

Teen as research-apprentice: A restorative justice approach for centering adolescents as the authority of their own online safety

Neeraj Chatlani^a, Arianna Davis^a, Karla Badillo-Urquiola^b, Elizabeth Bonsignore^c, Pamela Wisniewski^{d,*}

^a University of Central Florida, Orlando, FL, USA

^b University of Notre Dame, Notre Dame, IN, USA

^c University of Maryland, College Park, MD, USA

^d Vanderbilt University, Nashville, TN, USA

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ABSTRACT

We engaged with 21 teens to plan an intergenerational participatory design program called Teenovate for creating teen-centered online safety interventions. Socio-technical solutions for adolescent online safety mostly take on parent-centric approaches, overlooking teens' developmental experiences and growing desires for social autonomy. Therefore, we focused on creating a program which prioritizes strategies and solutions that center teens as the authority of their own online safety. This program would utilize a restorative justice approach, working to combat the historic inequalities that teens have faced in trying to manage their own online safety. We found that teens were intrinsically motivated to participate in a design program that would provide potential career experience and opportunities to make an impact in the field of online safety. Teens also acknowledged the importance of including different perspectives beyond their own in the design process, where contextually appropriate. However, they were also skeptical of being able to meaningfully contribute to the design space, due their lack of technical expertise and fear that adults would ignore or misuse their ideas. Therefore, teens desired an inviting educational space that would guide them into becoming equal contributors by teaching them the needed skills in research and design. Thus, we propose a new design role for teens, research-apprenticeship, based in Youth Participatory Action Research (YPAR), as an approach for balancing the tensions between dependence and autonomy when co-designing. This new justice-centered approach would allow teens to have long-term impact on the outcomes and products of large-scale participatory research programs, as well as keep teens safe online through a new generation of online safety tools created for and by teens.

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1. Introduction

The Human-Computer Interaction (HCI) research community (e.g., Badillo-Urquiola, Shea, Agha, Lediaeva, & Wisniewski, 0000; Ghosh, Badillo-Urquiola, Guha, LaViola, and Wisniewski, 2018; Xiao, Cheshire, & Salehi, 2022) has advocated for more teen-centered approaches for developing adolescent online safety solutions in the early phases of design. This is because adolescent online safety solutions, which typically consist of behavioral approaches and technological assistive features and tools for resolving risky online situations (e.g., cyberbullying, online harassment), have traditionally focused on parental mediation

as the primary means for keeping teens safe online (Baumrind, 2005; Wang, Zhao, Kleek, & Shadbolt, 2021; Wisniewski, Ghosh, Xu, Rosson, & Carroll, 2017; Yip et al., 2017). This approach neglects the fact that teens who are most vulnerable to the most serious online risks (e.g., sexual predation and cyberbullying) are often those who lack engaged and supportive parental supervision both on and offline (Badillo-Urquiola, Abraham, Ghosh, & Wisniewski, 2018; Badillo-Urquiola, Chouhan, Chancellor, De Choudhary, & Wisniewski, 2020). As such, our work, alongside the work of others (e.g., Law, Shapka, & Olson, 2010; Schiano & Burg, 2017) has called for new approaches for engaging youth in research which seek to create more equitable, teen-focused technology. This technology should be grounded in justice-centered design (Beneteau et al., 2020; Roldan et al., 2021) and move away from the paradigm of parental control towards positive adult-teen collaborations and teen self-regulation of their online behaviors.

* Corresponding author.

E-mail addresses: nchatlani@knights.ucf.edu (N. Chatlani), ariannajdavis62@knights.ucf.edu (A. Davis), kbadillou@nd.edu (K. Badillo-Urquiola), ebonsign@umd.edu (E. Bonsignore), pamela.wisniewski@vanderbilt.edu (P. Wisniewski).

To accomplish this goal, it is important to first understand the concept of justice-centered design and how it relates to the research domain of adolescent online safety. Justice-centered design (JCD), within the context of computing, seeks to combat deep societal inequities (e.g., oppression of minorities, labor exploitation, and imbalance power dynamics) that have historically been perpetuated through the design of technologies (Costanza-Chock, 2020; Lachney, Ryoo, & Santo, 2021). In this sense, JCD in the domain of adolescent online safety focuses on addressing the systemic injustices that result from deprioritizing the perspectives and needs of teens in online safety solutions (Badillo-Urquiola, Page and Wisniewski, 2019). As previously mentioned, most online safety interventions shift the responsibility for keeping teens safe onto parents, emphasizing surveillance and restrictive practices. Such approaches prevents teens from having the opportunity and space to understand and manage their own online behaviors and experiences, resulting in them potentially becoming even more vulnerable to online risks (Agha, Anaraky, Badillo-Urquiola, McHugh, & Wisniewski, 2021). Consequently, this lack of trust in teen's ability to mitigate online risk means that more authority is ceded to parents through even more restrictive parental controls, perpetuating this cycle of systemic oppression in deprioritizing teen online safety needs.

In addition to centering our work around the concept of justice, it is also important for HCI and Child-Computer Interaction (CCI) researchers to continually strive to better understand and account for the developmental differences between adolescents, children, and adults, especially when involving teens in participatory research (DeHart, Alan Sroufe, & Cooper, 2000). For instance, participatory design methods, which utilize a democratic, collaborative approach to the conceptualization and design of technologies (also known as co-design c.f., Björqvinnsson, Ehn, & Hillgren, 2010; Cumbo & Selwyn, 2022; Schuler & Namioka, 1993) have successfully been adapted for developmentally appropriate use with younger children (ages 7–11). When implementing these techniques with teenagers, prior research in HCI and CCI (c.f., Ashktorab & Vitak, 2016; Badillo-Urquiola et al., 2020, 0000; Bonsignore et al., 2016; Danielsson & Wiberg, 2006; Iversen, Dindler, & Hansen, 2013; Mazzone, Read, & Beale, 2008) has shown that adolescents are quite different to work with than younger children. Therefore, participatory design methods currently used to engage children may not always be well-suited for teens. To address these challenges, we engaged directly with teens to understand how they would want to develop an intergenerational participatory design program for teens specific to adolescent online safety — called the Teenovate Program. The following high-level research questions guided our inquiry:

- **RQ1:** *What considerations should be made when building a participatory design program for teenagers for the specific goal of promoting adolescent online safety?*
- **RQ2:** *What are the potential challenges associated with making such a program justice-centered?*

To answer these research questions, we conducted focus groups with 21 teens (ages 13–17) in six groups of two to four teens, who took part in a Zoom-based (due to COVID-19) study that consisted of three parts: (1) a focus group discussion on teen perspectives of online safety compared to their parents, (2) a brief co-design exercise where teens designed approaches for resolving a potential online “stranger danger” scenario, and (3) a structured Question and Answer (Q&A) activity to identify their preferences regarding the logistics of building the Teenovate Program.

Overall, we found that teen participants wanted a program that appealed to their unique developmental needs, focused on their desire for practical tools and features to address the most concerning online risks that affected their offline lives, but that

also treated them as mature individuals capable of independently addressing their own online risk situations. Teens were excited about the prospect of participating in a program that would allow them to have an impact on the way that all teens resolved online safety risks, and not just themselves. However, our participants also had several concerns related to their needs to ensure that such a program would center their voices as the most knowledgeable authority of their online safety experiences. For instance, they were concerned about imbalanced power dynamics that could hinder adult-adolescent collaborations, feeling that having adults (especially parents) involved in the design process could lead to their own ideas being deprioritized in favor of parent-focused measures that would take away from their freedoms and even harm teens. Teens also expressed skepticism of adults' intentions, relating experiences of how their own perspectives on online safety were considered by their parents and other adults. However, they also acknowledged that the gap in their own technical skills limited their potential to contribute equally. Furthermore, they were skeptical of other teens' ability to meaningfully commit to a program. Importantly, teens not only had clear ideas of how they wanted to design safety solutions for the risks that mattered most to them, but also wanted the program to extend their roles beyond design work. They desired end-to-end, long-term involvement, from working alongside researchers to design technology features, to co-managing of the program itself, and even sustained involvement after the design phase to see how their ideas evolved into tangible initiatives for improving online safety. Based on our findings, this research makes the following novel contributions to the adolescent online safety literature, and more generally, to the HCI and CCI research communities focused on justice-centered design:

- Insights into how teenagers' motivations to participate in design programs as practical, long-term change makers can be leveraged to improve the approach and incentives for these programs.
- Discussion of the challenges that can be faced when ensuring that participatory programs with teens maintain a justice-centered approach that emphasizes the hierarchal imbalances that youth often face when attempting to affect change, and potential solutions for ensuring that teens are treated equitably in these programs.
- A proposal for a new paradigm for engaging youth within participatory research programs, called “research-apprenticeship”, which will be uniquely applied to our program's goals of collaboratively developing impactful adolescent online safety solutions with teens. As research-apprentices, teens will be trained critical skills in User-Centered Design (UCD) research (e.g., study design, qualitative analyses) and User Experience (UX) (e.g., storyboarding, high-fidelity interactive prototyping) to become effective researchers and designers, with the goal of pushing the boundaries of PD into the realm of YPAR. Through the research-apprenticeship model, teens will be equipped to tackle important problems of adolescent online safety alongside adult researchers to create tangible, impactful online safety tools for teens, by teens.

2. Background

We situate our paper within the domain of adolescent online safety and build a case for why participatory design methods are well-suited to address the challenges associated with initiatives to promote adolescent online safety.

2.1. The Socio-technical design gap within adolescent online safety solutions

It is generally acknowledged that adolescence is a time of independence-seeking and risk-taking, where adolescents use online interaction and social media as a way of exploring social boundaries (Badillo-Urquiola et al., 2018, 2020). In some instances, preventing such experiences can actually be harmful and stunt developmental growth as teens strive to individuate themselves from their parents and mature into young adults (Badillo-Urquiola et al., 2018, 2020). The long-term goal of design-based interventions for online safety should be to guide youth in effectively managing online risks as they transition into adulthood, not just shield them from any and all online risks (Wisniewski, Carroll, Xu, & Rosson, 0000). Yet, this developmental perspective of healthy risk-taking and exploration seems to be lost when it comes to the state-of-the-art technologies developed for promoting adolescent online safety. These technologies tend to prioritize parents' abilities to monitor and restrict teens' online activity, firmly centering the power to control and resolve online risk situations in their hands, while also reducing the ability of teens to socialize and interact autonomously online (Ghosh, Badillo-Urquiola, Guha et al., 2018; Ghosh et al., 2018; Wisniewski et al., 2017). In the long term, this results in a paradigm of authoritarian control, where unique adolescent online safety needs are ignored in favor of parent-centered technology designs (Ghosh, Badillo-Urquiola, Guha et al., 2018; Ghosh, Badillo-Urquiola, Rosson et al., 2018; Wisniewski et al., 2017). As such, there is a sociotechnical design gap between what we know about healthy adolescent development and current systems designed to support adolescent online safety.

To bridge this gap, we take a justice-centered design perspective. JCD is innovative and well-suited, in this case, in that it shifts the primary mechanism for protecting teens online from an over-reliance on parental control to a focus on teens' self-regulatory behaviors (Fails, 2012). To move towards teen-centric and justice-centered online safety solutions, we must work directly with adolescents to create technologies that meet their developmental needs. Thus, we argue that teens must play a pivotal role in the design and development of the online safety interventions that are supposed to protect them from online risks. As such, we have built a Participatory Design (PD or co-design) program called "Teenovate", which aims to give teens a voice as the central authority on their own online safety experiences, by working together with teens to design and develop new online safety solutions which appeal to their specific developmental needs and unique online risk experiences.

2.2. Addressing the design gap in adolescent online safety through participatory design

Participatory Design (PD) approaches are well-established within the field of HCI (Costanza-Chock, 2020; Cumbo & Selwyn, 2022; Muller & Kuhn, 1993) and involve engaging end users directly in system/technology design. In the late 90's, a PD paradigm called "Cooperative Inquiry" (CI) was created (Druin, 1999) to place younger children (7–12 years old) as full partners with adults in the design process. The goal of CI is for teams of adults and children to collaboratively generate, share, iterate, and evaluate ideas in ways that compensate the cultural and communicative differences between generations as well as differences in developmental ability (Fails, 2012). Developmentally, teens are in the process of individualizing themselves from their parents: they need and desire autonomy, agency, and empowerment to make important decisions on their own and to reflect and learn from their mistakes (Dahl, 2004; Danielsson & Wiberg,

2006). Conversely, teens also lack the maturity of adults, so a guided partnership between CI researchers and teens could be highly beneficial (Yip, 0000). However, while CI has typically been employed to co-design technologies with young children (e.g., Clark, Ahmed, Metzger, Walker, & Wylie, 2022; Doorn, Gielen, & Stappers, 2014), it has not yet seen wide adoption within teen populations (Fitton, Read, & Horton, 2013; Mazzone et al., 2008).

Challenges of advancing CI's goal for equal partnership with teens so far lie in the mismatched developmental appropriateness of its techniques and the level of decision-making responsibility afforded to teens. CI historically has given its focus to catering to design environments suited for young children. As pre-teens (ages 9–12) begin to explore their social boundaries and demonstrate some risk-taking behaviors to gain a better understanding of themselves (McNeely, 0000), they mature into teens (ages 13–17), who have a better developed a sense of personal responsibility and self-regulatory abilities that allow them to better judge unsafe situations and find ways to mitigate risk or seek support (Dahl, 2004). Teens are in a unique position in which they are neither children nor adults. Thus, core questions remain—what PD/CI approaches should be used with teens, in what setting these studies should take place, and how should adult designers engage teens?

Prior works have shed some light on this question. For example, Bonsignore et al. (2016) observed that teens disparaged low fidelity prototyping techniques commonly employed with child co-designers, preferring peer interviews and videography that teens themselves controlled. Similar studies with teen populations (Danielsson & Wiberg, 2006; Poole & Peyton, 2013) have noted that focus groups and peer interviews formats yield more input from teens, likely due to developmental needs of adolescents for social support and peer interaction (Poole & Peyton, 2013). Relatedly, Knudtson et al. (2003) worked with a group of children between the ages of 10–13 and found that power imbalances between adults and the older children hindered the design process significantly, with older children focusing more on finding "the right answers", unlike the unhindered imagination of the younger children. Ashktorab and Vitak's study on cyberbullying prevention (Ashktorab & Vitak, 2016) focused on the highlighting of teens' experiences with cyberbullying and ways in which co-design could be utilized as a way of discussing a sensitive topic, and working together with adults to design possible mitigation tools. Their findings highlight the need to consider new approaches that engage teens in developmentally supportive ways (Fitton et al., 2013). With these new approaches, there is also a need to more clearly define the roles, responsibilities, and freedoms that teens will have within these projects. Bowler et al.'s review of co-design with children highlights the importance of ensuring that *all* roles are defined, both for participating children and adults, while maintaining transparency of how youth participation affects final designs (Bowler, Wang, Lopatovska, & Rosin, 2021). However, it remains to be seen how these practices can be further developed, through a justice-centered framework, into a long-term paradigm for working with teens to design online safety solutions on an equal footing with adult researchers.

2.3. Embedding restorative justice within Socio-technical solutions for adolescent online safety

In seeking a justice-centered approach to a design program focused on adolescent online safety, we turn to established justice frameworks and their applications to online environments. Restorative justice is generally considered an alternative justice approach and is centered on understanding the harm inflicted

on victims by specific offenders, understanding how communal relationships are affected by this harm, and taking steps to repair the harm caused. This process involves various stakeholders within communities around victims, to restore a sense of equilibrium through communication and appropriate reparations (Pranis, 2015; Zehr, 2015). In particular, Xiao et al. build on the idea of restorative justice and possible applications to adolescent online harm in order to improve long-term outcomes for youth (Xiao et al., 2022), noting that past applications of this framework to youth situations have yielded positive social developmental outcomes (Karp & Breslin, 2001; Katic, Alba, & Johnson, 2020). Their findings show that young victims of online harm depend on familial and interpersonal relationships in resolving online safety issues, and required time to process and understand the nature of the harm inflicted on them, along with possible paths for remediation. Restorative justice may prove useful in determining how youth's social environments can assist and take part in the harm reparation process, by centering the needs of online harm victims (youths) and designing solutions with their needs in mind, over time (Xiao et al., 2022).

This restorative justice approach applies well to the problem space of online safety solutions for youth, where technology developers and parents, in this case, have inadvertently become offenders of teens as they attempt to keep them safe from direct offenders online. The current trend of parent-focused online safety technologies and apps center the majority of decision-making power and online risk resolution to adults/parents, depriving teens of the ability to fully control their own online safety, and causing increased tensions between parent and teen (Badillo-Urquiola, Page et al., 2019; Ghosh, Badillo-Urquiola, Guha et al., 2018). As we work to develop a program that employs restorative justice, we consider the elements of this justice framework as they apply to the current relationship between teens and intervening adults. In order to reconcile the harm that has been cause to teens, they must be allowed the opportunity to process and then express their understanding of the injustice that they have experienced (i.e. lack of ability to regulate the safety of their online experiences). We build on this restorative justice approach by envisioning a participatory design program where teens work together with researchers to determine their own online safety needs, and then translate those desires into prototyped safety solutions. Furthermore, by involving a variety of stakeholders within teens' social circles, such as friends, parents, or teachers, we may work to build a communication space where teen participants can discuss their perspectives and frustrations over the current state of adolescent online safety. Thus, we embarked to answer our over-arching research questions on how such a program should be built and how to make it justice-centered. Next, describe our study, which seeks to gain this understanding.

3. Methods

Below, we provide an overview of our research methodology, including our study design, participant recruitment and demographics, and data analysis approach.

3.1. Study overview

Our study consisted of six focus group sessions with a total of 21 teens. Each session had up to four teens, alongside three adult researchers (e.g., Ph.D. student, M.S. student, and undergraduate student). The study took place on the virtual conferencing platform Zoom (0000) due to social distancing requirements during the COVID-19 global pandemic. Each session lasted approximately 2 h. Sessions were facilitated using AhaSlides (0000), an online interactive slideshow that allowed participants to submit

anonymous responses in the form of voting or open-response short answers depending on the question prompt. We chose to leverage anonymous feedback to facilitate honest conversations. To start the session, the entire team participated in an ice breaker activity where everyone stated their name, grade-level, and a fun fact about themselves. The research activities consisted of three main parts, also illustrated in Fig. 1:

- (a) A discussion where teens shared their thoughts on the current state of adolescent online safety, first through anonymous submission via AhaSlides (Fig. 1a) and then through open discussion. Discussion prompts focused on past online safety experiences, knowledge of current online safety approaches and the ways in which they typically resolve online risks, and their opinions on online safety from a teen-centered perspective.
- (b) A brief introduction to participatory design through a practice PD exercise (Fig. 1b), where teens first reviewed a storyboard made for a "Stranger Danger" scenario on Tik Tok, inspired by prior work (Badillo-Urquiola et al., 2019). The scenario featured a situation where a young girl was contacted by a stranger, who appears to be a young boy, and begins to ask for personal information. Zoom's whiteboard feature was then used to conceptualize online safety features that would help address the scenario. Afterwards, we compared participants' design ideas with the younger children's designs from the prior work (Badillo-Urquiola, Smriti et al., 2019), and discussed the differences between them.
- (c) A Q&A activity with brief discussions to plan high-level goals and low-level logistics of the Teenovate Program. Questions ranged from who should participate in the program, scheduling, incentive structures, and more. Some questions were short response, while others asked all participants to vote from a subset of pre-defined options (Fig. 1c) with an option to select "Other" and expand on their thoughts during the discussion.

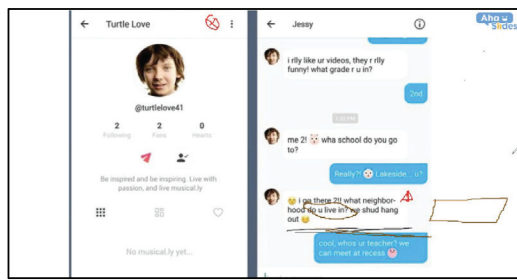
Prior to participation, we obtained parental consent, as well as teen verbal assent. The study was approved by the UCF Institutional Review Board. The study concluded with a brief post-survey to collect feedback about the session and the demographic information of participants. Each teen received a \$20 Amazon gift card for their time.

3.2. Participant recruitment and demographics

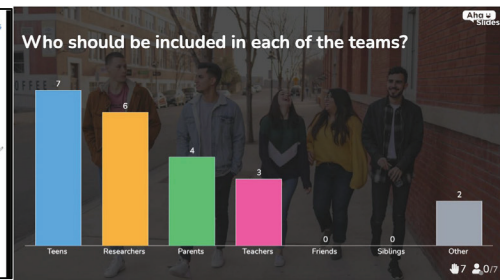
To recruit teens, we launched an email outreach campaign to various youth-serving organizations throughout the state of Florida between March 2020 to August 2020. The organizations provided the recruitment flyer to parents and youth members. Once a parent electronically consented to their child's participation in the study, we first scheduled a 15-min phone call with the teen to obtain the teen's verbal assent to participate in the study, ensure the teen could connect to Zoom and AhaSlides, familiarize the teen with the features of each platform, and schedule them for the research session. Overall, we recruited 21 participants for this study (see Table 1). Each session group was randomly formed from available participants as recruitment progressed and flexibly scheduled to accommodate participants as necessary. Teens were 13 to 17 years old ($M = 15$, $SD = 1.2$). A little over half identified as male (57%, $N = 12$) with the remaining teens identifying as female (43%, $N = 9$). We had a diverse group of participants that identified as Asian (29%), Hispanic/Latino (24%), White/Caucasian (19%), Black/African American (19%), multiple races/ethnicities (10%), or chose not to respond (10%).



(a) Open Discussion about Adolescent Online Safety and Risks



(b) Co-design Exercise



(c) Q&A Activity

Fig. 1. Screenshots of Zoom and Aha Slides for the three phases of the study.

Table 1
Participant demographics.

Session	ID	Age	Gender	Race/Ethnicity
S1	P1, P2, P3, P4	16, 14, 14, 16	Male, Male, Female, Female	Black/African American, None Selected, None Selected, Black/African American
S2	P5, P6	13, 16	Male, Male	Hispanic/Latino, White/Caucasian
S3	P7, P8, P9, P10	15, 14, 16, 15	Female, Female, Male, Female	Asian, Black/African American, Asian, Hispanic/Latino
S4	P11, P12, P13	15, 14, 17	Female, Female, Female	Asian, Asian, Asian
S5	P14, P15, P16, P17	16, 17, 15, 17	Male, Male, Male, Male	Black/African American, White/Caucasian & Hispanic/Latino, Hispanic/Latino, White/Caucasian
S6	P18, P19, P20, P21	17, 14, 14, 14	Female, Male, Male, Male	Asian, White/Caucasian, White/Caucasian, White/Caucasian & Hispanic/Latino

3.3. Qualitative data analysis approach

All Zoom sessions were audio and video recorded and transcribed verbatim for later analysis. We also retained participant responses from Aha slides. We conducted a grounded thematic analysis (Braun & Clarke, 2006) to answer each of our research questions based on the transcripts of the recorded Zoom sessions, the Aha slide responses, and design-based artifacts from the co-design exercise. To center our findings on teen voices, all responses from adult researchers were omitted from our analysis. First, each coder (first and second author) reviewed all the transcriptions individually to familiarize themselves with the data and generate preliminary codes and themes. Then, they met weekly to iterate over the codes and began clustering codes to develop an initial codebook (SpringerLink, 0000). During this time, the third and last authors provided high-level feedback on the coding process and codebook to help conceptually group the codes into cohesive themes. After iterating on the codebook, we

identified the final subset of emergent themes that aligned to our research questions, shown in Table 2, which consisted of codes that explored teens' motivations and hesitations when it came to participating in the proposed program.

4. Results

In this section, we present our findings from our analysis of teen participant responses and overall themes that correspond to our research questions. First, we detail high-level information from the teens concerning the logistical details for the structure of the PD program. Second, we present our participants' desires and requirements for participating in a PD program focused on adolescent online safety (RQ1). Finally, we describe the emergent challenges associated with making such a program equitable, approachable, and justice-centered for teens (RQ2). In these results, we use illustrative quotes as exemplars of the teen participants' perspectives. Each quote is attributed to the

Table 2

Final codebook for grounded thematic analyses.

RQ	Themes	Sub-Themes	Exemplar Quotes
RQ1 Considerations for participatory design with teens for online safety	Teens want extrinsic rewards that are tied to their intrinsic motivations for participating (90%, N = 19)	College preparation	"Something to like put on your college applications. It's like an extracurricular activity...on college applications, that can say like we actually helped with this technology"
		Helping other teens	"You know, helping kids not have their lives ruined"
		Self-fulfillment of participation	"The reason why I did this is because I wanted to do it"
	Teens desire practical online safety solutions for Real-life risks (90%, N = 19)	Preventing real life consequences	"I'd say that probably the [most severe risks] that involve like personal information... Since it doesn't just really affect your computer, it affects your entire life."
		Wanting proactive rather than reactive solution	"I think there should be stricter reporting consequences. If something gets reported it should be like immediately hidden...because other people might see it."
		Getting support when they need help	"It's when things get out of hand, like on the illegal side of things... That's when you get a parent and whatever authority involved."
	Teens want online safety designs That Treat Them As Mature Individuals (85%, N = 18)	Teens value privacy	"Teens are more—more private with conversations. I think we value privacy a lot more than little kids."
		Teens value independence	"Teens want to be able to have the freedom of choosing how to respond to the situation...and can develop some sort of independence."
		Teens don't want Child-Oriented Solutions	"Think that the menu for stranger danger is maybe too simple because it doesn't tell you enough...I'd like something a bit more advanced."
	RQ2 Challenges with making teen online safety design programs Justice-centered	Teens value others' viewpoints, but Want designs to remain teen-centered (85%, N = 18)	Inclusion of others' perspectives
Adults must make space for teen voices			"I liked how you guys made us feel that we can be honest; that there's no right or wrong answers"
Don't want teens designs used against teens			"If some of the technology we make here is going to be used against us...I'd rather just not design it."
Teens want to be the final authority of their own online safety solutions, not Adults (71%, N = 15)		Seeing projects through to the end	"I would be okay with being part of the program for an extended period of time because it makes it feel like you're being part of the solution"
		Involvement beyond design	"People feel big and important when they are like participating in collegiate level research and not just being like a test subject, but actually involved in, like development"
Teens are skeptical of other Teens, Adults, and their own design knowledge(71%, N = 15)		Skeptical of other teens	"Maybe teens lacking interest in the subject, like after time. Like they might lose interest."
		Skeptical of adults	"You might be worrying about what you'll say and whether [parents] will use it against you in the future. You don't know if they'll tell your parents."
		Skeptical of their own design skills	"I was thinking that they might feel comfortable, but they just don't know what to do if you're not tech savvy enough."

speaker using their participant ID followed by the gender and age (e.g., "P1, 16-year-old Male").

4.1. Logistics of a teen-centered online safety participatory design program

At the beginning of the Q&A Activity to determine how the Teenovate program should operate, we asked several questions pertaining to the basic details of the program's regular operation. This included questions on which stakeholder should be a part of the program's activities, when meetings should take place (to accommodate teen schedules), and how teen participants should be rewarded for their participation. We summarize teens' responses to those questions in this section. Regarding whom should participate in the Teenovate Program, in addition to teens (90%, N = 19) and adult researchers (86%, N = 18), some teens also said parents (71%, N = 15) should have a place on the design team. While this was surprising to us given the power differential between teens and parents, they explained that parents are often considered users of online safety technologies, and therefore could contribute opinions and experiences distinct from teens. However, some teens opposed including parents "because you might be worrying

about what you'll say and whether they'll use it against you in the future," – P13 (17-year-old Female).

About half of the participants also wanted teachers (52%, N = 11) on the team, since they felt teachers may also have different experiences and perspectives on teen interaction and social media. Fewer teens suggested friends (43%, N = 9), who reasoned that familiar faces would make the space more comfortable. However, other teens opposed this suggestion, concerned that too many familiar faces could create groupthink.

To decide when the program should meet, the participants had to determine which semesters the meeting dates should fall under, the frequency of these meetings, and how long these meetings should last. There was near unanimous agreement among teens that design sessions should take place during the summer (100%, N = 21), occur bi-weekly (90%, N = 19), and last approximately 2 h (100%, N = 21). Overall, the teens explained that they were just too busy during the academic year, though some teens (N = 7) did express interest in meeting during the school year, if necessary. The teens and researchers settled on the possibility of intermittent cohorts, where some teens participated during the academic year, with the majority engaging during the summer. Participants noted that they did not want to meet too

infrequently, fearing that they would lose momentum in their progress.

Another programmatic issue we discussed was compensation. The teens seemed hesitant to ask for too much money, with most stating that a \$20 gift card (62%, $N = 13$) was appropriate, explaining that it was worth the amount of gas it took to transport themselves or similar to what they would receive at a job for that duration. Others were fine with a gift card worth \$10 or less (39%, $N = 7$), a \$15 gift card (29%, $N = 6$) or a gift card worth more than \$20 (24%, $N = 5$). They preferred either an Amazon gift card or a Visa gift card, since either card allowed them the most variety to purchase what they wanted on their own time. Upon further discussion, however, many preferred non-monetary rewards, like volunteer hours (81%, $N = 17$) as an alternative. The participants explained that earning volunteer hours opened doors for monetary gain in the future such as using them to apply for scholarships or to fulfill extra-curricular activity obligations. Even if they were not able to gain volunteer hours from participating, proof of participation alone was deemed enough to enhance their college resumes with a unique experience that had an impact on the world. We discuss these considerations further in our thematic analysis for RQ1.

4.2. Considerations for participatory design with teens for online safety (RQ1)

In this section, we describe the ways in which teens wanted their possible rewards to be tied to their motivations for participating in design programs, their desires for practical online safety solutions, and the tailoring of these solutions to fit their own unique perspectives.

4.2.1. Teens wanted extrinsic rewards that are tied to their intrinsic motivations for participating

When teens talked about their motivation to participate in the program, few teens seemed interested in physical or monetary rewards, such as gift cards. In fact, most of the teens (79%, $N = 16$) saw extrinsic rewards as a bonus to their participation, rather than an incentive. Their intrinsic motivations, such as their future career goals and helping other teens, were the main reasons many teens said they would participate in the program. Some teens even felt that compensating teens for their time would send the wrong message:

"When you associate monetary compensation with it, you're communicating that this is a job in a way... But if you say no compensation, then you're communicating that the only reason why any of [us] are here is because [we] genuinely care about this issue, or [we] want to learn, or [we] want to have some type of academic experience." – P9 (16-year-old Male)

Whenever teens talked about extrinsic rewards, it was often tied to an intrinsic value. For example, the teens expressed a desire for rewards that aligned with their **college preparation** goals. Therefore, volunteer hours became a major extrinsic draw to participate. Teens stated they could use these volunteer hours to fulfill college scholarship requirements like the Fullbright Scholarship provided to students within Florida, or to fulfill obligations as members of extra-curricular clubs like the Boys Scouts. It was also important to these teens to be able to have extra-curriculars to add to their college resume. Teen participants felt that the program had the potential to be a unique and impactful activity to add to their resume, as a scholarly, college-focused experience.

"I just want to be able to put that on my college resume and say that I didn't do nothing over the summer. I actually wanted to help better protect teens from all the dangers on the internet and stuff like that." – P21 (14-year-old Male)

This shows the intrinsic motivation behind their desire for resume-worthy experience. Additionally, these teens wanted to **help other teens**, having recalled their own experiences with scams, strangers, and other internet dangers, or knowing others who have encountered more severe online risks *"and whose lives have been ruined because of it."* These teens would be motivated to join the program with the hope of helping spread useful information on ways to stay safe or creating preventative measures that keep future teens from experiencing harm. They also believed that participating would bring them a feeling of **self-fulfillment**, in part because they felt a sense of satisfaction knowing that they would be a part of an effort to solve a grand societal issue since, as one teen put it, *"when things are wrong, you have to make them right."* The other source of this feeling came from the learning experience to acquire new knowledge and skills was worthwhile for its own sake.

While many teens expressed a strong desire to participate in the program, they often found themselves at odds when considering the demands of other extra-curricular activities they were already involved in, which they tended to perceive as more valuable than participation in a new program. This was especially the case for older teens who were pursuing extracurriculars with college applications in mind.

4.2.2. Teens desired practical online safety solutions for Real-Life Risks

A common theme expressed among the teens was how their experiences with online risks inform the safety problems they would want to design for within a participatory program. These teens were most concerned about online risks that could result in severe harm to their physical, mental, personal, and social well-being (90%, $N = 19$), and thus were most interested in designing online safety technology that could **prevent irreversible real-life consequences**. For example, some of teens feared being 'doxxed', where their private information, like phone numbers or physical addresses, would be made public:

"...Getting doxxed is quite possibly one of the worst things that can happen... I've seen people give out like emails and Social Security. It's like, their life is ruined. You can't do too much about it once it's happened." – P17 (17-year-old Female)

The participants were also interested in creating designs that improved upon existing online safety features so that teens in the future would be able to utilize **proactive rather than reactive solutions**. They criticized many of the existing online safety measures, like blocking and reporting features. Teens with experience reporting user in the felt uncertain that their reports were being acknowledged by online platforms and did not feel that enough effort was being taken to prevent the offending user from continuing to harm them or others in the future. Teens with experience using either blocking or reporting features also commented on the shortcomings of both to repair the harm that had already occurred or prevent irreparable harm from occurring in the first place:

"I feel like if you report something, often it's like, inappropriate or graphic content. And by the time you see it, it's already kind of late, you know what I mean? I feel like the same thing with like, blocking someone—like when you're sent something that's, disturbing or whatever. You already saw it." – P11 (15-year-old Female)

The teens were thus interested in designing assistive tools and tech features that **gave teens human support when they needed help**. The reporting hotline described during the design activity was just one of many ways teens expressed the need to have

meaningful human support when navigating online risk. Outside of the design activity, the teens expressed the appeal of creating new approaches which allowed them to request support from a range of trusted individual in within a broader community. They feel that sometimes the struggle with staying safe online is recognizing when they are in a risky situation, so having an outside opinion from a trusted community could help curb this overlooked aspect of online safety.

"I think teens understand what stranger danger is... it's just they get carried away and have like a false sense of trust in the person they're talking to. So, like if someone else could see it from a different perspective and see it's not really a person you can trust, maybe teens would better understand." – P11 (15-year-old Female)

Teens believed one way to create this community of support was by working on designs that involve a team of professionals trained in handling online risks. Another way would be to draw support from a teen's friend network to collaborate on risk resolution or create conversations with parents in the event of extreme risks.

4.2.3. Teens want online safety designs that treat them as mature individuals

We shared with teens the designs children created in a previous study (Badillo-Urquiola, Smriti et al., 2019) in response to the same co-design exercise they completed. While the teens thought the children's designs would succeed at resolving the risk scenario, over half (57%, $N = 12$) also highlighted several different needs specific to teens. For example, they felt that **teens valued privacy more than children**. They stated that the children's designs that allowed the parents to view their child's conversation at any time were too invasive for teens, creating a feeling among teen users that they would be watched even when they are engaging in conversations that do not pose any risk. The participants viewed children as more comfortable giving up their privacy due to how much younger children rely on their parents:

"People our age would not want like a parental mediation... if my messages were parentally mediated, I would make a new account to avoid that... It makes sense for a younger age, but doesn't make sense for I think anyone middle school or older. It just, it wouldn't work out." – P7 (15-year-old Female)

There was also a sense that **teens valued their independence more than children**. These participants felt that teens are more likely to attempt to resolve a risky situation themselves before they turn to an adult for help, whereas the children's designs focused on contacting an adult and providing that adult with the tools to understand and resolve the risk scenario. The teen participants on the other hand, felt they would be able to independently manage some online risks themselves. They felt the children's designs did not support teens in making the decision to resolve the situation on their own and preferred to only involve an adult if they believed they needed guidance in that specific situation.

"I was gonna say that I agree with P18, because I do believe that teens want to be able to have the freedom of choosing, like how to respond to the situation that way. They don't have to rely on their parents and can develop some sort of independence." – P21 (14-year-old Male)

Finally, the participants concluded that teens simply **did not want solutions designed for younger children** in both their appearance and the types of features implemented. The types of features and UI that children might be satisfied using were too

simplicistic for teens to feel satisfied using them, such as *"super friendly like UI with little kids on there"* or *"a lotta animations or like rhyming phrases."* During the design exercise, these teens brought up parental control features, like age restriction only because the child in the scenario was much younger and would prefer not to have such a feature if they were in the same situation. Regarding the children's parental control designs, the teens expressed that it did not have enough advanced features that would help them better understand the risk situation or how the adult contacted to help them would take action to resolve it.

"I was gonna say that I agree with [P18], because I do believe that teens want to be able to have the freedom of choosing, like how to respond to the situation that way. They don't have to rely on their parents and can develop some sort of independence." – P21 (14-year-old Male)

Thus, while the teens felt that parental mediation may appropriate in risky situations "that can lead to further problems like down the road", they also felt parental control features designed for younger children would not offer enough transparency for teens to feel comfortable giving up their privacy and independence to stay safe. Teens desired online safety tools that allowed them to independently work to mitigate their own online risks, while being able to seek guidance in situations where they needed adult assistance. We define this approach as 'guided autonomy', which respects teens' ability to resolve risky online situations themselves, but giving them the option to seek help when necessary.

4.3. Challenges with making teen online safety design programs justice-centered (RQ2)

In addition to exploring the reasons why teens would want to engage in an online safety participatory design program, we also examined the emergent challenges in building such a program with a justice-centered mindset, to ensure that all teen participants would be treated equitably and with respect, along with their online safety solutions.

4.3.1. Teens value others' Viewpoints, but want designs to remain teen-centered

Most of the teens (85%, $N = 18$) throughout the study expressed ways they would feel most engaged in a participatory design program and even gave suggestions on how researchers may be able to facilitate the program to maximize engagement. They first described wanting the program to be **inclusive of the perspectives of others** rather than exclusively centering on teens' perspectives in the design of online safety solutions. The teens also valued the perspectives of teachers and other adults who may play an active role identifying and preventing online risks like cyberbullying. Some wanted to involve the perspectives those like parents in cases where the teens felt it was appropriate to design parental control features, especially to capture the range of parenting styles that teens experience.

"If a lot of parents are super chill with everything...you have different opinions than somebody who like my parents for example, are super, super strict right?" – P12 (14-year-old Female)

However, they also wanted researchers to ensure all involved adults would **make space for teen voices** to be heard. Researchers must ensure the environment chosen to host design session allows teen members to feel their productive and comfortable working in group situations. While designing, the teens felt that researchers should play an active role in making space for teens by communicating with them as friends rather than

authority figures and creating a casual atmosphere that allows everyone to socialize. The teen also appreciated when, during the study, researchers employed group moderation techniques that gave the floor to participants who felt too intimidated to speak in a group setting:

"...doing like, round robin where we could hear everybody, which was what you kind of did in the very beginning where we went through, and everybody introduced themselves." – P18 (17-year-old Female)

These teens additionally **did not want their designs to be used against teens** and sought assurance that the work they did would be implemented in real applications that would have a positive effect on the lives of other teens. One teen would not participate at all if the program had them making designs for technologies that would end up harming teens by taking away their privacy. Another did not want their time wasted making designs that would never be implemented into a working prototype or product.

"I think by having people that are there like industry professionals and, and companies and stuff like that like that would encourage them show up once in a while. And that that will make them think, 'Okay, well, at least my ideas going towards something.'" – P14 (16-year-old Male)

Thus, these teens believed that industry professionals and tech companies should be involved in the program in some way to allow teens to feel as though they are contributing to something that will be developed for the real world, even if the teens who designed it are not around to see the finished prototype. They wanted developers to partner with the design teams and give teens confidence to the "feasibility" of their designs by providing a technical expert's perspective.

4.3.2. Teens want to be the final authority of their own online safety solutions, not adults

To make the most of teens' commitment to the program, many of the participants (71%, $N = 15$) wanted their contributions to have a meaningful long-term impact on research of adolescent online safety. One way they expressed this was a desire to structure the program in ways that ensured they could **see their projects through to the end**, or at the very least make the most of their time while they were able to give it. Efficiency and productivity were at the forefront of their minds while working with the researchers to decide on the program's logistics. The teens stated design sessions should neither be too short nor too long nor too infrequent; they should be allowed enough time to make good designs without becoming exhausted in the long run. These teens were willing to commit to 10–15 sessions or even had no limit to the number of sessions if it means they create something worthwhile.

"I don't personally think there is a maximum because I know like projects take a long time. And if you need more, you should get more because you need like a good product." – P7 (15-year-old Female)

They also sought a meaningful impact through a desire to **expand their role beyond the design stage**. By doing so the teens felt they could not only contribute to the long-term success of the program, but also build upon their own goals and interest outside of design. As one teen explained, they personally viewed the program a means to explore how research is conducted, how technologies are developed, and to participate in prototyping:

"I think there's a lot of people that have an interest in the type of research that you're doing anyway...people feel big and important when they are like participating in like collegiate level research, and not just...being like a test subject, but actually involved in, like development...." – P9 (16-year-old Male)

Two other teens were both interested in contributing to other aspects of the research, such as the recruiting process, as they believed they could help spread the word among their peers about the merits of the program better than any recommendation from the adult figures in their lives. They could also spread the word about the program through their own clubs and internet social circles that researchers do not have that access to.

4.3.3. Teens are skeptical of other teens, adults, and themselves

Even though the participants seemed motivated to join a participatory design program geared towards teens, almost half (43%, $N = 9$) also shared hesitations about it. They expressed skepticism towards other teen and adult members participating in the program's design teams, and brought up a desire to have a selection process in which team members could be filtered out based on their motivations. The teens were **skeptical of other teens** when expressing suspicion of other their motivations for joining the program. For example, they implied that other teens that did not have intrinsic motivations to make a long-term commitment to the program would hinder the design progress in sessions and should thus be filtered from the recruitment process.

"You don't want people just going in there for the money and the service hours and not putting their whole mind to it." – P18 (17-year-old Female)

The participants were also **skeptical of adult members**, worried that their involvement would again lead to an imbalanced group dynamic which would override teen contributions. This extended to the long-term impact of online safety designs, with one teen expressed this skepticism through designs adults might desire to make:

"Like if some of the technology we make here is going to be used against us. Like if parents were to use it on us, like the monitoring thing, I might not be comfortable with having my parent monitor my DM's. So if that's going to be used against me in the future, I'd rather just not design it." – P13 (17-year-old Female)

Teens also questioned whether adult members would preserve teens' privacy when discussing sensitive subjects during the design process. For example, bringing parents onto the design teams caused some teens to worry about the privacy of what they say during design sessions. Even if the researchers assured their privacy, the teens speculated a parent may still tell a teen's parent what that the teen had disclosed during the design sessions. Thus, the teens felt certain adults, like those who have a prior relationship to the teen members, should be filtered from participating in program.

However, the teens were not just skeptical of others; they were also **skeptical of themselves**. They believed their own lack of skill, particularly a lack of technical expertise regarding design, would prevent them from feeling confident in making equally valued contributions during design sessions with adults, leading to a lack of teen involvement.

"So from experience, to get people to really, like I guess, internalize and really feel like they're a part of this, you have to kind of incrementally get them involved. And it's always just that first bit that's really challenging. Once you kind of get the ball rolling, and I want to kind of get them to feel like they're in this for sure, then

you're not really going to have a problem. But in that initial stage, you're going to lose a lot of people" – P9 (16-year-old Male)

Further conversation with these teens led to the session participants brainstorming potential ways to close this skill gap. One teen suggested that researchers should provide guidance on generating design ideas by giving “*simple instructions*”, “*asking questions*”, and “*prompting answers*” to prevent teens from disengaging if they do not know where to start. A few others suggested low commitment sessions dedicated to learning how to create designs before working on a real solution so they could get a clear understanding of the work expected of them.

5. Discussion

In the following section, we describe the challenges of creating participatory design programs that appeal to teens. We also present the unique characteristic of teens and how these characteristics impact our engaging with teens in the participatory design of adolescent online safety technologies, focusing on their specific online safety needs. Finally, we transition beyond teens’ roles as co-designers to teens as research-apprentices for promoting adolescent online safety.

5.1. Creating a sustainable online safety participatory design program for teens (RQ1)

Our study revealed a tension between the teens’ desires to include different adult participants in the design process, and the teens feeling that adults tend to override the risk experience of teens with preconceptions of what is needed for adolescent online safety. This results in safety features and apps that disregard teens’ desires to have more control over their own online safety. Previous research has aligned with this sentiment, showing how teens do not approve of available technology that focuses more heavily on parental monitoring and restriction (Ghosh, Badillo-Urquiola, Guha et al., 2018; Ghosh, Badillo-Urquiola, Rosson et al., 2018; Wisniewski et al., 2017). These tensions are directly aligned with our current understanding of teen development. Teens face the unique circumstance of being at a developmental stage in which they are not quite yet fully independent, mature individuals, and value guidance and support. However, they also do not require the same direct supervision as younger children (McNeely, 0000) and wish to independently explore their own capabilities, with assistance as needed. Our results align with this outlook, as shown by the ways that teens designed online safety features that appealed to their desire for guided autonomy. They focused on automated coaching and warnings for what could be considered risky online situations, while maintaining a level of agency to determine how and when they would want an adult to get involved for support.

While we initially only applied this approach of guided autonomy to the way in which our participants designed for online safety, we also realized a similarity in their outlook on their role within PD programs. Our participants also wanted more agency in how teens decide to design, and what participatory design methods would appeal to them, giving them the space to decide on their own approaches while relying on researchers as a source of knowledge and facilitation. In contrast to teens, younger children have been found to often accept the different responsibilities adults have (e.g., organizing co-design sessions) and do not feel that this difference impacts their role in the design process (McNally, Guha, Mauriello, & Druin, 2016). Unlike this child-oriented structuring, we find that teens wanted more creative freedom in the Teenovate Program, and desire equivalent responsibilities as the adults across the program implementation (e.g., recruiting other teens, choosing the design

prompt/activity). Teen-centric research programs should consider this mindset when developing their program structures. Giving teens a level of creative control and the ability to determine *how* they can contribute to the overall goals of the program, and not just *what* they can contribute, could help to alleviate some of these intergenerational tensions, and build trust between adult researchers and teen participants. This is especially important given the sensitive nature of discussions about adolescent online safety. Having a balanced means of control between teens and adults can provide a new, equal platform where teens feel comfortable expressing their safety needs and opinions with parents, adult designers, and other stakeholders.

One of the most interesting characteristics of our study participants was the in-depth detail of their expressions when asked what they would want in online safety features that worked for them. Teens had explicit ideas for features that centered around the concept of guided autonomy and had clear ideas for how both technology companies and social media platforms could achieve them. These considerations did not stop at their ideas for online safety designs, however. Teens also showed vast self-awareness and meta-cognitive thinking for the operation of the program itself, such as an understanding of the different values derived from the inclusion of various stakeholders in the design process, including parents, teachers, and software developers. However, they also kept in mind their desire that teen voices be the focal point for understanding their own online safety needs, and the overall operation of the PD program. As researchers, we began to realize that teens were seeking deeper involvement in the program than just functioning as design participants. They wanted more control that allowed them to make high-level decisions which would lead to long-term positive impacts on adolescent online safety for both themselves and other teens in their communities. Overall, we found that teens were not thinking of themselves as design participants in our program, but as ‘co-researchers’. This term has been used previously in relation to research participation, where van Doorn, Stappers, and Gielen (2013) developed a framework for children to assume the role of researcher by interviewing their peers and using their own experiences to contextualize data. This was further evolved by Iversen into the concept of child as ‘protagonist’, where children are instead involved in every stage of the research process (Doorn et al., 2014; Iversen, Smith, & Dindler, 2017). Further work with youth as co-research has shown that it can be successful in developing their knowledge of research methodology, and their autonomy within research programs (Clark et al., 2022). The idea of teens as co-researchers would expand this approach, resulting in responsibilities to manage the structure of the program, and to sustain work beyond the design phase to the creation of end-products implementing our designs.

5.2. Challenges of maintaining a justice-centered approach led by teen voices (RQ2)

Our participants were excited about the prospect of being able to make direct impact on adolescent online safety solutions through our program. However, they expressed skepticism that they would not have the technical design knowledge to work equally with adults. Overall, teens wanted more contextual understanding of *what* design techniques are used within PD environments. Previous research by Pitt and Davis shows that teens wanted more rationale over how the results of their design activities would contribute to the creation of the end-product, as a way of feeling more invested in the PD program (Pitt & Davis, 2017). Yet, our results go beyond the “*how*” to include *what* they will be doing in their design activities. Our results also showed that teens wanted more guidance specific to the design

techniques that are typically used by researchers and professional designers, as a way of having more confidence in their ability to meaningfully contribute work towards the program. Accordingly, researchers should be working to ensure that teen PD programs function as a space where teens can feel welcomed to both learn about how to design and the eventual impact of those designs. This does require preparation for teens to ensure they feel confident in becoming designers, and researchers can so do by incorporating educational experiences like User Experience (UX) design workshops (Rose, Davidson, Agapie, & Sobel, 2016), giving teens more knowledge of how researchers conduct PD programs.

Recruitment practices must also be considered. This is particularly important, as traditionally, PD has required the long-term availability of its participants to attend a series of design sessions throughout the development process. Availability, however, is a trait often found in privileged populations with parents who have time or resources to regularly transport their children to and from design sessions, as Walsh discovered (Walsh, 2018). Unfortunately, the teens that are most vulnerable to online risks are often those without the required support to regularly participate in design sessions. For instance, work by Badillo-Urquiola et al. shows that youth in foster care often have traumatic experiences that place them at much higher vulnerability to online risks (Badillo-Urquiola, Page et al., 2019). Yet, their foster parents and case managers are often overburdened with other responsibilities (e.g., medical issues or school) that would make it difficult for them to transport the teen to a design session. Therefore, we find it necessary to deviate from traditional session structure to accommodate disadvantaged populations, such as adapting the manner consent is obtained, since majority of parents among disadvantaged populations may not be available to sign consent forms in person. This exemplifies why it is crucial to understand how needs differ between different demographics of research participants, and how crafting new techniques to cater to those needs results in increased participation from that demographic. For example, furthering online approaches to co-design and co-research can be explored. The use of Asynchronous Remote Communities (ARC) methodology has been successfully used with teens in order to accommodate varied circumstances for participation, and could be well utilized in our online safety design programs where ensuring equitable access to participation is important (Bhattacharya et al., 2019).

A major challenge to improving the appeal of our PD program was in understanding how best to balance intrinsic motivations for teens with the external rewards of participating in the design program. Most teens seemed to actively discourage plain monetary compensation, similar to Yip et al. who found that gift cards or t-shirts failed to attract teen engagement in their PD program (Yip, 0000). Our participants not only felt skeptical about this reward structure, but instead favored rewards that were closely tied to their internal goals of preparing for college applications and boosting their resumes with collegiate experience, showing how they participated in a meaningful service program that had a positive impact on their social environment. Thus, while researchers should work to make their PD programs appealing to teen participants, any external rewards for teens should be directly tied to their intrinsic motivations. Researchers can work to offer incentives like certificates of participation, volunteer hours (which can be relevant to scholarship applications), and if possible, early college credit through their engagement in these college-level research programs. Teens' motivations to learn about research-focused design techniques can also be leveraged to show their development of skills, by framing PD programs as an opportunity for both research participation and educational experience. However, every group of teens may differ, and working directly with participants to determine what sort of rewards

most appeal to them will still remain an important factor of starting any teen PD program.

Additionally, given teens' concerns about how their contributed designs can impact the final design of a new technology feature or tool, extending teen involvement beyond design phases becomes necessary. The establishment of a teen advisory board for sourcing feedback on the Teenovate Program's continuing operations would assist in this regard, with consistent iteration over the long-term goals of online safety projects. We can also appeal to teens' needs for meaningful participation by involving them in the dissemination of results. This can be done through expansion into teen's communities, conducting presentations with parents to show our initial teen-centered designs and explain the resulting best practices for resolving online safety issues. Multiple methods are needed to sustain teens' intrinsic motivation to participate through inevitable setbacks and into long term commitments to a program in which they see themselves as active agents of change.

5.3. Proposing a novel 'teen as research-apprentice' YPAR/PD model

While this study began as a way of asking teens what kind of structure they would want in a participatory design program, we realized that teens really wanted something more akin to a Youth Participatory Action Research (YPAR) Program. This came from examining the relationship between their desires for guided autonomy in the design process, and their caring about the long-term effects that their designs would have on adolescent online safety as a whole. Our participants wanted to have a direct impact on how they resolve their online safety issues, centered on new ways of mitigating online risk, built around their own experiences. To that effect, YPAR aims to combine the efforts of researchers and a community of participants, especially marginalized communities, in a research process that investigates, clarifies, and reflects upon community-relevant issues. This forms a continuous effort to decide and commit to actions that address the issues-at-hand and benefit the community (McIntyre, 2021). While there are variants in the application of PAR, the central tenets of this methodology emphasize that research participants are local experts, due to their proximity to, and direct interaction with the issue(s) under investigation (Rodríguez & Brown, 2009).

YPAR in particular, operates on three base principles: (1) situating youth's participation beyond data collection and allow them to meaningfully determine how their inquiry should generate the knowledge that determines a practice or policy, (2) committing to genuine collaboration with youth such that they have the authority to determine the nature and outcomes of the research, and (3) actively affecting practice or policy through outcomes that improve youth's lives (Rodríguez & Brown, 2009). These principles are well-aligned with our desire to ensure a justice-centered approach to development of our program, as we can utilize these core tenets of YPAR to allow teens to have a deeper level of involvement than just technology design contribution. The YPAR framework affords us an opportunity to create a more developed level of equity between program participants, by giving teens more authority over the general operation and outcomes of the program itself. However, reviews of YPAR's efficacy have reported challenges with building teen participants' trust, where they felt like their contributions and feedback were often ignored or overruled by adult researchers and facilitators (Anderson, 2020; Anyon, Bender, Kennedy, & Dechants, 2018). In particular, researchers noted that it was difficult to establish an equity of operational power between teens and adults in environments where adult-dominant hierarchal structures were already present, such as in school settings.

This directly correlates to the concerns our own participants expressed in feeling that they would not have any say in the

control of the program, lessening their own investment and belief that they would be able to have an actual impact on the operation of the program and overall long-term goals. As we develop a teen-centered PD program, we must ensure that these hierarchical issues are addressed, so that teens can be reassured that their efforts will not be overridden by adult researchers or participants. This is especially important to the establishment of a restorative justice framework within our program, as the teen desire for guided autonomy applies not only their ideas for online safety, but to the creation of the PD program itself. In order to empower teens to break through the hierarchical barriers to participation in an intergenerational program, researchers must work to establish a project space where teens are considered the primary source of information and perspective on their own online safety needs. Adult and parental perspectives on adolescent online safety may certainly still contribute contextual value, but must be understood as such, so that prioritization is given to teen perspective. At the same time, researchers must also consider that the varied socioeconomic backgrounds and freedom of access to technology can constitute a variety of perspectives as to what is considered “being safe online” by both teens and adults. YPAR can potentially address these differences by ensuring that teen participants are able to articulate their own perspectives to each other, to researchers, and other adult participants, before major design activities are undertaken. By combining the justice-centered approach of YPAR with the technical design methodology of PD, the program can potentially address the teens’ needs for online safety designs that speak to their unique developmental needs and maturity, while also creating space for them to exercise greater control over the ways in which their designs are used to contribute to future online safety approaches.

5.4. Teen as research-apprentice: A case for centering teens as the authority on their online safety

Our teen participants desired to sustain their involvement in the program beyond the design phase, seeking end-to-end involvement with the desire to make a substantive, long-term on adolescent online safety. Therefore a new type of role would need to be created to accommodate them. The discussion of youth roles within PD programs has been explored through the lens of ‘infrastructuring’, a framework which aims to view PD as a more long-term, on-going process (Agid, 2016). Through examining past infrastructuring work, a number of new roles for youth PD participants have been envisioned, such as the “process designer”, which involves co-defining the PD processes that are used, and “player”, which involves teaching youth participants about the shared issues which the program focuses on (Schepers, Schoffelen, Zaman, & Dreessen, 2022). Iversen’s expression of child in the role of ‘protagonist’ (Iversen et al., 2017) serves as a foundational point for a new, teen-centered PD role, one which is defined by the unique social and developmental state of teens, and the need for a restorative justice approach to center their voices as the primary authority of their own online safety experiences and needs. We extend this work to begin defining our own new role, suited to the unique goals and approach of a justice-centered online safety design program. This new role would need to both allow for teens to assume some control over the larger operation of the design program and give them necessary tools and knowledge to gain confidence in exercising that control.

We define the concept of ‘research-apprentice’, a new role within our program that combines the methodological approaches of PD with the justice-centered nature of YPAR. Teen research-apprentices would begin their involvement as designers and perspective-based informants but would also learn through educational sessions on both human-centered design techniques

and the fundamentals of human participant research. Adult researchers will take the lead role in these early stages, guiding teens as they explore their own design abilities and determining where their interests lie in terms of creating an impact for adolescent online safety. Eventually, they will begin deciding what kinds of online safety problems they wish to work on, and work with the researchers to determine which research and design methods they wish to use in approaching solutions to these problems. At this point, researchers would move to a facilitation role, as teens take the lead on the design of new online safety technologies and approaches to online risk mitigation. This process works to transform an initially adult-led program into one that utilizes guided autonomy, where teens can take the lead in determining long-term goals and outcomes, but with any necessary assistance from researchers and other adults.

It is important to note that as research-apprentices, teen participants are not just educated and encouraged in design processes and project management, but also introduced to contemporary online safety research background, methodology, and analysis practices. The following best practices encapsulate a research-apprenticeship approach from beginning to end:

- **Early Stages (Gap Assessment):** A skills assessment could be given to identify gaps in a teen’s design knowledge and skill level. If an imbalance is found between team members, the goal of having teens work at the same level at researchers would be more difficult.
- **Training Skillsets:** Engaging with teens in educational workshops to teach the fundamentals of UX/UI design, prototyping, and high-level research methodology.
- **Collaborating on Real Work:** Working together with teens on research and co-design activities that allow them to make real-world impacts, such as addressing online safety situations in their own communities.
- **Taking Ownership:** As research-apprentices gain more experience, they should be allowed opportunities to take leadership roles within the program, coordinating and running design activities.
- **Transition from Apprentice to Teacher:** More experienced apprentices can transition into mentors for new teens, as teaching the apprenticeship process can reinforce understanding of the program.

In this way we attempt to expand the role of teens as research participants, into the possibilities of having their own conducted research with the goal of making societal impact, along the lines of scholarly activism (Mayer, 2020). However, care must be taken to ensure that researchers do not eventually forgo their own responsibilities to the program and create a situation where teen participants become primarily responsible for restoring their own online safety control. Once teens feel comfortable enough as research-apprentices, the program can be then expanded to include additional stakeholders and perspectives, safe in knowing that they now have the knowledge and capacity to overcome hierarchical barriers. Facilitating online safety discourse sessions between teens and adults can function as an initial establishment of restorative justice communication. After this, teens may be more inclined to seek further methods of making parents and adults aware of their online safety grievances and desires for teen-centered online safety resolution. Additionally, undergraduate or graduate students in computing and software development disciplines can be invited to collaborate with the program. This would be used to teach teens about the process of converting designs into testable prototypes, as a form of computational empowerment which develops teen’s knowledge to make informed technological decisions (Iversen, Smith, & Dindler, 2018). These

collaborations would expand the overall structure of the program, bringing in additional parties which must be considered in the changing power dynamic, as more adults are added to existing collaboration teams. The end-goal of the research-apprenticeship model for the Teenovate program would be to empower teens as the chief authority of their own online safety solutions, able to conceptualize, design, and ultimately realize those designs as viable tools and features for use by other teens.

5.5. Limitations and future work

All the participants resided within the state of Florida. Therefore, program preferences may be the result of the teen's school district calendar as well as their geographical relation to UCF and the STIR Lab. Furthermore, our findings were specific to the topic of online safety, therefore some considerations for forming an intergenerational design team may not be applicable to other research areas. We also acknowledge that social desirability can produce bias (Fisher, 1993). As a result, we focus on teen perspectives and concerns rather than their willingness to participate. A follow-up study after the program's launch could determine whether these hypothetical decisions would serve as major contributions to the program's success. Our work along with others (Badillo-Urquiola et al., 2020; Cumbo & Selwyn, 2022) has shown that CI techniques require modification to work with adolescent co-designers, therefore future research should explore new participatory design methodologies with adolescents beyond CI to ensure developmentally appropriate approaches are developed for teens. While project teams are designed to give teens a sense of ownership over their designs and projects, more work is needed to determine how co-design can be conducted on an applied basis. Finally, future research should explore how teens can be included in the creation of new online safety technologies beyond design stages, extending to recruitment, co-research, prototyping, and result dissemination, effectively broadening their roles in managing their own safety.

6. Conclusion

In the process of creating a new teen participatory design program for co-designing online safety solutions, we discovered that teens desired a more holistic approach to their involvement in research. This insight came from a deeper consideration of teens' developmental characteristics. Understanding that teens want to reconcile differences in how program controls are structured between adult researchers and themselves, we have begun developing a new, restorative justice-centered approach for the Teenovate Program, centered on the combination of principles from participatory design and participatory action research. We seek to give teens both the technical knowledge to assume some control of program management and the ability to extend our new designs for long-term impact on their own online safety. This empowers them to move beyond the role of designer and into a new position of research apprentice. As we consider current participatory design approaches and strive to embed participatory action research goals into the Teenovate Program, we also call on researchers to integrate these considerations in their own programs. By discerning new ways to balance the power dynamic between adults and teens, researchers can welcome teen communities into their work as topical and technical experts who assume influence over the process and outcomes of these programs.

7. Selection and participation of children

We had a total of 21 teenage participants, recruited through various youth programs (i.e., Boys and Girls Clubs) within Florida,

with a goal of balancing age ranges (13–17) and gender for each group. After a pre-screening survey, all parents signed informed consent forms, which included a data collection policy and consent for audio/video to be recorded. Parents could opt-in or opt-out to storing their contact information for future studies. After receiving completed consent forms, we provided teen participations with an assent form and received their verbal assent to participate over the phone. All personally identifiable data was removed to protect our participants' anonymity.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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