Promoting Early Adolescents' Tech Disengagement: Designing Digital Interventions by Involving End Users in Meta-design

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Abstract

Children's technology overuse is a pressing issue in today's digital era, particularly challenging with early adolescents, as they assert independence. Existing parental control tools targeting this issue often overlook early adolescents' perspectives, resulting in resistance towards interventions. In this paper, we first discuss our approach of involving early adolescents in participatory design to understand their needs and perspectives. We then share how we involved both early adolescents and their parents in formative design, exploring feedback on various design concepts to further investigate users' preferences. Finally, we outline our future plans to explore a persona-based approach to integrate tailoring activities into the digital intervention. Inspired by research in end-user development, this approach aims to accommodate the diverse needs of early adolescents and their families.

Keywords

overuse of technology, technology disengagement, digital intervention, early adolescents, parents, participatory design, end-user development

1. Introduction

The pervasive use of technology in our daily lives has raised alarming concerns about children's technology overuse. Studies indicate that excessive screen time (e.g., more than six hours daily [3]) is associated with detrimental effects on children's social and cognitive development, health, and well-being [12,17]. While many existing interventions aim to address this issue, most focus on enforcing rules without considering the needs and expectations of the target users, leading to resistance towards the interventions and reluctance to practice tech disengagement. This challenge is particularly significant among early adolescents, a demographic that presents unique design challenges due to their higher prevalence of tech overuse compared to other age groups [14], their developing sense of independence [8], and an increased potential for conflicts with parents [10].

Given early adolescents' growing need for autonomy, it is important to incorporate their perspectives into the design of interventions aimed at supporting self-regulation of tech use. To explore their vision for such digital solutions, we involved them in various formative design activities through a participatory design study [4], and a follow-up elicitation study with both early adolescents and their parents [5]. In this paper, we share our experiences and findings from these studies. Our study findings underscored the importance of addressing early

adolescents' varied individual characteristics and the diverse needs of families, indicating that designing a one-fits-all solution may not be suitable. Instead, enabling users to modify and adapt the tools according to their individual differences and evolving needs could prove beneficial. This approach is inspired by research in end-user development (EUD) which empowers users to modify a system as non-professional developers [6]. It emphasizes involving end users not only in the initial design stages but also in the continuous development of existing systems [9].

Building on the findings from our elicitation study, we propose a persona-based approach to facilitate EUD in the meta-design of interventions targeting early adolescents' tech overuse. Our proposed approach aims to allow end users to configure their own profiles with personalized settings, by selecting components from different relatable personas, supplemented by advanced settings for greater granularity.

2. Related work

While designing technology for children, HCI researchers have explored various approaches to involve children in the design process, aiming to understand their unique needs and perspectives [7,13,16,22], including cooperative inquiry [7], layered elaboration [22], mixing ideas [13], and collaborative design thinking (CoDeT) [16]. Participatory design with children has proven effective in enabling them to voice their opinions and guide researchers towards child-centric design choices, addressing age-specific requirements. Drawing on prior research, we investigated how to apply these techniques to involve early adolescents in the participatory design of digital interventions facilitating tech disengagement. Our study approach was adapted from the CoDeT framework [16], known for fostering collaboration among children.

In addition to including users in the initial design of technology, prior research has emphasized the importance of engaging them in meta-design, which extends beyond the original development [2,9,18,19]. In meta-design, end users remain constant co-designers of the system in an ongoing process of development, empowered to contribute changes to the system through various tailoring techniques [9]. End-user development enables non-technical users to modify systems through a set of activities, such as customizing existing functionality, integrating external features, and adding user-generated new features [25]. Since anticipating every user need might not be possible during initial development, EUD allows the users to own their problems and evolve the system according to their needs [6]. Prior HCI research with children has explored various EUD techniques in different contexts, including smart home technology and learning systems, to address their unique needs [1,2,15,21]. Inspired by this literature, our proposed approach involves early adolescents in the EUD of digital interventions aimed at tech disengagement.

3. Designing digital interventions addressing early adolescents' tech overuse

In this section, first, we share our experiences and findings from a participatory design study with early adolescents. Then we briefly discuss our findings from an elicitation study that highlighted the need for EUD in digital interventions.

3.1. Participatory design of digital interventions with early adolescents

To gain direct insights into early adolescents' views on the issue of tech overuse, perceptions of tech disengagement, and expectations regarding digital interventions, we involved 21 early adolescents in an online participatory design (PD) study (details can be found in [4]). Engaging this age group in HCI research is known to be particularly challenging [11], along with the fact

that regulating their own tech use might not be inherently motivating for them. Therefore, we designed the study to allow free expression of opinions and creativity, not including parents to avoid potential biases and power imbalances. Additionally, to facilitate collaborative creativity in participatory design, we conducted sessions with groups of three participants. Moreover, to gradually guide them towards designing their own solutions for tech disengagement, we conducted multiple sessions with each group. Following the recommendation of a two-hour daily screen time limit for children and youth [20], with over six hours deemed excessive [3], our study included early adolescents who use digital media for more than two hours daily.

In the first session, participants reflected on their own perceptions of technology overuse through a collaborative story-creation activity. This activity allowed us to observe their conceptualization of this issue. Then, in the next session, we asked them to brainstorm about different ideas that they find potentially useful to regulate their tech use. After this second session, we asked our participants to individually sketch a design solution asynchronously. Finally, in the third session, they shared their individual sketches with their group and collaboratively generated one final solution. Participation was encouraged by offering the opportunity to enter their collaborative sketches into a design competition, along with fostering engagement through team-building and ice-breaking activities.

Our findings from this study indicated participants' awareness of the negative impacts of excessive tech use. They actively participated in design activities to generate solutions addressing this issue. Their ideas to support tech disengagement included encouraging offline activities, incorporating awareness with tracking tools (e.g., time tracker, alarms, reminders), and educating early adolescents about the adverse effects of overuse. From the participant-generated design solutions and their responses during a focus group discussion, we identified design factors that they perceived as useful to limit their tech overuse. These factors were: 1) a balance between giving children more agency & parental involvement, 2) considering children's emotions while designing mediation strategies, 3) positive reinforcement to motivate participation, and 4) relatedness and novelty to make interventions engaging.

3.2. Identifying diverse end-user needs using contrasting design prototypes

While our PD study revealed key design factors for digital interventions, further exploration was required to translate these factors into concrete solutions that address the unique needs of early adolescents. Additionally, since such intervention might impact the family environment, understanding both parents' and early adolescents' viewpoints is essential. Therefore, we conducted an elicitation study involving both groups of end users in the formative design of digital interventions, using contrasting design prototypes as probes to collect their insights and preferences through semi-structured interviews (details can be found in [5]).

Findings from our elicitation study revealed the diverse needs of early adolescents and their families that digital interventions should address. Personalized interventions may be required for various factors such as early adolescents' level of tech dependency, self-motivation to regulate tech use, family dynamics, and parenting styles. For instance, some parents mentioned that their children, due to low self-motivation or high tech dependency, might need a more enforced approach than what our prototypes offered, requiring a stricter strategy to initiate tech disengagement. Additionally, participants highlighted the importance of adaptability for consistent long-term use, suggesting that interventions should allow easy parental overrides in case of unforeseen situations demanding rule changes. These diverse needs and preferences emphasize the necessity of incorporating end-user development, allowing both user groups to tailor the intervention according to their unique requirements.

4. Integrating end-user development into digital interventions

In this section, first, we discuss the necessity of integrating EUD into the digital intervention, followed by our proposed idea of incorporating a persona-based approach for supporting collaborative tailoring activities.

4.1. Recognizing the necessity for tailoring digital interventions

Our formative design activities empowered early adolescents to contribute responsible design ideas that speak to their requirements and expectations [4,5]. This involvement, however, is crucial not only at the *design time* but also at the *use time* to accommodate their evolving needs [9]. This is especially important for this demographic, as they undergo significant developmental changes in thinking patterns, self-concept, and motivation during the transition to adolescence [24]. Furthermore, parents of early adolescents may have varied needs in different situational contexts that may not be apparent during the initial design phases. Therefore, engaging both early adolescents and parents in collaborative EUD might be necessary to ensure effective and consistent use of the intervention.

To address the diverse needs discussed in section 3.2, providing a variety of features and hybrid options combining different strategies could be beneficial. For instance, self-motivated and individualistic early adolescents might prefer a virtual mentor over parental mentorship, while those who rely on peers may favor peer-based mentorship. An example of a hybrid approach could integrate peer-based strategies with parental guidance, allowing users to select peers for specific tasks while still receiving parental support. Additionally, differing family needs may require personalized solutions, e.g., some families may find a reward-based system beneficial, whereas others may prioritize intrinsic motivational factors. Therefore, adjustable settings that cater to early adolescents' needs and parental comfort levels could enhance the intervention's effectiveness. On the other hand, providing numerous setting options might be overwhelming, especially for non-tech-savvy users.

Our objective is to explore an appropriate tailoring approach that empowers end users to adapt the intervention without overwhelming them with complexity. Since our focus is designing a solution for early adolescents, they should be able to configure the intervention according to their specific requirements easily and efficiently, in collaboration with their parents, while effectively minimizing and resolving any potential conflicts. Our research aims to address the following research questions: 1) How can we present tailoring options to empower early adolescents and their parents to modify the digital intervention to adapt to their unique characteristics and evolving needs? 2) How do we facilitate negotiation to minimize potential conflicts during collaborative customization activities? To explore these questions and support tailoring the intervention to individual needs, we propose a persona-based approach, as discussed below.

4.2. A persona-based approach to support EUD: an initial proposal

Our initial vision of a persona-based approach involves early adolescents and parents in jointly tailoring interventions to meet their specific requirements for practicing tech disengagement. Personas are realistic representations with fictitious details of real-world users, commonly used in user-interface design [23]. While persona-based approaches are typically employed to gather user requirements before implementation in diverse scenarios [26], our approach utilizes believable and relatable personas as a layer of abstraction to facilitate EUD activities, enabling the continuous adaptation of digital interventions to meet evolving user needs.

We are currently exploring design solutions that present users with a range of relatable personas, each representing a set of diverse characteristics for both end-user groups (e.g.,

busy/overinvolved/strict parent, early adolescent with high self-motivation/high tech dependency/dependency on parents/supportive peer group, etc.). Each persona will share the identifying characteristics of an assumed parent/child, in a non-judgmental story-telling manner, with an underlying configuration that employs different combinations of design factors (e.g., varying levels of agency and parental engagement, intrinsic vs. extrinsic motivation, peer vs. parental mentorship). Both end users can simply select one of these default personas that aligns with their own needs and characteristics, configuring their profiles accordingly. They will have the flexibility to switch personas at any time or customize their unique profile by dragging and dropping components from the default personas. However, recognizing that the personas will not capture the needs and situations of all target users, we plan to include an advanced settings option, for greater fine-tuning. Users should also be able to save their configured profiles and revert back to them easily and share them with other users who have similar needs. Currently, we are in the process of refining these personas, and our future plan involves developing a prototype to explore users' responses.

While our goal is to ensure equal involvement of both user groups in EUD, conflicts may arise between the parents and early adolescents while collaboratively configuring their profiles for practicing tech disengagement. Therefore, we plan to incorporate features that facilitate negotiations in cases of conflict by encouraging discussions and offering various suggestions for compromises. For instance, if an early adolescent believes they can self-regulate their tech use without parental supervision, but the parent doubts the early adolescent's self-motivation to independently practice tech disengagement, one solution could be to gradually relax the rules based on their progress. An alternative solution could be to try out both groups' preferred configurations for a limited period and then decide based on their experiences. Real-time customizability also allows end users to experiment with different elements (e.g., rewards, joint activities, peer involvement), and find the best setting that works for both, instead of committing to a default one. Such adaptability in an intervention might have the potential for consistent long-term use, as it will continually evolve along with the users' needs while also offering elements of novelty.

5. Conclusion

To address the issue of tech overuse among early adolescents, it is crucial to design a digital intervention that promotes self-regulation of tech use while catering to the needs of both end-user groups: early adolescents and their parents. In this paper, we share findings from a participatory study involving early adolescents, and an elicitation study with both groups to better understand their needs and perspectives in designing a digital intervention. Our studies affirmed the importance of involving users in formative design activities and underscored the need to explore how to integrate end-user development into the intervention, empowering users to tailor it to their unique characteristics and evolving needs. We also propose our initial vision of a persona-based approach to address this research goal.

Acknowledgements

Short bio

Ananta Chowdhury is a PhD candidate at the Department of Computer Science at the University of Manitoba. Her research interests focus on Human-Computer Interaction, specifically, child-computer interaction, participatory design, and child-robot interaction. Ananta's recent research concentrates on designing child-centric tech-based mediation strategies addressing early adolescents' technology overuse. She has published her work on participatory design with children in ACM CHI and the Graphics Interface (GI) Conference, where she received the "Best Student Paper in HCI" award. Her latest work has been accepted for publication in the NordiCHI and the INTERACT Publication Series.

Timmy Wang is an undergraduate student in the Department of Computer Science at the University of Manitoba. He received the Faculty of Science Undergraduate Student Research Award in 2024, which enabled him to work with our Human-Computer Interaction research group for the summer. Timmy contributed to the persona-based approach to supporting End-User Development in digital interventions aimed at early adolescents.

Andrea Bunt is a Professor in the Department of Computer Science at the University of Manitoba where she co-directs the HCI lab. Prior to joining the University of Manitoba in 2009, Andrea completed a Ph.D. at the University of British Columbia and a Postdoctoral Fellowship at the University of Waterloo. Andrea's research is in Human-Computer Interaction, with an emphasis on feature-rich software learnability, technologies for families, and human-AI interaction. Andrea received the CS-Can | Info-Can Young Researcher Award in 2018 and has received Best Paper awards at ACM CHI, ACM IUI, and Graphics Interface.

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