Opinion paper

Lessons for child–computer interaction studies following the research challenges during the Covid-19 pandemic

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ARTICLE INFO

ABSTRACT

The impact of the Covid-19 pandemic has been experienced differently in and within individual countries and thus has had a different impact on the individual researchers in the child–computer interaction studies. There were several challenges that our research group experienced during the pandemic period, with a rapid transition to digital working conditions and a society managing altered living conditions. The changes happened on all levels of the society, and they affected our key participants — children, teachers, designers of children's digital books and publishers. In this Viewpoint article we highlight the lessons learnt from the changes in our study designs and data collection processes due to lockdown and other restrictions related to the pandemic. We draw on three case studies to showcase the adjustments we made and the impact such changes have had on the quality of data, participants' attitudes towards data collection and the studies' outcomes. The theoretical frameworks of 'funds of knowledge' and 'funds of identity' structure our discussion on the new knowledge, skills and resources that were mobilized during the pandemic from diverse community members. We propose the concept of 'community of practice' to guide future developments in child–computer interaction studies to support and sustain collectives of multi-disciplinary, trusted networks of diverse stakeholders.

1. Introduction

The 11th of March 2020 is a landmark day in the short history of the 21st century. It was the day when the World Health Organization (WHO) announced a global pandemic. Since then, the coronavirus disease 2019, Covid-19, has had immediate and long-term effects on the entire fabric of societies. To flatten the curve of infection, individual governments have been encouraging physical distancing. Most countries adopted a lockdown strategy, accompanied with a closure of public places including schools and pre-schools. The situation in Norway mirrored that of European countries in that politicians implemented strategies in line with WHO's advice for ≪testing, isolation and tracking≫. Norway has created its own Covid-19 tests and politicians locked-down large parts of the society to control the spread of the virus. The Norwegian Institute of Public Health, acting as the key Advisory Body to the Norwegian Government, followed the strategy of controlling the epidemic and evaluating possibilities for slowing

down its spread. The first Covid-19 infection was detected on the 26th of February 2020 and official lockdown mandate was issued on the 12th of March 2020. The lockdown included shutting down of schools and kindergartens, but child day care was re-opened on the 20th of April 2020 and primary school classes for years 1–4 and out-of-school care programs from the 27th of April. Norway has a free high-quality healthcare system with equal access to all services for all citizens. At the time of writing, the mortality rate in Norway is low, with 264 deaths, more than 10.162 reported cases and 588.550 tested people [1].

Our research group at the University of Stavanger is an interdisciplinary group of early childhood researchers interested in documenting and improving young children's learning and development. The pandemic imposed three main changes to our current research activities: *1, we replaced researcher observations with parent observations*; *2, we expanded our hub of resources for parents and children with corona e-books and 3, we switched from face-to-face focus group interviews to online-based digital interviews*. We outline the details of these changes and the lessons we learnt in implementing them, with the intention of informing future child–computer interaction studies that might experience similar challenges. We summarize our observations as extracted from three case studies, structured around the context of the

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study, challenges during the early stages of the pandemic, the changes we implemented and our own researchers' reflections on the impact of these changes for the quality of the individual research studies. We discuss our experiences in light of the frameworks of funds of knowledge and funds of identity as useful strategic tools for future work in child–computer interaction studies (CCIS).

2. Case study 1: Children's personalized books and empathy

2.1. Study context

The objective of this empirical study was to determine the relationship between children's reading of personalized books and empathy. Empathy was defined as the ability to experience the same feelings as those of another person in response to a particular situation (see [2]), that is children's experience of feelings that are the same as those of the story characters in the book. The rationale for the study was that repeated reading of books can mobilize the child's knowledge about specific emotions experienced by different story characters. Our original plan was to emulate the study procedure we followed with a British cohort, where we tested the impact of personalized books on children's vocabulary and speech [3]. In [3], we followed a within-subject counterbalanced design, with a strict reading protocol. The children were read the personalized books on an iPad, one-to-one with their parents in a university psychology lab. The personalized books were created with photographs provided by the children's parents and were presented to the children in the form of a digital story created with the Our Story app. This study took place in the city of Stavanger, where we focused on empathy as the main outcome variable, and we made plans for one-to-one reading led by the researchers in local kindergartens. Following ethical permission from the Norwegian Ethical Data Protection Agency (NSD), we recruited twenty children from two local kindergartens.

2.2. Changes following the Covid-19 outbreak

When it became apparent that researchers will not be able to visit children in kindergartens and read individually with each child, we decided to focus on parent–child reading of personalized books at home. Instead of using iPads and digital books, we used printed personalized books. Printed (paper-based) personalized books are widely available as commercial products, they are popular gifts for children, and they can be sent directly to parents' homes, thus removing potential barriers due to families' technological access or parents' digital competence. With the kindergartens' closure, the money that we saved on researchers' travel, could be diverted for printing and shipping physical books. The personalized books that we used as stimulus instruments had the same story for all children, but the story was customized to them based on their name, gender, hair, skin and eye color. The story titled 'Adventures in Alaska' followed the adventures of a girl or a boy visiting Alaska, finding new friends in a new country and experiencing four key emotions: curiosity, sadness, happiness and fear. Each participating child received their own personalized version of this story, with the main character named after the child and looking similar to the child. Parents were sent the personalized books together with a letter explaining the changes to the study protocol, a copy of the letter from NSD and a parents' questionnaire. In the parents' letter, we asked parents to read the book with their children at home and to note down the child's and their own reaction to it. We also asked the parents to encourage their child to make a drawing based on their experience of reading the book. The questionnaire contained

questions such as: '*What was your child's first reaction to the book?*'; '*Which book characters liked your child most and why?*'; '*When you ask your child to retell the story to you, what does he or she say?*'; '*What is your own view on the book, including the story plot, main story characters and overall experience of reading it with your child?*'. These questions were deliberately open-ended with room for parents to share their views and engage in a dialogue with the child. Parents were free to add their notes to the questionnaire or write them on an additional sheet of paper if their responses were longer than the provided space on the questionnaires.

2.3. Challenges

Logistical challenges included book delivery during the pandemic because of reduced postal services. This has caused significant delays to the planned distribution of books to the children. As a result, the date when children received their books was very close to their final date in the kindergarten before they began primary school. Given that our cohort was the eldest children in the kindergartens (aged five years), the study delay meant that the kindergartens lost contact with some children who went to school after the summer holidays. Due to the personalized nature of the books, we could not re-use them for other children potentially interested in the study the following year. The parents filled out the questionnaires during the summer months when they are usually on holiday and have no contact with the kindergarten. This meant that we had a high attrition rate, with only eleven fully completed questionnaires. Nevertheless, the questionnaires and drawings that were returned to us contained rich answers and provided us with detailed insights into children's and parents' perceptions about their personalized books.

2.4. Reflections

Questionnaires were a convenient and effective method to find out about the children's as well as the parents' views about their reading experiences. Some parents followed our request to note down children's verbatim responses, by writing, for example 'He said: I like the bear!'. Other parents described children's behavior with rich adjectives, and noted children's responses to the book over a longer period than we had anticipated, with a mention of repeated readings or the child's request to read the book 'every evening'. Moreover, parents noted their responses to the book separately from the child's experiences and these were not always in accordance with each other. For example, one mother wrote that while her child thought the book was 'So nice and I like it so much!', she found it 'Difficult to read'. This differentiation allowed us to get to know both adults' and children's perspectives, which we did not anticipate in the original design. With hindsight, we can see a variety in the length and detail provided by individual parents and recommend clearer instructions for future studies distributing questionnaires for parents' home completion. Had we made our expectations clearer by, for example, encouraging parents to write down their evaluations and/or children's verbatim comments in separate sections of the questionnaire, there may have been greater consistency in the type of data we received. Structuring parents' answers with clearer instructions and the request to only write children's answers verbatim, would allow us to capture children's direct quotes rather than the parents' interpretations of what the children said.

As for the question of empathy and children's experience with the emotions depicted in the personalized books, the changes to the study protocol meant that we could no longer determine the effects of personalization on children's empathy. Yet, although we did not have the rigor of an experimental design, we could gauge

children's views and attitudes towards the emotions depicted in the books. For this qualitative perspective we integrated the themes apparent in parents' questionnaires and in the children's drawings.

Overall, the pandemic introduced changes to the study design and study protocol that brought to fore perceptions of more stakeholders. The changes allowed us to get a sense of parents' views on reading personalized books in addition to children's views and these were based on an ecologically valid reading situation at home. Home reading avoided disruption to the schedule of the kindergarten, which was welcomed by the kindergarten owners. Gifting the books to the parents was met with an enthusiastic response from the parents, who asked us whether they could receive more of such books in the future. The teachers, too, were very positive about participating in future studies. They went an extra mile in contacting the parents during the pandemic and informing them about our study. The two kindergartens volunteered to facilitate future projects undertaken by our research group. This sense of ownership, or "buy-in" from the key gatekeepers is important for any child-oriented research (see [4]) and especially so in a small community that our research group operates in.

3. Case study 2: Expanding children's digital books with "Corona e-books"

3.1. Study context

The International Collective of Children's Digital Books is a group of researchers, designers, developers, authors, illustrators and publishers interested in children's e-books, apps and digital books. The group has currently 82 active members and several affiliated members and organizations from eighteen countries. The activities of the Collective are financed through various sources, including the members' own research grants, philanthropic funds and pump-priming funds from the University of Stavanger, Norway. The Collective acts as the main hub for bringing together multi-disciplinary international researchers who meet at digital and physical events/conferences and informal meetings. These meetings are planned to include cross-sectional discussions with digital books' designers, developers, publishers and content creators. The need for such a cross-disciplinary dialogue has been highlighted by the members' previous research in which they documented low quality of commercially produced e-books for children and the negative impact of such e-books on children's learning [5]. The structure of the Collective facilitates a sustained dialogue between researchers and designers of children's digital books, in close collaboration with teachers, parents and the children themselves. The Collective's website www.childrensdigital books.com acts as a database of open access articles concerning children's digital books and is a key depository of latest research findings on children's reading on and with screens. The website is also a digital space for parents and teachers to find information about research-based tips and guidelines for selecting, using and sharing digital books with children of pre-school age.

3.2. Changes following the Covid-19 outbreak

The pandemic brought an increased traffic to the Collective's website and a substantially greater interest in the information about effective ways for reading with children digitally. A flurry of messages, emails and requests for interviews arrived from journalists, teachers and parents across the world interested in reading with children on screens. New publishers and app producers asked to join the network and have their products featured on the website under the Collective's recommended resources.

In addition to the interest in the Collective's existing resources, the pandemic generated a new project: Corona E-books for children. These were e-books put together by child practitioners and educational professionals to explain the pandemic in a child-friendly language. The stories in the Corona e-books explained what the virus was, how children can protect themselves against the virus by washing their hands, why there are sudden changes in the classrooms and at home, and how to process difficult emotions such as fear or sadness of losing a relative. Some e-books were simple downloadable PDFs, some had a more sophisticated design. All e-books were illustrated, and some contained downloadable drawings for children to complete. The e-books were available for free from various websites and shared on social media but there was not one place for parents and teachers to find them. The Collective decided to create a new webpage ("Corona E-books") dedicated to digital reading in the times of a pandemic. This webpage hosted download links to selected Corona E-books produced by the community, as well as information for teachers and parents about reading on screen with children during lockdown. The webpage was met with an enthusiastic response from the public, with many parents and teachers sending us their own e-books about their experience of the pandemic, together with children's drawings and stories.

3.3. Challenges

The sudden increase in traffic was a challenge for our small administrative team, with several requests not followed up for weeks. There was a strong desire from the user groups to upload children's own stories to the Corona E-books webpage, which we could not accommodate due to insufficient capacity for their review and storage space on the university servers. We also noted an increase in email phishing attacks, and hackers taking advantage of the pandemic by sending fraudulent emails to our inboxes. We needed to collaborate with university IT teams to be able to handle those challenges.

3.4. Reflections

We were overwhelmed with the positive response from the public to our initiative and interest in the Collective's work. The voluntary work that went into the production of the Corona E-books showed the potential of international communities to come together in challenging times. E-book platforms have been noted to lack user engagement in their design [6], and thus the possibility to add users' own e-books was met with great enthusiasm from the community. The interest solidified our conviction to maintain the website but also increased our responsibility for its maintenance. Having direct access to the website management allowed us to add resources quickly, and as and when they became available. In addition, the trust in the community among the core members was crucial to ensure the integrity in rapid decision-making about new recommended resources displayed on the site. A rapid turnaround was possible because of established working relationships based on mutual support and trust. Furthermore, e-book technology enabled a swift distribution of much needed child-related literature during the lockdown. The voluntary basis of the Collective was both an advantage and a limitation: on one hand, it allowed for free contributions and production of content without any formal expectations from the individual members and on the other hand, the voluntary architecture did not allow for rapid scaling-up. For example, individual members were free to contribute to building the content for the Corona E-book webpage, but without a formal website team, there were inconsistencies in communication over social media and the website updates. A more formal organization of the Collective might be

necessary in the future with staff members dedicated to handling increased email and social media traffic and the contributions from wider community members in times of need. Available in multiple languages and free to download, the Corona E-Books constituted a new example of using screens to inform and educate children and support their reading for pleasure.

4. Case study 3: Transferring from face-to-face to online interviews

4.1. Study context

The third case study is part of a doctoral research project focused on the evaluation of the quality of provision in early childhood education in Norway. The study aims to identify the key factors in teachers' educational practice that improve children's emotional and cognitive development, based on the observational criteria in the Sustained Shared Thinking Emotional Well-being (SSTEW; [7]) & Classroom Assessment Scoring System (CLASS, Pre-K & Toddler, [8]). The key interest is to find out the beliefs and experiences of key educational professionals (kindergarten teachers, employees of the educational psychology services (PPT), Center for multilingual children and young people and the municipality staff) towards the use of the SSTEW and CLASS systems in Norwegian early childhood settings.

4.2. Changes following the Covid-19 outbreak

Shortly before the Covid-19 outbreak, the study received ethical approval from the NSD and the principal investigator started participant recruitment. The lockdown implied a change to the design from face-to-face to digital interviews. We notified NSD and following their approval, notified the participants who have already agreed to participate in the interviews. In addition to changing the design to online interviews, we added a supplementary question to the interview guide, gauging participants' view on conducting the interviews digitally. This way, we expanded our research objectives within this project. During the Covid-19 pandemic, we conducted six digital focus group interviews with teachers from local kindergartens and educational psychologists. The group size ranged from two to seven participants.

4.3. Challenges

Conducting focus group interviews remotely was a new experience for us as well as for our participants. Following the recommendation by the University's IT department, we used the Zoom platform. Norwegian universities have institutional Zoom accounts that are compliant with GDPR and Norwegian privacy legislation.[1] Zoom allows for on-screen recording that is indicated with a red flashing button when active. It is possible to record both video and audio of the interview and we opted for an audio recording, as originally planned for the face-to-face interviews. Before we could start data collection, we had to make sure that the participants had access to the necessary hardware and software to be able to participate in the digital interviews. In our email communication to the participants, we emphasized the importance of testing their Internet connection and Zoom Client for Meetings software before the interview date. We requested that they contacted the project manager if they did not have a good microphone and access to a quiet room where they could participate in the interview without anyone overhearing what they, or other participants, said. Before the interview, we offered the participants the option to take part in a pre-interview to ask

any questions they might have about the interview protocol and potentially prepare some notes that they could then discuss at the full interviews. On the day of the interview, the research manager started the Zoom meeting half an hour before the scheduled time to allow participants to set up. Despite these efforts, some participants did not manage to connect to Zoom or had difficulties with their video or microphone during the interviews or could not see all participants in the Gallery view. Another significant challenge was that despite being reminded by email, several of the participants logged into the interview only minutes before the start, which took valuable time from the interview slot. We also noted that when two of the participants sat together and shared one screen, they tended to be in full agreement with each other's views, which was different from groups that were not co-located and participated via their own individual screens.

4.4. Reflections

The change from face-to-face to digital focus group interviews meant an increase in the number of participants for our study. Before the digital change, the study only had one voluntary participant from Educational Psychology Service (PPT). After the shift to the digital approach, seven more signed up. Educational psychologists in Norway frequently travel between individual schools and have high demands on their time. Unlike the teacher participants, who requested that the interviews take place within their working hours while they were on the school premises, the PPT staff were more flexible with the time of the interview. Indeed, the PPT staff commented that the possibility to participate in the interview digitally provided an opportunity for occupational groups to save valuable time:

'I think it is very good, we have got used to undertaking the conversations in this way in these times. From my perspective, instead of driving to Stavanger, it is easier for me to say yes and to participate. Otherwise I would have needed to use more time'.

A digital interview might thus be a preferable option for selected educational professionals. Future research could consider the possibility of using digital interviews as part of 'blended spaces' [9], where the physical and digital experiences are harmonized, and where the agency of the participants, and the volatility of the spatial arrangement, are brought together.

Another gain from the digital interviews was the increase in the participants' and our own understanding of the affordances of videoconferencing. The participants were aware of the need to upskill themselves in the use of technologies and appreciated the opportunity to do so with our focus group interviews. As one teacher told us: 'Because of Covid-19, we have had a steep learning curve in using the technologies.' For us, a digital data collection provided an opportunity to refine our interview techniques. In particular, it was important for us to ensure that all participants got the opportunity to voice their views and to ensure that there were clear rules in place to facilitate the conversation. The researcher made sure that everyone had their turn to speak and commented on non-verbal cues to draw all participants' attention to their responses. For example, the researcher said: 'I can see you are nodding, are you in agreement?'. The researcher also always mentioned the participants' first names when giving them the word. This made it easier to identify who speaks when in the post-interview transcriptions.

All interviews were attended by a moderator, who steered the interview in a constructive direction. A moderator is recommended for face-to-face focus group interviews (see for example [10,11]) and in our experience, even more important for digital interviews where the interviewer has to keep an eye on several tasks simultaneously. This was commented on positively by the participants, for example one teacher said:

'I think it is great when you say whose turn it is to speak because I sit here and wonder whether I should say something and I do not want to interrupt the others [participants], I have been to other digital meetings where people cut short each other. So it is really good you have a structure here.'

While we cannot make a comparison between data obtained face-to-face and digitally, we noticed rich and open conversations during our digital focus group interviews. The literature indicates that shy and quiet individuals prefer to conduct interviews digitally than face-to-face [10,12]. Overall, the possibility to conduct interviews digitally seemed to have been perceived positively by the participants:

'I think it is wonderful that we get used to do it [digitally] because I think that when we meet physically, time gets used for other things … these [digital] meetings are more effective, I think.'

5. Discussion

Having situated the challenges during the Covid-19 pandemic for our research group, we discuss the changes and challenges experienced during the pandemic in relation to theory and the wider field of child–computer interaction research. We selected the theoretical frameworks of Funds of Knowledge [13] and Funds of Identity [14], FoK and FoI hereafter, to guide our reflections. We selected FoK and FoI for two main reasons: first, the central tenets of FoK are about local knowledge bases that can be mobilized from untapped potential to creative realization and second, the pedagogy of Funds of Knowledge directly integrates diverse community members and positions them as agents who have the power to effect change.

6. The theoretical frameworks of FoK and FoI

FoK was established in the 1980s/1990s by Luis Moll, Norma González, James Greenberg, Carlos Vélez-Ibáñez and Cathy Amanti, at the University of Arizona (Tucson, USA). Following an ethnographic inquiry process with local teachers, the researchers and educational collaborators established a model for connecting the learning happening in schools to the learning outside the school [15]. The core idea of the approach is to learn about, and from, children's and students' lives. The authors define FoK as the 'historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being' ([15], p. 72). This concept has been widely used in educational research, with expanded interpretations among diverse research groups (see for example, [16,17]). The FoK research groups call for a deeper, more solid and genuine understanding of diverse learner communities and their integration with formal learning and research process. In the FoK studies, children, parents and community members are empowered to share their views and lived experiences. In its core, FoK contains the principles of social justice, where homes are recognized as diverse and equal in making their contribution to formal learning environments and where community members are the action initiators for conceptualizing and implementing change. Esteban-Guitart and Moll [14] extended funds of knowledge to 'funds of identity', which include the 'historically accumulated, culturally developed, and socially distributed resources that are essential for people's self-definition, self-expression, and self-understanding' (p.37). Funds of identity capture the resources that people draw on to define themselves. Esteban-Guitart [18] further explained that funds of identity are not meant to be an abstract concept but to be educationally useful and act as an educational tool to 'promote significant learning experiences' (p.6). By definition, funds of identity vary from person to person and the researchers'

role is to first and foremost to acknowledge, recognize and reveal them as they collaborate with various stakeholders.

Historically, FoK highlights the ethnographic methodology as the golden method for authentically valuing and documenting community lives [19]. However, the knowledge and skills that individual students bring to the classroom can be documented in various ways, including interview and observation methods, whereby researchers act as mediators and orchestrators of the research process. Moll [20] proposed "study groups" to bring together researchers and teachers to collaborate on the development of teaching programs. In this context, a 'community of practice' is defined as a group of people who share a common objective, such as a common profession, for example, and who are involved in practices based on the sharing of information and experiences' ([21], p.70). We propose that in our experience of handling research during the pandemic, we capitalized on the funds of knowledge and funds of identity of our participants and collaborators, and began to form a community of practice for future work. It is this contribution that we highlight in relation to lessons learnt for the future of child–computer interaction studies.

7. Reflections for the field: methodological contributions

The frameworks of funds of knowledge and funds of identity offer useful strategic tools for future work in CCIS. Reflecting on our Covid-19 research experiences, we can conceive of the changes and challenges as of a process in which we, researchers, strengthened the voices of communities and profiled the FoK they possess. In case study 1, we empowered parents to act as data collectors and incorporated their perceptions into our evaluation. In case study 2, we created a structure to enable community-generated resources, the corona e-books, to be shared and distributed. In case study 3, we facilitated the participation of more educational professionals and implemented techniques to make all participants' voices included in a digital arena.

In our study with personalized books (case study 1), the initial study design connected to children's funds of knowledge and identity in that we used books that were personalized to children's individual lives and in that we aimed to explore children's emotional responses to these books. Our amended study design expanded this focus to the home context and children's parents. Personalized books are rarely read in kindergartens because of their individualized character and teachers' limited capacity to engage in one-to-one reading. The home reading context is thus a more likely scenario for children to experience adults reading books made specifically for their children. In sharing the books with their children, the parents drew on their reading skills and knowledge, which vary across families. In the parent questionnaires, the parents shared with us their views on the books, which ranged from enthusiastic responses to more reserved replies about the books' length and quality. The amended study design allowed us to tap into this variety and ask our participants directly about their different views and experiences. With the opportunity to discuss the books with their children (and note the answers on the questionnaire), and children's reflections captured in their drawings, the parents' and children's reader identities were brought to the fore. The adoption of the study protocol thus led to productive frames of inquiry and widening the audience and participation for the research. Future research could involve parents and children more directly in the data collection process by, for example, encouraging parents to video the reading interaction with their child. Equipping parents with data-collection tools such as audio-recorders or simple cameras, would provide richer data than that can be captured in written notes. At the same time, more data may delay the data collection process,

which was already significantly delayed because of difficulties regarding contact with parents and extra pressures on families' time given the pandemic challenges.

CCIS researchers could also encourage parents to respond with a creative artifact, or to make a drawing together with their child. To capture long-term engagement, parents could be encouraged to trace the family reading patterns over time with a reading diary. The proponents of FoK make it clear that the traditional FoK's method of ethnographic research can be usefully complemented with other research methods [15] and the CCIS research could be enriched with greater methodological pluralism.

In addition, future research could incorporate family FoK into the books' production by encouraging for example, the creation of personalized digital books at home. We have originally envisaged to do so in the kindergartens on an iPad and help with the researcher, but this could also happen at home, where parents are sent guidance on how to create digital personalized books with free story-making apps (for example the Our Story app can be used to make digital books with user photographs and texts). This activity was spontaneously taken up by parents interested in Corona E-Books, but families can produce their own books on any topic. Participatory research methods that involve children and families as co-researchers are familiar to CCIS researchers but are not so widely employed by FoK scholars. The CCIS' long tradition of the maker movement and the idea that with the right tools, everyone can be a maker of technologies, could enrich future FoK studies and exemplify the ways in which child–computer interaction studies influence the field of education.

8. Reflections for the field: collaboration with practitioners

Covid-19 was a factor that facilitated the integration of new resources and cohesion of existing members in the International Collective of Children's Digital Books. The structure of a digital collective facilitated the integration of the FoK of researchers, designers and community members into a shared pool of resources, where experiences and expertise could be exchanged and benefited from. Messaging and video-conferencing services facilitated the ways in which different stakeholders could be put into contact and collaborate at distance. The rapid production and generous sharing of the Corona E-books illustrated the members' desire to enrich scientific knowledge with the knowledge from children's everyday experiences. To maintain these relationships, we identified the capacity issue as a factor that prevented an expansion of the Collective's work. Instead of thinking of formalizing the Collective into a hierarchical structure of management and leadership, the FoK framework offers us an alternative structure. If we acknowledge that all members of society – children, parents, researchers, designers or story authors – can contribute to, and improve, reading with screens, then we need a Collective that is organized around these networks of expertise. One possibility is to organize the Collective into heterogeneous teams, who work more closely together and regularly meet and inform the other teams. This structure was tried and tested by Hogg [22], who followed the FoK framework and facilitated the organization of parents, teachers and students into teams in a high school in New Zealand. Such a team-based collaboration, Hogg [22] argues, allowed for capitalizing on the FoK of each individual. Through authentic and trust-based relationships between parents and school personnel, a community of practice increased student engagement.

Further learning lesson relates to the production of user content. The rapid production of digital books during the pandemic reminded us that there needs to be a cultural shift in the way digital books are produced, with more emphasis on crowd-sourced resources from the community, including the children. Quality assurance is an important consideration in this process and the structure of a Collective with researchers and teachers allows for rapid evaluations. The quality issue is not isolated to children's digital books, indeed, these lessons could be expanded to teams working on topics relevant to children's learning with digital toys or apps for mathematics or science activities. Users' own content that is curated by the Collective could be a way to increase the intellectual and material resources of the community on a sustainable basis. The lockdown situation whetted the appetite of parents and children to understand more about reading for pleasure on screen and as researchers we carry the responsibility to not lose this interest but sustain it with research-based information for children's caregivers.

We could conceive of future CCIS as that of Communities of Practice (CoP) that optimize and coordinate the workings on specific issues pertinent to the wider society (see [23]). Inspired by the study groups and FoK premise for collaboration, each CCIS community of practice could be concerned with a specific issue to strategize a research problem and design solution. Similarly to our International Collective of Children's Digital Books, which has created and maintained a network of trust among designers, researchers and users of children's digital books, there could be collectives of researchers focused on children's internet of toys, game apps or virtual reality. Another example is the Kidrec community (https://kidrec.github.io/) that brings together multi-disciplinary researchers as well as educators and designers with a specific interest in children's recommender systems. Regular meetings, open sharing of ideas and guiding frameworks and design developments, have helped the groups establish trusted community resources and stronger scientific results.

This is connected to our experience of conducting focus group interviews digitally and using interview techniques that allow the participation of more voices. Digital interviews contributed to the professional development of educational professionals in the area of digital literacy. Aligned with the idea of CoP, we recommend building communities of researchers, designers and practitioners, that are a source of mutual support and provide a space for exchange of knowledge and expertise. As DeMatthews et al. [24] point out, educational researchers carry the responsibility to not only synthesize but also translate research into practice, which is of particular salience during a pandemic. A CoP can be thus an invaluable asset for a pandemic-stricken world.

9. Conclusion

Since the times early pioneers, such as Seymour Paper and Alan Kay in the field of child–computer interaction, the design of computer systems for children has gone through significant developments. With dedicated scientific conferences and outlets, the CCIS have become a specialized field within the broader human–computer interaction area. Strongly influenced by Alison Druin's work, the notion of child-centered design has moved the field to value children's own views and desires. Furthermore, the empowerment possibilities embedded in the Maker Movement have pushed the boundaries of CCIS to democratize the access to design. But while these trends have successfully widened and enriched human-computer interaction design, they can be criticized for not offering a sustainable or long-term way forward for the field [25]. With the impetus for paying more attention to the ethical obligations of designers and researchers-designers in the era of artificially intelligent technologies [26], CCIS need a vision that makes the community sustainable and continuously innovating. Based on our experience, we argue that such a vision needs to encompass child-centered design intentions, communities of practice of researchers, designers and teachers, *and* a close attention to the funds of identity individual stakeholders bring to these efforts. The network of adults around each

individual child (the child's family members, social workers or teachers) co-constitute a context in which technologies are used. This context is not free from personal and political biases. Indeed, the human-technology entanglement provides CCIS researchers with a political task: 'digital technology is not just a tool; that innovation is a political arena in which we can participate; that technology creators are political actors who cannot be allowed to be above democratic accountability; and that we can have a voice in shaping technological futures' ([27], p. 75). The Covid-19 pandemic and its accompanying technological solutions around contact tracing, data management and monitors, showed us that as a collective, we have an important role in influencing public discourse and practice in times of great need. Our voice is strengthened with the funds of knowledge of all the stakeholders we work with and enables us to achieve more collectively than we ever could individually.

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.

Acknowledgment

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