the amount of time you spend using screens for these activities?

   - a. Watching TV/streaming video/DVDS
   - b. Playing games on gaming console
   - c. Texting/messaging on phone
   - d. Browsing the internet
   - e. Playing video games on any device

7. Do you have a set bedtime during the school week and weekends? If so, what are they?
   Format: Fill-in
   Options: Fill-in, Prefer not to answer
   School week bedtime: _____
   Weekend bedtime: _____
   Prefer not to answer: ___

8. Do you think that viewing screens is good or bad for your...?

   (a) ...mental health (how you think and feel about yourself and the world around you)?

   (b) ...school work?

   (c) ...sleep?

   Options: Extremely good, Good, Neither good nor bad, Bad, Extremely bad

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Perceived parent-child conflict (children's perspective)

Some parents set rules when it comes to technology.

9. When you now think about your parents or caregivers, do you have disputes or arguments about using a phone?
   Format: Likert scale
   Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

10. When you now think about your parents or caregivers, do you have disputes or arguments about using a tablet or computer?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

11. When you now think about your parents, do you have disputes or arguments about using certain mobile applications, games, shows, or websites?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

12. When you now think about your parents, do you have disputes or arguments about video games?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

B.2.1 Revised Mental Health Inventory-5 MHI-5

We are interested in how you felt lately... **Scale:** 4-point Likert scale from 0 to 3 (0 = never, 1 = sometimes, 2 = several times, and 3 = always)

13. How much of the time, during the last month, have you been a very nervous person?
14. How much of the time, during the last month, have you felt calm and peaceful?
15. How much of the time, during the last month, have you felt downhearted and blue?
16. How much of the time, during the last month, have you been a happy person?
17. How much of the time, during the last month, have you felt so down in the dumps that nothing could cheer you up?

Youth Physical Activity Questionnaire

We are interested in what activities you did during the last week.

18. **Question:**Did you do the following activities in the past 7 days?
    Format: Multiple choice
    Options: Yes, No

SPORTS ACTIVITIES

- Aerobics
- Baseball/softball
- Basketball/volleyball
- Dancing
- Football
- Gymnastics
- Hockey (field or ice)
- Martial arts
- Rugby
- Running or jogging

- Swimming lessons
- Swimming for fun
- Tennis/badminton/other racquet sport

LEISURE TIME ACTIVITIES

- Bike riding (not school travel)
- Trampolining
- Bowling
- Household chores
- Play on playground equipment
- Play with pets
- Rollerblading/skating
- Scooter
- Skateboarding
- Jumping rope
- Walk the dog
- Walk for exercise/hiking

ACTIVITIES AT SCHOOL

- Physical education class
- Travel by walking to school (to and from school = 2 times)
- Travel by cycling to school (to and from school = 2 times)

19. **Question:** Did you do the following activities during your free time in the past 7 days?
Format: Multiple choice
Options: Yes, No

- Art & craft (e.g. pottery, sewing, drawing, painting)
- Doing homework

- Listen to music
- Play indoors with toys
- Playing board games/cards
- Playing computer games (e.g. PlayStation/XBox/Nintendo)
- Playing musical instrument
- Reading
- Sitting talking
- Talk on the phone
- Travel by car/bus to school (to and from school)
- Using computer/internet/tablet
- Watching TV/videos

B.3 Parent Survey

B.3.1 Parent Demographic Questions

1. What is your name?
   Format: fill-in

2. What is your birth month?
   Format: multiple choice
   Options: January (1) - December (12)

3. What is your birth year (YYYY)?
   Format: fill-in

4. Which of the following best describes your relationship to the child?
   If you prefer a term or have a relation that we did not include, please add it under Other.
   Format: Multiple Choice/Fill-in
   Options:

   - Biological Parent

- Adoptive Parent
- Step Parent
- Foster Parent
- Grandparent
- Aunt or Uncle
- Sibling
- Other: _____
- Prefer not to answer

5. What is your gender?
   Format: multiple choice
   Options:

   - Woman
   - Man
   - Non-binary
   - These terms don't describe me. I identify as: _____
   - Prefer not to answer

6. Which of these best describes you or how you currently identify? (Please check all that apply.)
   Options:

- Lesbian
- Gay
- Bisexual
- Bicurious
- Queer
- Questioning or unsure
- Straight / Heterosexual
- Fluid
- Pansexual
- Asexual
- These terms don't describe me. I identify as: _____

7. What is your race? (Check all that apply)
   Format: checked boxes
   Options:

   - White or European American
   - Black or African American
   - American Indian or Alaska Native
   - Native Hawaiian or other Pacific Islander
   - Asian
   - Other. I identify as: _____
   - Prefer not to answer

8. If What is your race? (Check all that apply) = Asian
   If you selected "Asian," with which Asian ethnicity do you identify? (Check all that apply)
   Options:

   - Asian Indian (1)
   - Chinese (2)

- Filipino (3)
- Japanese (4)
- Vietnamese (5)
- Korean (6)
- Other (7) _____
- Not applicable (8)

9. If What is your race? (Check all that apply) = Native Hawaiian or Pacific Islander
   If you selected "Native Hawaiian or Pacific Islander," with which ethnicity do you identify? (check all that apply)
   Options:

   - Native Hawaiian (1)
   - Guamanian or Chamorro (2)
   - Samoan (3)
   - Other (4) _____
   - Not applicable (5)

10. Are you Hispanic, Latino/a, Spanish, or Middle Eastern Origin?
    Format: check all that apply
    Options:

    - No, not of Hispanic, Latino/a, or Spanish origin (1)
    - Yes, Mexican, Mexican American, Chicano/a (2)
    - Yes, Puerto Rican (3)
    - Yes, Cuban (4)
    - Yes, Middle Eastern (5)
    - Yes, another Hispanic, Latino/a, or Spanish origin: _____ (6)

11. What is your child's gender?
    Format: multiple choice
    Options:
    Woman or girl

Man or boy
Non-binary
Prefer not to answer
Prefer to self-describe: _____

12. What is your child's race? (Check all that apply)
Format: checked boxes
Options:

- White or European American
- Black or African American
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander
- Asian
- Other. I identify as: _____
- Prefer not to answer

13. Is your child Hispanic, Latino/a, Spanish, or Middle Eastern Origin?
Format: check all that apply
Options:

- No, not of Hispanic, Latino/a, or Spanish origin (1)
- Yes, Mexican, Mexican American, Chicano/a (2)
- Yes, Puerto Rican (3)
- Yes, Cuban (4)
- Yes, Middle Eastern (5)
- Yes, another Hispanic, Latino/a, or Spanish origin: _____ (6)

14. If you selected "Asian," with which Asian ethnicity do your child identify? (Check all that apply)
Options:

- Asian Indian (1)

- Chinese (2)
- Filipino (3)
- Japanese (4)
- Vietnamese (5)
- Korean (6)
- Other (7) _____
- Not applicable (8)

15. If you selected "Native Hawaiian or Pacific Islander," with which ethnicity does your child identify? (check all that apply)
    Options:

    - Native Hawaiian (1)
    - Guamanian or Chamorro (2)
    - Samoan (3)
    - Other (4) _____
    - Not applicable (5)

16. What is the highest level of education you have completed?
    Format: Multiple choice
    Options:

    - Grade 8 or less
    - Grade 9 to 12 —no diploma
    - High school graduate or equivalent (GED)
    - Some college
    - Associate's degree (for example: AA, AS)
    - Bachelor's degree (for example: BA, BS)
    - Master's degree (for example: MA, MS, MEng, MEd, MSW, MBA)
    - Doctorate or professional degree (for example: MD, DDS, DVM, LLB, JD, PhD, EdD)
    - Prefer not to answer

17. What is your current employment status?
    Format: Check all that apply
    Options:

    - Not employed for pay, not looking for employment (includes stay-at home parents)
    - Not employed for pay, looking for employment
    - Full-time student
    - Part-time student
    - Employed fewer than 10 hours per week (including self-employment)
    - Employed 10 – 29 hours per week (including self-employment)
    - Employed 30 or more hours per week (including self-employment)
    - Retired
    - Not able to work
    - Other: _____

    If participant responded that they are employed in question above:

18. Please answer yes or no to each of the following. When do you usually work?
    Format: Check box
    Options:

    - Some daytime hours between 8 a.m. and 6 p.m.
    - Some evening hours after 6 p.m.
    - Some overnight hours between midnight and 8 a.m.
    - Some early morning hours before 8 a.m.
    - Some rotating shifts
    - Some weekend hours

19. Which of the following categories best describes your current marital status?
    Format: Multiple choice
    Options:

    - Single
    - Married
    - Separated

- Divorced
- Widowed

20. Where do you and your child(ren) currently live?
    Format: Fill-In
    Options: City, State, Zipcode; Prefer not to answer

21. How many people currently live in your household?
    Format: Fill-in
    Options: Fill-in; Prefer not to answer

22. Which family members or relatives, and how many, are currently living in the same household with you? Please check all relationships with respect to your child (e.g., my child's grandparent, great grandparent(s), sibling, aunt, uncle etc.).
    Format: Check boxes
    Options:

    - Biological Mother: _____
    - Biological Father: _____
    - Biological Parent: _____
    - Adoptive Parent: _____
    - Step Parent: _____
    - Foster Parent: _____
    - Grandparent: _____
    - Great-grandparent: _____
    - Aunt: _____
    - Uncle: _____
    - Sibling: _____
    - Stepsibling: _____
    - Other: _____
    - Prefer not to answer

B.3.2 Child Demographic Questions

23. What type of school does your child currently attend?
    Format: Multiple choice
    Options:

    - Private school
    - Public school
    - Charter school
    - Home-school
    - Other (please specify) _____
    - Prefer not to answer

24. Does your child have any of the following diagnosed emotional or behavioral needs?
    Format: Checked boxes, fill-in
    Options:

    - My child does not have a documented emotional or behavioral need
    - Attention Deficit Disorder (ADD)
    - Attention Deficit Hyperactivity Disorder (ADHD)
    - Oppositional Defiant Disorder (ODD)
    - Conduct Disorder (CD)
    - Autism Spectrum Disorder (ASD)
    - Learning Disability (e.g. Dyslexia, Dysgraphia, Dyspraxia, etc.)
    - Anxiety Disorder (e.g. Generalized Anxiety Disorder)
    - Post-Traumatic Stress Disorder (PTSD)
    - Depression
    - Bipolar disorder
    - Obsessive-Compulsive Disorder (OCD)
    - Tourette's Syndrome
    - Eating Disorder (i.e., Anorexia nervosa, Bulimia nervosa, binge eating disorder, Pica, rumination disorder, avoidant/restrictive food intake disorder)
    - Other: Please specify _____

- Prefer not to answer

25. What kinds of technological devices does your child use at home?
    Format: Checked boxes/fill-in
    Options:

    - Smartphone (e.g., iPhone, Android, etc.)
    - Tablet (e.g., iPad, Android, etc.)
    - Desktop Computer
    - Laptop Computer
    - Video Game Console (e.g., Xbox, Playstation, Switch, etc.)
    - Voice assistant/digital assistant
    - Smartwatch
    - eReader
    - Other: _____
    - My child did not use a device
    - Prefer not to answer

26. How often does your child use this device by themselves?
    Format: Options
    Options:

    - Several times a day
    - About once a day
    - 3-5 days a week
    - 1-2 days a week
    - Every few weeks
    - Monthly
    - Every few months
    - I Don't Know

27. How often does your child use this device with other family members?
    Format: Options
    Options:

- Several times a day
- About once a day
- 3-5 days a week
- 1-2 days a week
- Every few weeks
- Monthly
- Every few months
- I Don't Know

Perceived Parent-Child Conflict

Raising children is sometimes a challenge for parents. What is it like for you?

28. Is there a dispute with your child about mobile phone use?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

29. Is there a dispute with your child about tablet use?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

30. Is there a dispute with your child about video game use?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

31. Is there a dispute with your child about certain mobile applications, websites, games, or shows?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

32. Our team will be continuing to study families and health. May we contact you in the future about similar studies?

Format: Multiple choice
Options:

- Yes, please contact me about future participation
- No, I am not interested at this time
- Prefer not to answer

33. Is there anything else that you'd like to share with us regarding this study? **Format:** Fill-in

B.3.3 26 Parenting Styles and Dimensions Questionnaire – Short Version (PSDQ)

Scale: 1 (never) to 5 (always)

- I am responsive to our child's feelings or needs.
- I take our child's desires into account before asking the child to do something.
- When our child asks why (he)(she) has to conform, I state: because I said so or I am your parent and I want you to.
- I explain to our child how we feel about the child's good and bad behavior.
- I encourage our child to talk about the child's troubles.
- I find it difficult to discipline our child.
- I encourage our child to freely express himself/herself even when disagreeing with parents.
- I punish by taking privileges away from our child with little if any explanations.
- I emphasize the reasons for rules.
- I give comfort and understanding when our child is upset.
- I yell or shout when our child misbehaves.
- I give praise when our child is good.
- I give into our child when the child causes a commotion about something.

- I explode in anger towards our child.
- I threaten our child with punishment more often than actually giving it.
- I take into account our child's preferences in making plans for the family.
- I state punishments to our child and do not actually do them.
- I show respect for our child's opinions by encouraging our child to express them.
- I allow our child to give input into family rules.
- I scold and criticize to make our child improve.
- I spoil our child.
- I give our child reasons why rules should be obeyed.
- I use threats as punishment with little or no justification.
- I have warm and intimate times together with our child.
- I punish by putting our child off somewhere alone with little if any explanations.
- I help our child to understand the impact of behavior by encouraging our child to talk about the consequences of their own actions.
- I scold or criticize when our child's behavior doesn't meet our expectations.
- I explain the consequences of the child's behavior.

B.3.4 Family Routines Inventory

Scale: Always- Everyday, 3-5 times a week, 1-2 times a week, Almost never

Workday Routines

- Caregiver(s) have some time each day for just talking with the children
- Caregiver(s) have certain things they do every morning while getting ready to start the day
- Caregiver(s) have a regular play time with the children after coming home from work
- Children do the same things each morning as soon as they wake up

- Caregiver(s) and children play or spend time together sometime each day
- Caregiver(s) and children do something together outside the home almost every day (e.g., shopping, walking, etc.)
- Family has a 'quiet time' each evening when everyone talks or plays quietly

Weekend and Leisure Time

- Family goes someplace special together each week
- Family has a certain 'family time' each week when they do things together at home

Children's Routines

- Caregiver(s) read or tell stories to the children almost every day
- Each child has some time each day for playing alone
- Children take part in activities after school
- Children do moderate to vigorous physical activity
- Children get 10-12 hours of sleep per night
- Children eat healthy foods and minimize sugary/salty foods

School-Related Routines

- Children go to school the same days each week
- Children do their homework at the same time each day or night during the week
- Children seek emotional support from caregiver(s) when they have a bad day

Caregiver(s)' Routines

- Parents have a certain hobby or sport they do together regularly

Bedtime

- Children have special things they do or ask for each night at bedtime (e.g., a story, a good-night kiss, a drink of water)
- Children go to bed at the same time almost every night

Meals

- Family eats at the same time each night
- At least some of the family eats breakfast together almost every morning
- Whole family eats dinner together almost every night

Extended Family

- At least one parent talks to his or her parents regularly
- Family regularly visits with the relatives

Leaving and Homecoming

- Family checks in or out with each other when someone leaves or comes home
- Caregiver(s) come home from work at the same time each day

Disciplinary Routines

- Parent(s) have certain things they almost always do each time the children misbehave

Chores

- Children do regular household chores

B.4 Survey Measure Details

The parent-child conflict measure characterized their conflict when it comes to technology use from parent's perspective, with a scale adapted from [182], (r = 0.57, p ¡ .001; alpha = .71). This measure was also used to characterize children's perceived conflict with their parents when it comes to technology use, with a scale adapted from [182], (r = 0.59, p ¡ .001; alpha = .72).

Daily physical activity was measured using Youth Physical Activity Questionnaire (YPAQ) [52], in terms of the frequency, duration, intensity and mode, over the past 7 days, of both PA and sedentary activities. Original validation work was conducted in England with 12–13-year-olds and demonstrated acceptable validity (rs=0.42, p=0.04). The 5 items selected from the Sleep and Screen Time Questionnaire include ("What kinds of technological devices do you use at home?", "How often do you use the Internet at home on any of

the devices you have?", "Do your parents/caregivers have rules or limits about the amount of time you spend using screens for these activities?" , "Do you have a set bedtime during the school week and weekends? If so, what are they?" "Do you think that viewing screens is good or bad for your...health, school work, sleep?").

APPENDIX C

Chapter 4 Appendix

C.1 Child Design Workshop Protocol

When: Fall 2023
Where: Three local libraries/universities
Duration: 1.5 hours (including ∼20 minutes eating/arrival and icebreaker)

Notes: In keeping with the principles of qualitative research, these questions may evolve through the course of this research, or be omitted. Any relevant information on technology behaviors from the parent survey can be integrated where appropriate.

Welcome + Food + Introduction + Child Assent

Discussion

Digital Media Use

- What do you use the most: YouTube to watch videos? Netflix, Disney+, or Hulu to stream TV or movies? Video games?
- How does watching continuously impact your health and well being? How does it make you feel?

Manipulative Design Patterns

Kids have told us what happens after the autoplay plays new shows or they have played video games for a while without stopping.

- Do any of these things happen when you have been playing video games or watching videos for a while:
  - Forgetting to eat,

  - Not going to the bathroom,
  - Feeling upset or angry,
  - Feeling uncomfortable (pain in your back, neck, head, or eyes),
  - or None of them?

  YouTube and Netflix can continue playing videos for a long time because they have autoplay. This means that at the end of that video or episode of a show, another one plays within 10 seconds. Kids have also described to us how a lot of video games have no "end." They just continue.

- What do you think of autoplay OR how video games do not end?
  - How does playing continuously impact you? How does it make you feel?
  - How good or bad do you think autoplay is your health and well being?
- If you made your own streaming site for friends your age, would you...
  - have autoplay go between the videos?
  - want to be able to turn off autoplay?
- What do you think of video games not having an end?
  - How does playing continuously impact you? How does it make you feel?
  - How good or bad do you think playing continuously is your health and well being?
- If you made your own video game for friends your age, would you make it endless without smaller stopping points?

Small Group: Design Activity

1. Let's split up based on what you do most: play video games, stream TV shows or movies, or watch videos. Form groups of 2 or 3.
2. Take 5 minutes with your group to brainstorm and draw out some ideas for your app could work differently to be helpful for health and well-being.
3. Spend 15 minutes designing.

Line Judging feedback on in-game supports for health and well-being

Instructions for the children: I'm going to ask you if you'd like a technology idea for your health routines. So, move yourself in one direction if you like it, in the opposite direction if you dislike it, or remain in the middle for "unsure." So, would everyone please stand near the middle of the line. When I share an idea, move towards the windows if you think YES you like it, move towards the walls (left) if you think you don't like it, if you're unsure, go in the middle. We will then ask you to raise your hand if you want to share your opinions on the idea. You can stand anywhere on the line to state your opinion and if your opinions changed, you could change your position on the line. We will repeat this process with each new idea. We want to know your thoughts..so there are no right or wrong answers.

Prompt: Imagine you're playing a video game or watching videos. Consider the following scenarios about pop-ups that could appear on your screen. Please reflect on whether you would want such a feature and explain why or why not:

1. A pop-up that sets a **time limit** and locks you out of the device. **Why or why not?**
2. A pop-up suggesting **breaks for activities or things to do**, like:
   - Solving a math problem.
   - Stretching or doing a breathing exercise.
   - Physical exercise, like jumping jacks or push-ups.

   How long should the break be? Why? Why not?
3. Would you prefer such a pop-up **in place of** time limits on screen time or **in addition to** them?
4. Pop-ups that tell you:
   - "Facts" about how breaks from technology can be helpful.
   - "Facts" about the potential effects on a child's body and mind from looking at a screen for too long.
5. How often should these pop-ups be suggested (e.g., after every _____ minutes of playing or watching)?
6. Are there any types of content that should not be interrupted, such as educational activities?

7. If you run out of screen time on an app and ask for more time, would you want the device to tell your parents:

    - What you are playing or watching?
    - The potential benefits of what you're doing for children?
    - Suggestions for how long children in your age group should spend on the activity?

    Why or why not?

8. Should the pop-up mention that you already took a health break and would like more time?

Presentation of Designs to Parents

Children present their design ideas to their parents (5 minutes) and reflect on their work individually (5 minutes).

Field Notes

After each session, researchers will write individual field notes and debrief as a group to discuss insights.

C.2 Parent Focus Group Discussion Guide

Introduction

Thanks so much for joining us. My name is Alicia and I'm a PhD student at the University of Michigan. Olivia and I work with a professor named Tiffany Veinot in the School of Information. We are interested in learning about family routines and the activities that are helpful for children's health and well-being.

Logistics

This conversation will take about 40 minutes, but if you need to take a break at any time, please just let me know. I want to be respectful of your time, so there may be points when I'll need to move the conversation along to another question.

Confidentiality/Consent:

First, participating in this study is completely voluntary, and you can stop participation at any time without penalty. You can also skip any questions that you don't want to answer, whatever the reason, and you don't have to tell us why. If you participate, we'll write down and also audio-record your answers. We'll destroy the recording after it is transcribed. I will keep your name separate from your answers. Anything you share will be used for our team's research purposes and your responses will be kept anonymous.

Discussion Guide:

- Can you tell me about the last time you and your child started using a new app or device?
  - Who created this routine? Why was it created?
  - Does your child do it automatically? Do they ask for it?
  - Did you use any tools or technologies as part of this? (e.g., timers)?
- Could you describe what makes these activities easier for you?
- Could you describe what makes these activities more challenging for you?

Parents, in the survey, you all described how your kids use video games or stream TV shows or movies online. You all reported various things that happen for your children (physically and emotionally) when they engage in video content for a while.

Children in our past work have described their interest in additional support for their health and well-being as part of their use of digital media.

- Do you want technology to incorporate health supports, such as nudges, in their children's digital media use? What kind? How so?
- How should platforms (the video game, YouTube app, or streaming service) be more supportive of child health and well-being or the child's autonomy?
- For those of you who have parental controls, to what extent are you willing to reduce this control of their technology if they receive reminders or suggestions to take a break?

Define dark patterns to the parents.

- For those of you who have parental controls, to what extent are you willing to reduce this control of their technology if dark patterns are eliminated?

Tech-based Scenario: Imagine your child used a video game that suggested things to do while taking a screen break that they would receive throughout the game.

- Is this something you'd download?
  - Yes - why?
  - If not, why not? What would be helpful to you?
- Who would you want to pre-set the options or suggestions that would be offered: you, your child, or the family together?

Conclusion:

That is all of the questions we have for you, do you have any final thoughts? Is there anything I did not cover that you'd like to discuss or that you think I should know? Let's head back to where the kiddos are.

C.3 Parent Survey

1. What is your name?
   Format: fill-in
2. What is your birth month?
   Format: multiple choice
   Options: January - December (12)
3. What is your birth year (YYYY)?
   Format: fill-in
4. Which of the following best describes your relationship to the child? If you prefer a term or have a relation that we did not include, please add it under Other.
   Format: Multiple Choice/Fill-in
   Options:
   - Biological Parent
   - Adoptive Parent
   - Step Parent
   - Foster Parent

- Grandparent
- Aunt or Uncle
- Sibling
- Other: _____
- Prefer not to answer

5. What is your gender?
   Format: multiple choice
   Options:

   - Woman
   - Man
   - Non-binary
   - These terms don't describe me. I identify as: [_____]
   - Prefer not to answer

6. Which of these best describes you or how you currently identify? (Please check all that apply.)
   Options:

   - Lesbian
   - Gay
   - Bisexual
   - Bicurious
   - Queer
   - Questioning or unsure
   - Straight / Heterosexual
   - Fluid
   - Pansexual
   - Asexual
   - These terms don't describe me. I identify as: _____

7. What is your race? (Check all that apply)
   Format: checked boxes
   Options:

- White or European American
- Black or African American
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander
- Asian
- Other. I identify as: _____
- Prefer not to answer

8. If What is your race? (Check all that apply) = Asian
   If you selected "Asian," with which Asian ethnicity do you identify? (Check all that apply)
   Options:

   - Asian Indian
   - Chinese
   - Filipino
   - Japanese
   - Vietnamese
   - Korean
   - Other _____
   - Not applicable

9. If What is your race? (Check all that apply) = Native Hawaiian or Pacific Islander
   If you selected "Native Hawaiian or Pacific Islander," with which ethnicity do you identify? (check all that apply)
   Options:

   - Native Hawaiian
   - Guamanian or Chamorro
   - Samoan
   - Other _____
   - Not applicable

10. Are you Hispanic, Latino/a, Spanish, or Middle Eastern Origin?
    Format: check all that apply
    Options:

    - No, not of Hispanic, Latino/a, or Spanish origin
    - Yes, Mexican, Mexican American, Chicano/a
    - Yes, Puerto Rican
    - Yes, Cuban
    - Yes, Middle Eastern

- Yes, another Hispanic, Latino/a, or Spanish origin: _____

11. What is your child's gender?
    Format: multiple choice
    Options: Woman or girl
    Man or boy
    Non-binary
    Prefer not to answer
    Prefer to self-describe: _____

12. What is your child's race? (Check all that apply)
    Format: checked boxes
    Options:

    - White or European American
    - Black or African American
    - American Indian or Alaska Native
    - Native Hawaiian or other Pacific Islander
    - Asian
    - Other. I identify as: _____
    - Prefer not to answer

13. Is your child Hispanic, Latino/a, Spanish, or Middle Eastern Origin?
    Format: check all that apply
    Options:

    - No, not of Hispanic, Latino/a, or Spanish origin
    - Yes, Mexican, Mexican American, Chicano/a
    - Yes, Puerto Rican
    - Yes, Cuban
    - Yes, Middle Eastern
    - Yes, another Hispanic, Latino/a, or Spanish origin: _____

14. If you selected "Asian," with which Asian ethnicity do your child identify? (Check all that apply)
Options:

- Asian Indian
- Chinese
- Filipino
- Japanese
- Vietnamese
- Korean
- Other _____
- Not applicable

15. If you selected "Native Hawaiian or Pacific Islander," with which ethnicity does your child identify? (check all that apply)
Options:

- Native Hawaiian
- Guamanian or Chamorro
- Samoan
- Other _____
- Not applicable

16. What is the highest level of education you have completed?
Format: Multiple choice
Options:

- Grade 8 or less
- Grade 9 to 12 —no diploma
- High school graduate or equivalent (GED)
- Some college
- Associate's degree (for example: AA, AS)
- Bachelor's degree (for example: BA, BS)
- Master's degree (for example: MA, MS, MEng, MEd, MSW, MBA)

- Doctorate or professional degree (for example: MD, DDS, DVM, LLB, JD, PhD, EdD)
- Prefer not to answer

17. What is your current employment status?
    Format: Check all that apply
    Options:

    - Not employed for pay, not looking for employment (includes stay-at home parents)
    - Not employed for pay, looking for employment
    - Full-time student
    - Part-time student
    - Employed fewer than 10 hours per week (including self-employment)
    - Employed 10 – 29 hours per week (including self-employment)
    - Employed 30 or more hours per week (including self-employment)
    - Retired
    - Not able to work
    - Other: _____

18. Which best describes your family's monthly household income from all sources before taxes?

    - $0 - $999
    - $1,000- $1,999
    - $2,000- $2,999
    - $3,000 - $3,999
    - $4,000- $4,999
    - $5,000 - $6,999
    - $7,000- $8,999
    - $9,000- $10,999
    - More than $11,000
    - Prefer not to answer

19. Which of the following categories best describes your current marital status?
    Format: Multiple choice
    Options:

    - Single
    - Married
    - Separated
    - Divorced
    - Widowed

20. Where do you and your child(ren) currently live?
    Format: Fill-In
    Options: City, State, Zipcode; Prefer not to answer

21. How many people currently live in your household?
    Format: Fill-in
    Options: Fill-in; Prefer not to answer

22. Which of the following best describes your current family structure? **Format:** Multiple choice
    Options:

    - Nuclear family (Two parents living with children)
    - Stepfamily or blended family (Parents living with children)
    - Grandparent family (Grandparent living with children)
    - Single parent family (One parent living with children)
    - Extended family (Multiple generations of family living together)
    - Unconventional family
    - Other (Please specify): [fill-in]
    - Prefer not to answer

23. Does your child have any of the following diagnosed emotional or behavioral needs?
    Format: Checked boxes, fill-in
    Options:

    - My child does not have a documented emotional or behavioral need

- Attention Deficit Disorder (ADD)
- Attention Deficit Hyperactivity Disorder (ADHD)
- Oppositional Defiant Disorder (ODD)
- Conduct Disorder (CD)
- Autism Spectrum Disorder (ASD)
- Learning Disability (e.g. Dyslexia, Dysgraphia, Dyspraxia, etc.)
- Anxiety Disorder (e.g. Generalized Anxiety Disorder)
- Post-Traumatic Stress Disorder (PTSD)
- Depression
- Bipolar disorder
- Obsessive-Compulsive Disorder (OCD)
- Tourette's Syndrome
- Eating Disorder (i.e., Anorexia nervosa, Bulimia nervosa, binge eating disorder, Pica, rumination disorder, avoidant/restrictive food intake disorder)
- Other: Please specify _____
- Prefer not to answer

Thank you. Now, we would like to ask a few questions about your child's technology use at home.

24. What kinds of technological devices does your child use at home?
Format: Checked boxes/fill-in
Options:

- Smartphone (e.g., iPhone, Android, etc.)
- Tablet (e.g., iPad, Android, etc.)
- Desktop Computer
- Laptop Computer
- Video Game Console (e.g., Xbox, Playstation, Switch, etc.)
- Voice assistant/digital assistant
- Smartwatch
- eReader

- Other: _____
- My child did not use a device
- Prefer not to answer

25. How often does your child use this device by themselves?
    Format: Devices from previous question
    Options:

    - Several times a day
    - About once a day
    - 3-5 days a week
    - 1-2 days a week
    - Every few weeks
    - Monthly
    - Every few months
    - I Don't Know

26. How often does your child use this device *from previous question* with other family or other household members?
    Format: Multiple Choice
    Options:

    - Several times a day
    - About once a day
    - 3-5 days a week
    - 1-2 days a week
    - Every few weeks
    - Monthly
    - Every few months
    - I Don't Know

27. Which video content does your child engage weekly or more often? *Select all that apply and please share examples of the games/apps they play games on, and/or the types of videos they watch.*
    Format: Select All, Fill-In

- Video Games [e.g., Animal Crossing, Roblox, Minecraft] [*Fill-In*]
- YouTube videos/channels [e.g., Ryan's World, Cosmic Kids Yoga] [*Fill-In*]
- Movies or TV shows on streaming services [*Fill-In*]
- Cable TV shows [*Fill-In*]
- Other video-based content [*Fill-In*]
- Prefer not to answer
- None of the above

28. How long are typical sessions of: **Reported Video Content**? How often do they occur weekly?
    For example, She plays Minecraft for 30 minutes twice on weekdays - after school and before bed. She watches YouTube videos for about an hour on Saturdays.
    Format: Fill-In

29. Describe the limits (if any) that your child has on those activities and/or the types of games or shows.
    Format: Fill-In

30. Do any of the following occur when your child engages technology for an extended period of time?
    Format: Select all that apply.

    - Forgetting to eat
    - Forgetting to go to the bathroom
    - Feeling upset
    - Feeling angry
    - Feeling uncomfortable (pain in their back, neck, head, or eyes)
    - Acting out
    - Other: _____
    - Prefer not to answer
    - None of the above

Perceived Parent-Child Conflict

Raising children is sometimes a challenge for parents. What is it like for you?

31. Is there a dispute with your child about mobile phone use?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

32. Is there a dispute with your child about tablet use?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

33. Is there a dispute with your child about video game use?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

34. Is there a dispute with your child about certain mobile applications, websites, games, or shows?
    Format: Likert scale
    Options: 1 - "never", 2 - "about once a week", 3 - "several times a week", 4 - "every day"

Parenting Styles and Dimensions Questionnaire – Autonomy Scale

Finally, please tell us about your parenting approach.
Scale: Never, Sometimes, About half the time, Most of the time, Always

35. When my child asks why they have to listen to me, I say: because I said so OR I am your parent and I want you to.

36. I help my child to understand the impact of behavior by encouraging our child to talk about the consequences of his/her own actions.

37. I emphasize the reasons for rules with my child.

38. I punish by taking privileges away from my child with little explanations.

39. I take into account my child's preferences in making plans for the family.

40. I allow my child to give input into family rules.

41. I give my child reasons why rules should be obeyed.

42. I explain the consequences of my child's behavior.

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