Reflections on Online Child-Centric Participatory Design Approaches: Two Case Studies with Children and Early Adolescents

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Given that participatory design is a powerful tool to understand target users' perspectives, HCI researchers employ a range of participatory design methods in child-centric technology design. While participatory design is traditionally conducted in co-located settings, during the COVID-19 pandemic, many researchers had to shift to an online setting, adapting virtual tools to facilitate online participatory design activities. In this paper, we present our experiences of conducting two online participatory design studies during the pandemic. The first study involved children of age 7-11 years in the design and evaluation of a child-centric tutorial authoring tool for digital art. The second study involved early adolescents (11-14 years) in a participatory design study to understand how they envision tech-based solutions to support disengagement from excessive use of technology. We reflect on the study methods employed in both studies as well as the challenges and opportunities when conducting online participatory design studies with younger populations from different countries.

CCS CONCEPTS • User Studies • Participatory Design

Additional Keywords and Phrases: Children, Early Adolescents, Online Study, Child-Centric Design

1 INTRODUCTION

Participatory design with children is an effective way to elicit children's perspectives while designing child-centric technologies [13,15,22]. Since this method allows researchers to better understand the age-specific requirements of children and facilitates child-oriented design thinking, it has been used in many research studies with different age groups [2,5,6,19,21,24,26,27,28].

Participatory design (PD), where participants work together with the researchers and contribute to the design process, is traditionally conducted in co-located settings. Due to health safety concerns and COVID-19 restrictions, as of 2020, it became more common for researchers to conduct PD studies online [11,16,20]. This sudden transition introduced numerous challenges including technical difficulties, video conferencing fatigue, appropriate logistics support [11,16,20], and adapting common PD activities using physical materials (e.g., sketching, paper prototyping) to online settings. Although there were numerous challenges, online PD also removed several barriers to participation (e.g., geographical barriers, time to travel to the study location), providing researchers with the opportunity to collect insights from participants with different backgrounds and cultures without being restricted by the time and expenses needed to conduct the co-located study sessions across multiple locations and time zones [16].

In this paper, we reflect on our experience from two case studies, where we involved different age groups of children in online participatory design of child-centric technologies in two different domains. The first study focused on the design and evaluation of a tutorial authoring tool for digital art with children (7-11 years old) [9]. The second study explored the design of tech-based mediation strategies with early adolescents (11-14 years old) to promote disengagement from technology overuse [10]. We share our overall reflections on conducting remote PD sessions including the adaptation of methods for the online setting, participant involvement in online design activities, use of virtual tools, and the challenges and advantages we experienced in the process.

2 RELATED WORK

In today's digital age, technology plays a significant role in the lives of children. To understand children's perspectives and requirements, researchers have investigated various approaches to involve them in the design process. These approaches include contextual design [3], cooperative inquiry [14,18], mixing ideas [17], layered elaboration [29], and collaborative design thinking (CoDeT) [22]. Research has shown great potential for child-centric design approaches with children of different age groups, ranging from young children [1,8,17] to teenagers [5,6,7,12,25,28]. The COVID-19 pandemic required many researchers to move from traditional in-person settings to online platforms [9,11,16,20]. In adapting to online settings, researchers have developed models and strategies, such as being adaptable to balance expected and unexpected factors during online sessions [20] and have documented

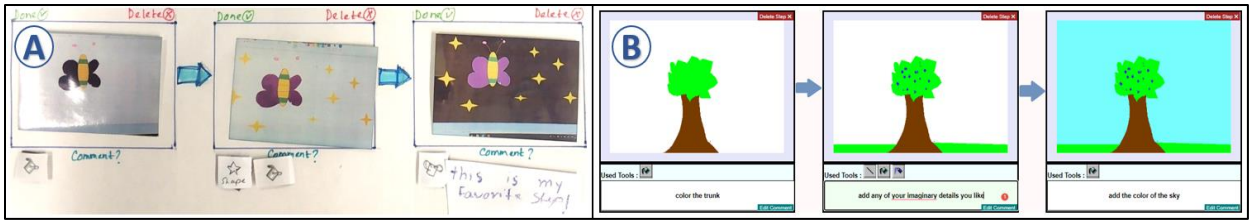

Figure 1: Close-up snapshots of tutorials created by our participants in the first case study. (A) A part of a tutorial created by a participant using our lo-fi prototype. (B) A part of a tutorial created by a participant during our online study using the higher fidelity prototype.

and compared the experiences of different co-design groups [16]. Our case studies are motivated and informed by this prior work.

3 CASE STUDY 1: DESIGNING A TUTORIAL AUTHORING TOOL FOR DIGITAL ART WITH CHILDREN

In this study, we explored the design of a child-centric tutorial authoring tool for digital art, where children could create tutorials for other children (details of this study can be found in [9]). Our goal in designing such a tool was to enable children to share their artistic creativity along with their art creation process while also benefiting other digital art enthusiastic children. Our child-centric design approach had two phases: 1) an in-person participatory design study with eight locally recruited 6-11-years-old children and 2) an online study with sixteen 7-11-years-old children from three different countries (Canada: 9, US: 6, Bangladesh: 1). The first study was conducted in October 2019. The second one was also supposed to be conducted in person during February 2020, however, due to the onset of the pandemic, we had to transition to an online setting quite suddenly. Below we briefly describe how we started with our first study and later shifted to an online setting, the challenges we faced and how we attempted to address them.

In the first phase, we started with a general approach to tutorial authoring – capturing individual steps of the drawing workflow and allowing children to decide when to capture the steps. Based on this general idea, we created a low-fidelity (lo-fi) prototype, which was a paper-based template with slots to display the drawing steps of the digital art. In an in-person PD study, we asked our participants to interact with our lo-fi prototype. To not constrain their drawing process, we asked them to create the digital art on a computer so that they could use all the digital tools required for their art creation. When they were ready to capture a step of their drawing, we captured photos of their drawing and printed them out with a polaroid printer. After completing the drawing, the participants created a workflow with the captured steps using our lo-fi prototype (see Figure 1A for an example).

Based on our participants' feedback on our lo-fi prototype, during the second phase of our research, we developed a higher-fidelity prototype to elicit further feedback from children regarding tutorial authoring for digital art while they attempted to create a tutorial with our prototype (see Figure 1B for an example). This prototype was a semi-automated Wizard-of-Oz prototype that required input from a study facilitator to ultimately generate the tutorial. In our second study, we aimed to have participants work with this higher-fidelity prototype to further probe into their thoughts and opinions on how to design such a tool.

In shifting our study methods to an online setting, one challenge was how to allow the study facilitator to act as the "wizard" for the prototype. While this could be easily done in an in-person study with a wireless keyboard, we had to find an effective way to enable children to interact remotely with a prototype that was not fully functional and thus could not easily be remotely deployed. Our solution was to use "TeamViewer", an application that allowed participants to access the study facilitator's computer screen and directly interact with the prototype without needing to install anything on their computer. While it saved our participants from additional installation overhead, it also introduced lag, which slowed down their art creation process.

Another challenging aspect was maintaining engagement throughout the sessions, given the age range of our participants (7-11 years). During the pandemic, many schools moved online and attending long classes remotely often created video conferencing fatigue in children [4]. Since attending an online study would prolong the overall screen time of the day, we had to be mindful of the length of the study session, which led us to reduce our number of study activities and thus limited the breadth of our PD data. For example, we initially planned to have children try out a sample child-authored tutorial, but we cut this activity from the online study after piloting due to fatigue. Simultaneously, we had to ensure that the sessions were interesting and engaging given that children can have short attention spans [16]. Hence, to provide breaks from the online tasks and create a conversational atmosphere, we intermixed open-ended interview questions with the study tasks. Overall, our participants seemed engaged in our study sessions and provided useful insights into children's incentives and capabilities to create digital art tutorials with a tutorial authoring tool.

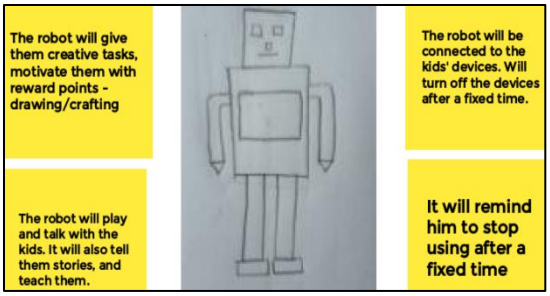

Figure 2: Part of a final design solution generated during the PD sessions of our second case study, where participants of a group attached their hand-drawn sketches and annotations to Google Jamboard.

4 CASE STUDY 2: PARTICIPATORY DESIGN OF TECH-BASED INTERVENTIONS WITH EARLY ADOLESCENTS

In this study, we involved early adolescents in online participatory design to understand their perceptions of technology disengagement and how they would design tech-based mediation strategies to control their technology overuse (details of this study can be found in [10]). This study was conducted online (in March 2022) which allowed us to recruit internationally. We ended up with 21 participants from 7 different countries (Canada: 9, Bangladesh: 3, France: 3, India: 3, Dubai: 1, Netherlands: 1, Philippines: 1). To ensure active participation from our early adolescent participants, we designed a group-based study because collaboration is known to be an effective way to promote creativity [23] while holding a sense of accountability in teamwork [22]. We formed 7 groups in total with 3 members in each group. Here we describe how we engaged our participants in the group-based multi-session online PD, how we designed the sessions and our experiences with the virtual tools we used to facilitate the sessions.

We conducted three separate online sessions where we designed different PD activities to involve participants in the design of a tech-based intervention that would promote healthy tech use. Considering participants' Zoom fatigue, we kept each session no longer than 60-90 minutes. In the first session, to observe how participants contextualize their concept of technology overuse and tech disengagement, we asked them to create a collaborative story using Google Slides. In the second session, we had a collaborative brainstorming activity using Google Jamboard where we asked participants to write ideas that they perceived to be useful to limit tech overuse. After this session, we encouraged our participants to engage in an individual asynchronous activity of sketching a tech-based intervention based on their collaboratively generated ideas. Along with saving online screen time, this offline task allowed our participants to offer their individual perspectives on the collaborative design process. Based on the individual sketches produced from this task, in the final session, each group created a final sketch of a tech-based solution using Google Jamboard. To motivate active participation, we informed them that at the end of the research study, their collaborative sketch would be entered into a design competition where all the participants of this study would be able to vote for their preferred solutions. Additionally, to promote engagement and group collaboration, we incorporated team-building and ice-breaking activities in between the tasks.

The virtual tools that we used to facilitate the co-design activities seemed to be useful in enabling our participants to collaborate online efficiently. Since most of the participants had experience attending online classes during the pandemic, all were comfortable with video conferencing on Zoom. Although some of the participants did not have previous experience with Google Slides and Google Jamboard, they became comfortable with the tools quickly with the help of the facilitator and their team members. Both tools allowed them to see real-time changes made by their team members and work on the documents synchronously. One issue with Jamboard was that free-hand drawing was difficult for participants who were using a mouse. Hence, they opted for drawing on paper which did not allow their team members to directly edit the sketch. They were able to provide verbal suggestions and later contribute by adding annotations once they uploaded the sketch to the Jamboard (see Figure 2 for an example). Anticipating that drawing digitally could be a struggle for some participants, we provided icons and objects in the Google Slides for the story creation activity. This decision seemed to be effective in terms of reducing time and struggle to identify what to draw and how for the story. On the other hand, there is a possibility that it might have restricted participants' creative expression.

5 CHALLENGES AND OPPORTUNITIES

Both case studies presented in this paper are unique in terms of their domain of investigation, target age range and their application of co-design methods in the online study sessions. These studies provide examples of how participatory design can be facilitated

online with children to enable active participation using a range of virtual tools. Since both studies involved international participants, they also demonstrate the potential for online PD that can bring global perspectives into the domain of exploration. However, while submitting our paper to a conference, some reviewers expressed concerns that involving international participants in a focused investigation might introduce too much diversity to contextualize the findings with a small sample size. This raises the question of how to best integrate diverse perspectives into PD. For example, can we gain valuable design insight through a diverse participant pool in a single study, or is it preferable to instead have multiple small studies, each tailored to populations with particular backgrounds? In the case of our online studies, the differences in participants' perspectives owing to geography were subtle enough that we were not able to detect them with our study methods. While it could be possible that, for our domain of investigation, the variability in family dynamics in our participant pool dominated the cultural and geographical factors, the question remains on how to identify cultural factors with smaller sample sizes.

Children can be a difficult target audience to recruit, and conducting online studies widened our potential pool. The online setting also made scheduling the individual study sessions more flexible, since caregivers did not have to commute to our lab to let their children attend the study. In our second study, however, which was multi-session, it was challenging to schedule participants. Since participants often were in different time zones, sometimes we had to wait weeks before we could find a schedule that worked for all three participants of a group. Additionally, while we did not collect information on socio-economic status, we suspect that most of our participants might belong to families with relatively high socio-economic status. For example, to participate in an online study conducted in a foreign university, an international participant must have access to the Internet and a computer, which would exclude participants from lower socio-economic backgrounds. As HCI researchers, it is necessary to explore how we can include the unheard voices of international participants from under-developed countries in the online participatory design of inclusive technology.

Conducting the online study introduced some challenges which included internet connection issues, participants being distracted by siblings and technical difficulties setting up the study. Despite the challenges of adapting to an online setting, we found that our younger participants were sometimes even more engaged in the remote study than in our first in-person study. While we were concerned that the lack of physical presence might negatively impact participants' engagement in the study, surprisingly, being in the comfort zone of their own homes, participants seemed more open to contributing to the study tasks and interviews than when we were able to conduct PD activities in person. On the other hand, as researchers, we felt that building rapport with our participants was easier in person. Moreover, the overhead of managing multiple tools simultaneously to smoothly run a session and the Zoom fatigue of running multiple sessions in a day was challenging for the study facilitator. Additionally, while scrutinizing different virtual tools to identify whether they could support typical physical participatory activities, we faced additional scrutiny from our institutional ethics board over secure storage policies, an issue that we did not have to worry about with physical prototyping. Since online PD is now more common than in pre-pandemic times, more research is needed to investigate how we can design an integrated set of virtual tools aimed to support a wide range of child-centric PD activities while addressing privacy concerns regarding participant data.

Overall, while comparing the online PD studies with the in-person study, we realized that the transition to an online setting did not seem that challenging for our child participants. They were comfortable interacting with the virtual tools and engaged in the participatory design activities while providing high-quality contributions to the design process. The only issue we observed that might have affected participants' artistic creativity was the lack of flexibility in the online drawing. On the other hand, we did feel that in an offline study, the physical presence makes the interaction with participants more fluid and natural. Further, the tangible and interactive experiences with prototyping can provide a more accurate representation of the intended use of the proposed technology and allow participants to focus on the PD activities, without being bothered by the additional technicalities of the virtual tools. Future research could explore ways to facilitate online participatory design where children could have a similar experience to physical participatory design activities so that they could contribute even more to the design process.

6 CONCLUSION

In this paper, we present our experiences of conducting two online participatory design studies during the COVID-19 pandemic with two different age groups of children. We hope our reflections on the study methods will encourage HCI practitioners to explore new ways to involve children in the online participatory design of child-centric technologies.

REFERENCES

[1] Wolmet Barendregt and Tilde Bekker. 2013. Exploring the potential of the drawing intervention method for design and evaluation by young children. CHI '13 Extended Abstracts on Human Factors in Computing Systems on - CHI EA '13: 193.

[2] Erlend Bergen, Dag F. Solberg, Torjus H. Sæthre, and Monica Divitini. 2018. Supporting the Co-design of Games for Privacy Awareness. International Conference on Interactive Collaborative Learning, Springer, Cham, 888–899.

[3] H. Beyer and K. Holtzblatt. 1997. Contextual Design: Defining Customer-Centered Systems. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

[4] David S. Bickham, Summer, Moukalled, and Michael Rich. 2021. Young people's media use and remote schooling experiences during the COVID-19 pandemic. . TMS Proceedings.

[5] Vanessa Cesário, António Coelho, and Valentina Nisi. 2018. Co-designing Gaming Experiences for Museums with Teenagers. Interactivity, Game Creation, Design, Learning, and Innovation., Springer, Cham., 38–47.

[6] Vanessa Cesário, António Coelho, and Valentina Nisi. 2019. Word Association: Engagement of Teenagers in a Co-design Process. IFIP Conference on Human-Computer Interaction., Springer, 693–697.

[7] Vanessa Cesário, Sónia Matos, Marko Radeta, and Valentina Nisi. 2017. Designing interactive technologies for interpretive exhibitions: enabling teen participation through user-driven innovation. IFIP Conference on Human-Computer Interaction, Springer, Cham, 232–241.

[8] Bester Chimbo and J. H. Gelderblom. 2014. Comparing young children and teenagers as partners in co-design of an educational technology solution. Proceedings of the ISI e-Skills for Knowledge Production and Innovation Conference., 17–21.

[9] Ananta Chowdhury and Andrea Bunt. 2022. Tutorials for Children by Children : Design and Evaluation of a Children's Tutorial Authoring Tool for Digital Art. Graphics Interface 2022.

[10] Ananta Chowdhury and Andrea Bunt. 2023. Co-Designing with Early Adolescents: Understanding Perceptions of and Design Considerations for Tech-Based Mediation Strategies that Promote Technology Disengagement. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems, (To appear).

[11] Aurora Constantin, Jessica Korte, Judith Good, et al. 2022. A Distributed Participatory Design Research Protocol for Co-designing with Children. Proceedings of Interaction Design and Children, IDC 2022: 510–516.

[12] Arianna Davis, Neeraj Chatlani, Karla Badillo-Urquiola, and Pamela Wisniewski. 2021. Teenovate-Using Participatory Action Research to Create a Sustainable Teen Program Designing Adolescent Online Safety Solutions. Available at SSRN 3882835.

[13] Allison Druin. 1999. Developing Cooperative New Technologies Inquiry : for Children with Children. Proceedings of the SIGCHI conference on Human Factors in Computing Systems: 592–599.

[14] Allison Druin. 1999. Cooperative inquiry: Developing new technologies for children with children. Conference on Human Factors in Computing Systems - Proceedings, ACM Press, 592–599.

[15] Jerry Alan Fails, Mona Leigh Guha, and Allison Druin. 2012. Methods and Techniques for Involving Children in the Design of New Technology for Children. Foundations and Trends® in Human–Computer Interaction 6, 2: 85–166.

[16] Jerry Alan Fails, Dhanush kumar Ratakonda, Nitzan Koren, Salma Elsayed-Ali, Elizabeth Bonsignore, and Jason Yip. 2022. Pushing boundaries of co-design by going online: Lessons learned and reflections from three perspectives. International Journal of Child-Computer Interaction 33: 100476.

[17] M.L. Guha, Allison Druin, Gene Chipman, J.A. Fails, Sante Simms, and Allison Farber. 2004. Mixing ideas: a new technique for working with young children as design partners. Proceedings of the 2004 conference on Interaction design and children: building a community: 35–42.

[18] Mona Leigh Guha, Allison Druin, and Jerry Alan Fails. 2013. Cooperative Inquiry revisited: Reflections of the past and guidelines for the future of intergenerational co-design. International Journal of Child-Computer Interaction 1, 1: 14–23.

[19] Priya Kumar, Jessica Vitak, Marshini Chetty, et al. 2018. Co-Designing Online Privacy-Related Games and Stories with Children. IDC '18 Proceedings of the 17th ACM Conference on Interaction Design and Children: 67–79.

[20] Lee, Kung Jin, Wendy Roldan, Tian Qi Zhu, et al. 2021. The Show Must Go On: A Conceptual Model of Conducting Synchronous Participatory Design With Children Online. Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, 1–16.

[21] Brenna McNally, Priya Kumar, Chelsea Hordatt, et al. 2018. Co-designing Mobile Online Safety Applications with Children. Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18, 1–9.

[22] Maarten van Mechelen, Ann Laenen, Bieke Zaman, Bert Willems, and Vero vanden Abeele. 2019. Collaborative Design Thinking (CoDeT): A co-design approach for high child-to-adult ratios. International Journal of Human Computer Studies 130: 179–195.

[23] Pinar Oztop and Michaela Gummerum. 2020. Group creativity in children and adolescents. Cognitive Development 56, December 2019: 100923.

[24] George Palaigeorgiou and Vasiliki Sidiropoulou. 2021. Can Elementary Students Co-design the Learning Content of Educational Apps: The We!Design!Fractions Participatory Design Approach. Springer International Publishing.

[25] Caroline Pitt and Katie Davis. 2017. Designing together? group dynamics in participatory digital badge design with teens. Proceedings of the 2017 Conference on Interaction Design and Children., 322–327.

[26] Kyrill Potapov and Paul Marshall. 2020. LifeMosaic: Co-design of a personal informatics tool for youth. Proceedings of the Interaction Design and Children Conference, IDC 2020: 519–531.

[27] Gavin Tierney, Theresa Horstman, and Carrie Tzou. 2021. Youth co-design of responsive digital badge systems: disrupting hierarchy and empowering youth. CoDesign 17, 313–329.

[28] Ralph Vacca. 2019. Brokering data: Co-designing technology with latina teens to support communication with parents: Leveraging cultural practices of latinx youth through co-design. Proceedings of the 18th ACM International Conference on Interaction Design and Children., 197–207.

[29] Greg Walsh, Alison Druin, Mona Leigh Guha, et al. 2010. Layered elaboration: A new technique for co-design with children. Conference on Human Factors in Computing Systems - Proceedings 2: 1237–1240.