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Challenges And Solutions In Designing Interactive Children's Books

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Abstract:

Within the scope of this position paper, we will examine the difficulties associated with ensuring inclusion when children are involved in collaborative design. Within the field of human-computer interaction (HCI), there is a strong commitment to encouraging inclusive user research as a means of fostering a better knowledge of users and the requirements they have. In a similar vein, academics working in the field of Child Computer Interaction (CCI) are aggressively pushing the direct participation of young users. The participation of parents and guardians is the first step that must be taken in order to create an inclusive environment; nevertheless, this continues to be a difficulty. Both the literature in CCI and our experience in managing a project that included very young children in the co-design of technology to enhance the development of pre-reading abilities will serve as the basis for the discussion that will take place. The notion of the kid as protagonist, as it has been championed by current literature, will be presented, and we will investigate whether or not the community has adopted it throughout time, as well as how it has done so. When doing user studies that include children, we will begin by conducting a systematic study of the many techniques that are available to reach out to and include children. This analysis will begin with a focus on distinct domains, contexts, and age groups. We will be able to expand on open topics that are for the CCI as well as the HCI community to ponder on as a result of our experience with the recruitment of young children and the battle to make our research inclusive. This will give an insight into a facet that is seldom covered in the literature.

Keywords: Children, Codesign, Collaborative Design, Inclusivity

Introduction:

In recent years, children have begun utilising technology at an ever younger age. Tablets and laptops are now being used by toddlers as young as three or four years old, and students are using them for both educational and recreational purposes. Children, on the other hand, do not have the ability to utilise technology independently; rather, their use of technology is heavily influenced by the ideas of their parents, teachers, and other

carers. As a result, researchers have to make it a priority to include both children and adults as stakeholders in the process of designing technology for children, in addition to professionals who are knowledgeable in the domains of education and child psychology.

Nevertheless, the participation of children should not be seen as secondary to the adults; rather, they should be at the centre of the design process, taking on a position similar to that of a protagonist, as advocated by Iversen et al. [19].

In this paper, we will begin by providing an overview of the most pertinent research on how to involve children, parents, and other adult stakeholders in the design of new technology. Following that, we will write about our own experience in involving children in co-design sessions, both at school and in an extra-curricular setting. We will detail our insights and observations, as well as the struggles and challenges that we encountered in the course of our work. At last, we will arrive at our conclusions and provide some points of thought for the community to consider.

Related Work:

The most pertinent study on including users in design will be discussed in this part. More specifically, we will focus on involving children, parents, and guardians, and we will outline both the theory and the methodologies that were utilised in the research.

Involving Users in Design:

As a result of its origins in Scandinavia in the 1970s, the concept of participatory design was first intended to be a means of including manufacturing workers in the study and creation of new software for their workplace [22]. As such, it was focused with the concept of democratising work [3]. However, it swiftly expanded, and its ideas are now used all over the globe. This is due to the fact that it has shown that it has numerous advantages. For instance, incorporating users in the design process has a good influence on both the success of the system and the contentment of its users [20]. Users are able to voice and share their experiences, which is another way in which the process of co-design has intrinsic ethical features [35]. Users are given the opportunity to participate in the creation of goods that will improve their quality of life, which may be seen as an empowering process [17].

Designing With and For Children:

Children have begun to be included in the design of new technologies in recent decades, first as testers, then as informants, and eventually as design partners in their own right [9]. In the past, co-designing processes were mostly carried out with adult users. However, in recent decades, children have also begun to participate in the design process. According to Read et al. (2002) [27], the optimal age for collaborative design is between the ages of seven and ten years old. This is because

children of that age have a fair aptitude for abstraction and contemplation, but they are still extremely creative, and they do not have any biases or assumptions. When it comes to design, both brainstorming and prototyping are effective strategies for children of this age range. Prototyping allows children to discover a greater variety of design concepts, while brainstorming allows them to offer more specific criteria [31]. In addition, other techniques for evaluating technology with children, such as the Fun Toolkit, have been created for older children, particularly those who are at least seven years old [28].

Certain strategies those were initially intended for older children, such as the Cooperative Inquiry ([8]), have been effectively adapted for younger children with certain modifications. These modifications include allowing the children to sketch their thoughts rather than writing them down and working in smaller groups [10]. The findings of Superti et al. (2020) [37] and Farber et al. (2002) [10] both highlight the fact that youngsters perform better when they are working in intimate groups. This is further backed by [2], who goes beyond that to give evidence showing younger children, between the ages of 4 and 5, have the greatest difficulties working cooperatively and function best in pairs. [2] also supports this idea.

Barendregt and Bekker (2013) [1] used the drawing intervention method to elicit design ideas from children aged 4 to 7 years old. They discovered that the younger children found it difficult to collaborate and had difficulty using drawings to communicate design ideas. Other techniques have been shown to be useful with older preschoolers, but they still present challenges with children on the younger side of this age range. Another example is that Barendregt and Bekker (2013) [1] used the drawing intervention method. This was also the case for Hiniker et al. (2017) [14], who used techniques such as Fictional Inquiry and Comicboarding, which were developed to elicit insights from adults users, with children aged 4 to 6 years old. While children aged 5 and 6 years old were able to successfully generate design ideas, children aged 4 years old had more difficulty doing so. On the other hand, younger children continued to engage with enthusiasm, which suggests that they may participate completely in the design process if they were provided with more adult facilitation from adults. This is also supported by Farber et al. (2002) [10], who point out that "More adult facilitation" is one of the modifications to design approaches that is required in order to facilitate the participation of younger children. On the other hand, Marco et al. (2013) [21] found that less structured sessions, in which children were only needed to receive a limited number of instructions, tended to yield more trustworthy and meaningful data for researchers.

In addition, there are a great deal of design approaches that have been created especially for younger children. For example, children have the potential to become protagonists in the design process [33], as envisioned by Iversen et al. [19] and in accordance with an approach that is based on constructive play practice, with the goal of establishing a cooperative process and generating a storyline. One further example is the experiment known as Mixing Ideas [12], which has been used to encourage young children to work together. Play-based design is another method that has been created for younger children. This method involves young children engaging in activities that include pretend play with the assistance of an adult facilitator [37].

It is still challenging to properly incorporate younger children, and there is still a great deal of study that needs to be done in this area, despite the fact that collaborative design has made progress towards inclusion by incorporating children of a broader age range than in the past. The importance of this study cannot be overstated since children are beginning to utilise technology at an earlier age than ever before. As a consequence, it is imperative that children be engaged in the design of the technology that they use.

The Role of Parents:

Due to the fact that children are not yet capable of using technology on their own, the viewpoints and insights of parents are essential in the creation of technology for children. As a result of this, several studies have specifically sought the opinion of parents about their own requirements and points of view, particularly with regard to issues such as the utilisation of technology for educational purposes and the safety and appropriateness of the technology. In certain research, the viewpoints of both parents and children have been contrasted, and activities that both parents and children participate in have been taken into consideration.

The viewpoints of parents about the appropriateness and compatibility of technology 87 adult guardians, including parents and other family members, were asked to participate in questionnaires and interviews by Sobel et al. (2017) [32] in order to get insight into their perceptions of location-based smartphone games, notably Pokemon GO. Seventy percent of the guardians were female. Adults were concerned about their safety in the real-world environment, despite the fact that they appreciated the fact that playing Pokemon GO led to an increase in the amount of time spent exercising and spending time outside.

On the subject of children's cybersecurity risks, Quayumm et al. (2021) [26] conducted semi-structured interviews with 25 parents of children aged 10 to 15 years old. Eight of the parents were fathers, and seventeen were mothers. The parents believed that children should be aware of the potential dangers that they face online, as well as be

able to think critically and be sceptical of what they discover on the internet.

Researchers Sun et al. (2021) [36] conducted interviews with 23 parents of children ranging in age from one to eleven years old in order to gain insight into their perceptions of the physical and digital safety risks that smart home technology poses for their children. The researchers discovered that parents encountered risks that they had not anticipated when they introduced smart home technology into their homes. Furthermore, they discovered that as children grow older, the perceived risks shift from physical to digital safety.

The viewpoints on technology, on the other hand, might vary even within a family, with various sets of parents having different beliefs and perspectives on the subject. In the study conducted by Derix and Leong (2020) [7], the probing technique was used to collect information from seventeen participants who came from eight households that had at least one kid under the age of twelve. For the eight family sets, there were six families consisting of a mother and a father, one family consisting of two moms, and one family in which the tasks of parenting were shared by a mother, an aunt, and a grandmother simultaneously. In most families, one parents engaged with the probes in a most comprehensive way than the other(s), and when collective responses to the probes were compared with individual ones, in many cases the collective response coincided with the response from the parent who had engaged more with the probes, who was also the parents with more domestic and childcare responsibilities.

Perceptions of parents on the use of technology in education With the purpose of determining the areas in which parents require the assistance of technology in order to support their children's learning, Hightower et al. (2019) [13] conducted semi-structured interviews with twelve mothers of children ranging in age from three to five and a half years old. The purpose of these interviews was to investigate the mothers' beliefs regarding the role of media in their children's STEM learning. Parents have reported utilising the media as a support tool for STEM learning. They believe that the media should be utilised as a reinforcement of ideas that have previously been taught to the children. However, they have also expressed worry about obtaining media that is suitable for their children's age and educational level.

Yu et al. (2020) [39] conducted interviews with parents who had purchased coding kits for their children to use at home. The purpose of these interviews was to get an understanding of what the parents anticipated their children would come out of using the kits, what responsibilities the parents would play, and whether or not they had any reservations about the activity. Among the participants were 18 parents with children ranging in age from three to nine years old, including thirteen mothers and five dads. In spite of the fact that parents were aware of the advantages

of coding kits, they were also concerned about the fact that they lacked the computer programming expertise necessary to assist their children.

Solyst et al. (2022) [34] conducted a survey that included 133 parents of children who were in middle school or high school. Of the 133 parents, 105 were moms and 21 were dads. The study inquired about the perspectives of parents on computer science, as well as the degree to which they believed it was essential for their children to acquire knowledge in this field. The findings of the study indicate that the initial impression that parents have of computer science is that it involves the use of gadgets and applications, rather than the creation and development of these things. Further, when this assumption is rectified, parents have the impression that the significance of computer science decreases. A limited number of parents actively encourage their children to learn computer science, with parents who are more familiar with computer science being more likely to encourage their children to follow the same path. This is despite the fact that only a small number of participants expressed scepticism regarding computer science, and the majority of them believed that their children are capable of learning it.

Include both the parents and the children in the design process There have been a number of studies that have included both children and their parents in the creation of technology on a variety of different levels. According to the findings of a study conducted by Horton and Read (2012) [16], a total of twelve parents and their children between the ages of six and ten were questioned about the types of technology that were present in their homes, who owned it, if it was shared, and whether or not the kid was permitted to use it. All that was asked of the children was what kind of electronics they have at home. In spite of the fact that children are able to provide correct information on the technological devices that they have at home, the findings of the study indicate that they do not always correlate the products that they have at home with the ones that their parents claim they have access to.

Oygu¨r et al. (2021) [23] conducted a study that contrasted the viewpoints of children and parents. The study included conducting interviews with 17 households that had children ranging in age from 7 to 12 years old. These families were using wearable devices to monitor their physical activity on a daily basis. The interviews were conducted with a total of 18 parents, 15 of whom were women and three of whom were dads. The results of this research shown that children and parents place different importance on various factors and have different motivations when it comes to the use of wearables. While parents are mainly motivated by the health and well-being of their children, children are more concerned with the entertainment and achievement that comes with achieving their objectives.

In Sadka and Zuckerman's (2017) [29] study, both parents and children participated in a co-making activity at home. The researchers displayed their findings on a two-dimensional scale with two metrics: parent initiative, with low initiative corresponding to the "mentor" role and parent as peer and high initiative corresponding to the "peer" role; and attention, which is a prerequisite for a successful co-making activity and for both the peer and mentor role, with the latter being preferable because it is more focused on the child's learning process than on the completion of the activity.

In a study that lasted for six weeks and involved six families with children aged ten to twelve years old, Hoffman et al. (2013) [15] evaluated an in-car game. They discovered that adults and children have different expectations and desires. Additionally, parents were concerned that introducing a game during car journeys might cause their children to shift their focus towards the screen, which would cause them to become detached from the family and the environment.

Using the Cooperative Enquiry technique, Yip et al. (2016) [38] recruited sixteen families, consisting of both parents and children, via a middle school in the area. These families participated in a series of nine co-design sessions that took place over the course of ten months. They took note of the many ways in which parents participated in the co-design activity, including both passive and supportive participation, acting as advocates for their children, and taking on the role of parental managers. In addition, they took note of the worries that the parents had about the co-design activity. These issues included the worry that they would have to spend time away from their children's schoolwork and the sacrifices that they may have to make in order to attend the sessions.

The third and last session of the collaborative design sessions that Garg and Sengupta (2020) [11] performed with children included the participation of parents as design companions. Throughout the course of these sessions, the parents continued to develop their children's designs by including elements that were associated with social participation, parental controls, and privacy. In general, it is evident that the majority of research that include parents are the ones that were conducted relatively recently, and that moms make up the majority of the parents who participated in these studies. On the other hand, there is a major bias due to the fact that participation in these research is always voluntary and the fact that the parents that take part are also the parents who are ready to utilise technology with their children. Nevertheless, concerns over privacy, digital safety, and control are recurrent themes that can be found across the body of research that has been conducted.

The Role of Teachers:

It has been shown that including educators in the process of designing

technological solutions may have a beneficial impact on the outcomes of learning [6], as well as on the teachers' ability to take ownership and agency not only in the design process, but also in the diffusion of the innovation [25].

Teachers may also be included as facilitators in assessment activities, demonstrating that they are able to discover comparable usability issues as the researchers with very little training [24]. This is true even if students see them as authoritative figures, while researchers are not perceived in this light by students.

A further point to consider is that when instructors participate in co-design activities in the classroom, they anticipate and experience a variety of user benefits, not just for themselves but also for the students [4]. For instance, they anticipate that they, along with their kids, will acquire a greater understanding of technology, and that the youngsters will have a good time along the way. However, considering that instructors often have limited time to devote to these activities, B¨orjesson et al. [4] proposes the idea of including design activities into the curriculum of professional development for teachers, with the aim of making it more convenient for them to take part in these activities.

In point of fact, this was the strategy that Celeptoku et al. (2020) [5] used, as they planned a professional development workshop in which twenty-two educators gained knowledge about computer science and developed lesson plans to incorporate it into their classrooms. The workshop gave educators the opportunity to get a better understanding of the potential of computer science to teach critical thinking and to better prepare students for their future. At the same time, it gave researchers the opportunity to investigate the views and expectations that teachers have about the role that computer science may play in the classroom.

Teachers' needs and preferences for digital activities that are to be used in schools are extremely important in order to guarantee that the activities are carried out in the classrooms. This is because when teachers have a favourable attitude towards an innovation, they have a tendency to use it more in their class [30]. For instance, teachers prefer games that promote learning and align well with the school curriculum, while at the same time improving soft skills and increasing engagement with computers [18].

Our Experience:

A number of different user studies were carried out by our team during the duration of our project. These user studies included semi-structured interviews with educators, parents, and subject matter experts, as well as evaluations and collaborative design sessions with children. These sessions were undertaken in both educational and extracurricular contexts.

In the following section, we will discuss the procedures that we used in order to

recruit participants, arrange the research, and evaluate the data. Additionally, we will discuss the difficulties that we faced and the insights that we were able to get.

Working with Schools:

In 2019, we began our collaboration with preschools by forming a partnership with a private preschool in Lugano. The purpose of this research was to perform a user study with children between the ages of three and six, who would be assessing a reading software that was installed on a tablet. Preschool is a kind of education that is not required to be attended in Switzerland; yet, it is nonetheless required to adhere to a curriculum that is prescribed by the government. We came to the conclusion that it would be beneficial to have a partnership with a private school that provided longer hours for working parents. As a result, we were able to participate in activities that went beyond the curriculum of the school.

While the headmistress of the school was excited about our initiative, the teachers were cautious since the majority of them were reluctant to utilise technology in the classroom. For instance, even though every classroom was equipped with an interactive whiteboard, only the English teacher could be seen using it. As a result of the fact that students already spent a large amount of time in front of screens at home, some educators felt that there was no need to additionally integrate technology in the classroom.

A presentation of our study, a short survey on the reading habits of their children, and an informed consent form that the parent would be required to sign were all included in the permission forms that we developed for the parents. Furthermore, we included our contact information in order to make it possible for parents who had inquiries to get in touch with us.

The permission form was signed by the majority of parents; nevertheless, there were some parents who informed us that they did not want their children to take part in the activity, and there were other parents who phoned us with worries and questions.

We were able to have individual time with each child while the other children continued with their activities with the teacher. In addition, teachers were able to choose the best times of the day for us to perform our study, which was when the children were neither too tired nor too excited. They also advised us on each child's individual personality and mood. These are just some of the tangible advantages that we were able to take advantage of when we conducted our user study in a school setting.

Our study sessions, on the other hand, were to be scheduled at times when our professors had time for us. This was necessary since the activity that we provided was deemed optional, and as such, it should not interfere with the activities that were taking place at school.

Following the COVID-19 epidemic that occurred in 2020, we made an effort to restart our engagement with schools. As part of this effort, we were able to conduct semi-structured interviews with preschool teachers in order to get a better understanding of how their viewpoint on the use of technology in schools had changed.

On the other hand, instructors had a significantly increased workload both during and after the closures, and as a result, we were unable to carry out any more co-design sessions or user studies inside the school.

We also attempted to form partnerships with the public schools in the city region, as we thought that doing so would have enabled us to engage with a more varied group of students. It is important to emphasise that we made this effort. On the other hand, as was indicated earlier, public schools in Switzerland are subject to a substantial amount of scrutiny from the cantonal authorities. As a result, it is more challenging for them to find the time to participate in activities that are not part of the established curriculum. Despite the fact that we were successful in securing a semi-structured interview with a teacher who had been in charge of online learning during the school shutdown, we were unable to follow up with any school visits.

Designing In A Non-School Context:

During the course of our study, we also carried out user studies in contexts that were not educational, namely at the university and at a children's library in the neighbourhood. Because our institution provides a summer camp for the children of employees that lasts for a week, we made the decision to do a co-design session during the camp. We used drawings as a means of eliciting the children's suggestions for design via the use of this approach.

Nevertheless, this approach presented a great deal of difficulties in terms of logistics. In the beginning, it was essential to seek permission from the Ethics Committee in addition to approval from the legal office of the university. After that, parents were required to sign an informed consent form about their participation. We had to negotiate with the camp entertainers in order to find a time and a place that were suitable for everyone, as well as to rely on them to provide an alternative activity for older children during the same time frame. This was necessary due to the fact that the camp schedule was extremely packed, and the camp participants were of varying ages. There were several children who were older than the age range in which we were interested. Even though we were able to successfully carry out the activity in the end, we were only able to get a limited amount of insight due to the fact that we only had one session with youngsters with whom we were not acquainted.

In addition, we collaborated with a children's library in the area to organise a series of collaborative design workshops

for children. The purpose of these sessions was to learn about the design of technology that would assist children in developing their pre-reading abilities.

It was with great enthusiasm that the personnel of the library offered their assistance. They disseminated the information about our initiative as well as the permission form via the mailing list of the library, which is comprised of parents who are frequent patrons of the library.

Through the use of a different location that was also made available to us by the library, we were able to successfully carry out two distinct sets of sessions, which included a total of more than fifteen youngsters.

The partnership with the library provided us with a number of benefits, including the fact that it was a well-known organisation that a large number of parents were already acquainted with, and that we could depend on the mailing list to disseminate information on the project. We were able to develop a connection with the youngsters by conducting a study over the course of many weeks. This enabled us to get tremendous insight and come up with unique design concepts. When we held our second series of co-design sessions, a number of youngsters who had taken part in the first set of sessions also signed up for subsequent sessions.

However, there were also some drawbacks: first, because the children were recruited through the library's mailing list, there was a selection bias in the children who participated in the study. This was due to the fact that the children were already familiar with and interested in books and reading, and they came from families that also placed a high value on reading.

Due to the fact that we conducted the exercise as the school day was coming to a close, the students were often exhausted or thrilled, making it difficult for them to concentrate on skills such as reading. In spite of the fact that we did not like to be seen as authoritative figures, we made it a point to cultivate relationships with each youngster, which enabled us to carry out the activity in a more efficient manner. We placed a high value on communication with the parents, some of whom were interested in our project and asked a lot of questions about it. However, we also had the impression that the majority of the parents did not really care about the particulars of the project. They viewed our user study as "another activity organised by the library," which meant that they had an hour in which they could run errands while someone else took care of their children. This resulted in a number of issues, including parents failing to inform us when their children would be missing from the study due to sickness or when they wanted to withdraw totally from the research. Additionally, parents often arrived late to bring their children to the library, which reduced the amount of time we were able to spend with them, which was already limited.

For the most part, the assistance that we received from the library was

essential to the accomplishment of the research. They provided us with projectors, pillows for the children, and facilities that made it possible for us to conduct our study in the most efficient manner possible.

Conclusion:

In this section, we will lay out what we have learnt from the difficulties that we have experienced during the course of our project, as well as how we intend to resolve these difficulties in the future.

In our research, one of the most difficult obstacles was to find youngsters to participate. In this regard, working with schools has a significant benefit over attempting to recruit children for after-school activities. This is because the majority of the children in the class will be allowed to participate, providing that their parents sign the permission form. With that being said, schools often have very limited leeway when it comes to arranging activities that are not part of the curriculum. As a result, it is vital to reach a compromise with both the instructors and the administration in order to find time for user studies.

When we worked with a library, we were able to recruit children through an established institution that already had a community of parents and children readers. On the other hand, because the activity was organised after school, we had much more flexibility in terms of when and how we organised our study. Working with a library is like having the best of both worlds.

On the other hand, it is important to point out that the number of children who participated in the sessions was not very high. A significant number of children attended just a few of the sessions, and some of them signed up but never showed up. Having foreseen this problem, we accepted a greater number of children than we had imagined we would need. This was due to the fact that we rightly predicted that not all of the children would be present at each and every session. In the description of our investigations, it was indicated that parents play a significant role in enabling and supporting the involvement of their children. They were typically hesitant about introducing technology to their children because they are generally frightened of exposing their children to the hazards of being hooked to screen time. Despite the fact that they acknowledged the significance of technology for their children's future, they were quite careful about introducing it. The most important thing that we have realised is that inclusiveness is not something that comes lightly; rather, it is something that demands thoughtful preparation and work. However, being open and ready to listen is already a good beginning towards achieving it.

References:

[1]. Barendregt, W., Bekker, T.: Exploring the potential of the drawing intervention method for

design and evaluation by young children. In: CHI'13 Extended Abstracts on Human Factors in Computing Systems, pp. 193–198 (2013)
[2]. Benford, S., Bederson, B.B., A˚kesson, K.P., Bayon, V., Druin, A., Hansson, P.,
[3]. Bjorgvinsson, E., Ehn, P., Hillgren, P.A.: Participatory design and "democ- ratizing innovation". In: Proceedings of the 11th Biennial Participatory De- sign Conference. p. 41–50. PDC '10, Association for Computing Machin- ery, New York, NY, USA (2010). https://doi.org/10.1145/1900441.1900448
[4]. Borjesson, P., Barendregt, W., Eriksson, E., Torgersson, O., Bekker, T.: Teachers' expected and perceived gains of participation in classroom based design activities. In: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. pp. 1–9 (2019)
[5]. Celepkolu, M., O'Halloran, E., Boyer, K.E.: Upper elementary and middle grade teachers' perceptions, concerns, and goals for integrating cs into classrooms. In: Proceedings of the 51st ACM technical symposium on computer science education. pp. 965–970 (2020)
[6]. Cviko, A., McKenney, S., Voogt, J.: Teachers as co-designers of technology-rich learning activities for early literacy. Technology, Pedagogy and Education 24(4), 443–459 (2015)
[7]. Derix, E.C., Leong, T.W.: Probes to explore the individual perspectives on tech- nology use that exist within sets of parents. In: Proceedings of the 2020 ACM Designing Interactive Systems Conference. pp. 519–531 (2020)
[8]. Druin, A.: Cooperative inquiry: developing new technologies for children with chil- dren. In: Proceedings of the SIGCHI conference on Human Factors in Computing Systems. pp. 592–599 (1999)
[9]. Druin, A.: The role of children in the design of new technology. Behaviour and information technology 21(1), 1–25 (2002)
[10]. Farber, A., Druin, A., Chipman, G., Julian, D., Somashekhar, S.: How young can our design partners be? Tech. rep. (2002)
[11]. Garg, R., Sengupta, S.: Conversational technologies for in-home learning: using co-design to understand children's and parents' perspectives. In: Proceedings of the 2020 CHI conference on human factors in computing systems. pp. 1–13 (2020)
[12]. Guha, M.L., Druin, A., Chipman, G., Fails, J.A., Simms, S., Farber, A.: Mixing ideas: a new technique for working with young children as design partners. In: Proceedings of the 2004 conference on Interaction design and children: building a community. pp. 35–42 (2004)
[13]. Hightower, B., Sheehan, K., Lauricella, A., Wartella, E.: Exploring parent use of early stem media to inform design for children. In: Proceedings of the 18th ACM International Conference on Interaction Design and Children. pp. 102–108 (2019)
[14]. Hiniker, A., Sobel, K., Lee, B.: Co-designing with preschoolers using fictional in- quiry and comicboarding. In: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. pp. 5767–5772 (2017)
[15]. Hoffman, G., Gal-Oz, A., David, S., Zuckerman, O.: In-car game design for children: child vs. parent perspective. In: Proceedings of the 12th international conference on

interaction design and children. pp. 112–119 (2013)
[16]. Horton, M., Read, J.C.: Parents and children having and using technology: what should we ask? In: Proceedings of the 11th International Conference on Interaction Design and Children. pp. 252–255 (2012)
[17]. Hourcade, J.P., Ingram, R., Neale, H., O'malley, C., et al.: Designing storytelling technologies to encouraging collaboration between young children. In: Proceedings of the SIGCHI conference on Human factors in computing systems. pp. 556–563 (2000)
[18]. Hussain, S.: Empowering marginalised children in developing countries through participatory design processes. CoDesign 6, 99–117 (06 2010). https://doi.org/10.1080/15710882.2010.499467
[19]. India, G., O, A., Diwakar, N., Jain, M., Vashistha, A., Swaminathan, M.: Teachers' perceptions around digital games for children in low-resource schools for the blind. In: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems. pp. 1–17 (2021)
[20]. Iversen, O.S., Smith, R.C., Dindler, C.: Child as Protagonist: Expanding the Role of Children in Participatory Design, p. 27–37. Association for Computing Machinery, New York, NY, USA (2017), https://doi.org/10.1145/3078072.3079725
[21]. Kujala, S.: User involvement: a review of the benefits and challenges. Behaviour & information technology 22(1), 1–16 (2003)
[22]. Marco, J., Baldassarri, S., Cerezo, E.: Nikvision: Developing a tangible application for and with children. J. Univers. Comput. Sci. 19(15), 2266–2291 (2013)
[23]. Nygaard, K., Bergo, O.T.: Planlegging, styring og databehandling: grunnbok for fagbevegelsen: Datamaskiner, systemer og spr˚ak. Del 2 (1974)
[24]. Oygu¨r, I., Su, Z., A. Epstein, D., Chen, Y.: The lived experience of child-owned wearables: Comparing children's and parents' perspectives on activity tracking. In: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems. pp. 1–12 (2021)
[25]. Pardo, S., Vetere, F., Howard, S.: Teachers' involvement in usability testing with children. In: Proceedings of the 2006 conference on Interaction design and children. pp. 89–92 (2006)
[26]. Penuel, W.R., Roschelle, J., Shechtman, N.: Designing formative assessment soft- ware with teachers: An analysis of the co-design process. Research and practice in technology enhanced learning 2(01), 51–74 (2007)
[27]. Quayyum, F., Bueie, J., Cruzes, D.S., Jaccheri, L., Vidal, J.C.T.: Understanding parents' perceptions of children's cybersecurity awareness in norway. In: Proceedings of the Conference on Information Technology for Social Good. pp. 236–241 (2021)
[28]. Read, J.C., Gregory, P., MacFarlane, S., McManus, B., Gray, P., Patel, R.: An investigation of participatory design with children-informant, balanced and facili- tated design. In: Interaction design and Children. pp. 53–64. Eindhoven (2002)
[29]. Read, J.C., MacFarlane, S.: Using the fun toolkit and other survey methods to gather opinions in child computer interaction. In: Proceedings of the 2006 confer-

ence on Interaction design and children. pp. 81–88 (2006)
[30]. S¨odergren, A.C., Van Mechelen, M.: Towards a child-led design process a pilot study: when pre-schoolers' play becomes designing. In: Proceedings of the 18th ACM International Conference on Interaction Design and Children. pp. 629–634 (2019)
[31]. Sadka, O., Zuckerman, O.: From parents to mentors: Parent-child interaction in co-making activities. In: Proceedings of the 2017 Conference on Interaction Design and Children. pp. 609–615 (2017)
[32]. Santos, M.L., Prudente, M.: Perceptions of public-school teachers on the use of virtual laboratories in teaching science. In: 2022 13th International Conference on E-Education, E-Business, E-Management, and E-Learning (IC4E). pp. 35–39 (2022)
[33]. Sluis-Thiescheffer, W., Bekker, T., Eggen, B.: Comparing early design methods for children. In: Proceedings of the 6th international conference on Interaction design and children. pp. 17–24 (2007)
[34]. Sobel, K., Bhattacharya, A., Hiniker, A., Lee, J.H., Kientz, J.A., Yip, J.C.: It wasn't really about the pok´emon: parents' perspectives on a location-based mobile game. In: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. pp. 1483–1496 (2017)
[35]. Solyst, J., Yao, L., Axon, A., Ogan, A.: " it is the future": Exploring parent per- spectives of cs education. In: Proceedings of the 53rd ACM Technical Symposium on Computer Science Education V. 1. pp. 258–264 (2022)
[36]. Steen, M.: Co-design as a process of joint inquiry and imagination. Design Issues
[37]. Sun, K., Zou, Y., Radesky, J., Brooks, C., Schaub, F.: Child safety in the smart home: parents' perceptions, needs, and mitigation strategies. Proceedings of the ACM on Human-Computer Interaction 5(CSCW2), 1–41 (2021)
[38]. Superti Pantoja, L., Diederich, K., Crawford, L., Corbett, M., Klemm, S., Pe- terman, K., Currin, F., Hourcade, J.P.: Play-based design: Giving 3-to 4-year-old children a voice in the design process. In: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. pp. 1–14 (2020)
[39]. Yip, J.C., Clegg, T., Ahn, J., Uchidiuno, J.O., Bonsignore, E., Beck, A., Pauw, D., Mills, K.: The evolution of engagements and social bonds during child-parent co-design. In: Proceedings of the 2016 CHI Conference on Human Factors in Com- puting Systems. pp. 3607–3619 (2016)
[40]. Yu, J., Bai, C., Roque, R.: Considering parents in coding kit design: Understanding parents' perspectives and roles. In: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. pp. 1–14 (2020)