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# Insights from impacts of the digital divide on children in five majority world countries during the COVID-19 pandemic

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**ABSTRACT**
The digital divide is especially pertinent in Majority World Countries (MWCs), and this was exacerbated greatly by the pandemic. Tackling the digital divide underpins the work of Human–Computer Interaction for Development (HCI4D) and remains an important global endeavour. Our project aimed to understand how children and young people (CYP) in MWC coped during the pandemic and how technology played a role. Voices of CYP were complemented by those of their parents and professionals with whom CYP interacted regularly. Our empirical study involved 73 CYP and 76 adults from Brazil, Kenya, Pakistan, South Africa, and Turkey. Qualitative data from diaries, drawings and focus groups were analysed thematically. Four major themes were identified – 'access', 'usage', 'risk', and 'future Among others, some intriguing findings were that CYP acutely felt the peer pressure on ICT ownership and tended to direct frustration at parents, who grappled with their untenable roles as gatekeepers to digital worlds. Implications for addressing the digital divide include long-term strategies to improve infrastructures and mobilise community-based collaborative efforts and enhance digital literacy.

## 1. Introduction

Human–computer interaction for development (HCI4D) is an interdisciplinary research area aimed at understanding and designing technologies for underserved, under-resourced, and under-represented populations around the world (Dell and Kumar 2016; Pal 2017). It addresses specific sociocultural and infrastructural challenges facing developing regions, as well as the specific needs and goals of people thereof regarding their use of technologies (Ho et al. 2009). Drawing on HCI conceptual and methodological tools, HCI4D contributes to understanding the human dimension of *information and communication technologies for development (ICT4D)* at the international level (Abdelnour-Nocera and Densmore 2017). In the early 2000s, the field of HCI responded to the call for tackling the *digital divide* – a mission underpinning the inception and growth of ICT4D and HCI4D – by stepping up its social agenda (Shneiderman 2001). While the two-decade efforts of HCI4D have narrowed some gaps, such as improving the usability of digital devices (van Biljon 2020; Samuel Nkwo, Orji, and Ugah 2021), the COVID-19 pandemic has exacerbated digital divide issues, which were aggravated by negative financial consequences. In this paper,

we present our work on examining these issues, particularly their impacts on children in five Majority World Countries (MWCs) in this unprecedented period of global and widespread impact on children's wellbeing (Cortés-Morales et al. 2021).

The original definition of the digital divide (National Telecommunications and Information Administration [NTIA] 1999) referred to those who have access to ICT (or even more narrowly to the internet) as opposed to those who have not. Subsequently, it has evolved to consider different patterns of usage and levels of skills that enable users to optimize benefits from deploying ICT with the aim of enhancing quality of life (Van Dijk 2017). The notion of the digital divide is used interchangeably with terms including digital inequality, digital exclusion (vs. inclusion), and digital poverty (Burgess 2020; Schejter, Ben Harush, and Tirosh 2015; Warren 2007). In an increasingly digital age, those who are not engaging effectively with the digital world are at risk of being left behind. Consequently, inequalities in many aspects of life are widened, stifling opportunities for social mobility.

The digital divide can be examined at different levels, within and across communities, countries, or regions.

The term *global digital divide* typically refers to studying how the extent of the divide differs between Majority and Minority World Countries in quantifiable measures as derived from specific models (Pérez-Castro, Mohamed-Maslouhi, and Montero-Alonso 2021). During the pandemic there was an increasing reliance on ICT, which meant that the internet was hailed as a lifeline (Internet Society 2021). However, for those in isolation during lockdowns, the pandemic has aggravated access and usage problems. Furthermore, it is clear that the digital divide worsened due to the loss of income for households, further exacerbating the issue on the affordability of broadband services.

Arguably, one group who were especially affected by the pandemic was CYP. To contain the spread of the virus, school closures during lockdowns were implemented worldwide, albeit not without controversies (Armitage and Nellums 2020; Esposito and Principi 2020; Van Lancker and Parolin 2020). According to the United Nations (2020), about 1.6 billion learners in 190 countries across the world were affected by the pandemic, with 94% of the world's school population impacted by those closures. A significant implication of closing schools was that CYP lost in-person interactions with teachers and peers, becoming homebound with household members and reliant on digital technologies, if available, to continue education. Nonetheless, the digital divide rendered online learning very challenging in many MWCs, as well as in disadvantaged communities of Minority World Countries such as the U.K. (Holmes and Burgess 2020) and the U.S. (Dorn et al. 2020).

Much of the existing research conducted to date has used questionnaires to capture data on the impact of the pandemic on children's education, and this has consistently revealed the severity of the digital divide (e.g. Josephson, Kilic, and Michler 2021; Spaull and van der Berg 2020; UNESCO 2020[1]). While there is some interview data emerging in the literature (e.g. Ravi, Ismail, and Kumar 2021), this has tended to provide adult perspectives. However, if we are to address the digital divide in respect to this population, it is critical to understand how CYP experienced it during this unprecedented period in different MWC contexts as well as how such experiences may contrast with those of their parents and professionals. This rationale underpinned our study.

The empirical work described in this paper was conducted under the auspices of an interdisciplinary project with nine experts who represented the fields of human–computer interaction (HCI), child psychology, youth mental health, sociology, human geography, history, and international politics. The team was supported by five site coordinators/researchers together with their local support groups. The project aimed to *understand how CYP experienced, perceived, and coped with adverse impacts of the pandemic*, especially in relation to their mental health and wellbeing, and how they would envision their post-pandemic lives. The understanding was built from the CYP's perspective through their own voices. Furthermore, it is well-recognised that the social contexts where CYP are situated can have significant influences in shaping their experiences, making sense of their perceptions, and informing their coping strategies (Burr 2015). Hence, it was deemed essential for the project to explore also how adult close relatives (parents, grandparents) and professionals (e.g. teachers, educational psychologists, youth workers) with whom the CYP interacted regularly, navigated, and negotiated the social and economic precarity engendered by the pandemic.

A defining characteristic of our project is (child-centeredness). Historically, the term 'child-centred' has been linked to education (e.g. the Dewey's philosophy) and development (e.g. the Piagetian theory), using liberal and scientific approaches to understanding and supporting children to fulfil their potential (Chung and Walsh 2000). A more progressive view of 'child-centeredness' is that children should direct their activity and participate in making decisions relevant to their lives (Stuardo-Concha, Segovia, and Hernández-Hernández 2021). This notion has widely been adopted in the field of HCI (i.e. participatory design; e.g. Read, Fitton, and Horton 2014) and in this study as well. Specifically, children were enabled to share their first-hand experiences and interpretations of the pandemic and to explore their vision of post-pandemic lives through *child-based* reflective diaries, *child-led* dialogues with adult close relatives, and *child-engaged* focus groups with peers and professionals. These participatory approaches can empower children to make their voices heard (Lyndon 2020) in relation to inequalities they are facing, thereby co-constructing potential solutions with relevant stakeholders. A qualitative methodological framework was appropriate in meeting the research aims.

Furthermore, the rationale for including voices of CYP's social others is grounded in the social constructionist theory in its broadest sense (Burr 2015; Danziger 1997). Accordingly, people co-construct knowledge through social interactions in everyday life, with language playing a critical role. People's understanding of a mundane event or a specific incidence is shaped by the historical, sociocultural, and economic contexts in which they are situated. As our constructions of the world can perpetuate certain patterns of social action while excluding others, they are thus bound up with power relations, which have implications for defining what is permissible for different people to do and what is legitimate for people to treat others (Burr

2015; Hall 2001). For instance, in our project, the extent to which parents regulate CYP's usage of digital technologies, especially when access is limited, can be regarded as a manifestation of power negotiation and balance.

Inequalities in access to resources for sustaining health and wellbeing have been exacerbated by the COVID-19 pandemic and impacts of this can disproportionately be more severe in low-resource countries than their wealthier counterparts (Nanda 2020; Schellekens and Sourrouille 2020). These concerns underpinned the project's approach to gathering data from MWCs over three continents – Latin America (Brazil), Africa (Kenya, South Africa), and South Asia (Pakistan, Turkey). The project was *not* aimed to perform quantifiable cross-cultural comparisons, rather to qualitatively capture experiences and perspectives across different sociocultural MWC contexts. The involvement of multiple sites thus aimed to gain insights into the role of different contextual factors in influencing CYP's attitudinal and behavioural responses to the pandemic. Juxtaposing the inter-generational and inter-national data could make it possible to identify patterns as well as distinctions among different stakeholders and regions, thereby informing the design of local interventions.

While the qualitative data collected could be analysed from multiple perspectives, we addressed a specific research question: *How was the digital divide perceived, experienced, and coped by children (8–10 years old), young people (14–16 years old), and their significant social adults in the five MWCs during the COVID-19 pandemic?*

The main contributions of our work are threefold:

- *Methodological*: Our multi-nation, multi-context, and multi-stakeholder data collection approach represents a comprehensive methodological framework, which can be employed by other researchers to study complex sociotechnical issues. The systematic five-phase process (Figure 2, Table 3) is specified with implementation guidelines, which researchers can adapt to local sociocultural features. Our inductive approach to thematic analysis was consolidated with the multidisciplinary codebook validation process (Table 4), which can be considered as another methodological contribution. These methods enabled us to develop a deep understanding of *impacts* of the digital divide.
- *Conceptual*: The emphasis on child-centredness, enabling CYP's voices to be captured at the individual and group level, is the core of our conceptual framework, which we augmented by contextualising them in CYP's social and support networks, including not only their peers but also parents, elders, and professionals. We present a concrete case of applying the social construction theory to gain insights into the digital divide.
- *Practical*: Based on the analysis results of the empirical findings, we have drawn *implications* for addressing the issues identified, such as one-device-one-child with emphasis on high-quality interaction design, engaging learning contents and effective training for CYP, teachers, and parents.

## 2. Related Work

The phenomenon of the digital divide has been studied for approximately two decades. A search with the keywords 'digital divide' in the database Scopus indicated that the first publication was authored by Katz and Aspden in 1997. The authors found the evidence of the digital divide: the internet users at the time were generally wealthier, as well as more highly educated, and a disproportionate number of ethnic minority groups were not aware of the internet. Such an observation seems perpetuating in the meantime, as reported in the recent work of Francis and Weller (2022) on the relations between wealth, race and inequality in digital access influencing remote learning. Nonetheless, in the span of twenty years, research efforts have visibly increased (Figure 1), accumulating to 7450 publications as of September 2021. The recent surge in the period of 2020–2021 with 1651 publications on this specific topic can clearly be attributed to the pandemic.

Breaking down the publications by country, the top two were the U.S. and U.K., occupying ~30% and ~10%, respectively (Table 1). In contrast, the five MWCs where we conducted our empirical study occupied relatively very low percentages. The notable differences can be attributed to existing disparities in research infrastructure such as the internet speed (Table 1).

Since the notion emerged in the mid-1990s, different conceptual models aiming to analyse the phenomenon have been developed. Among them, Van Dijk (2005) proposed his theory of resources and appropriation to explain how an unequal distribution of resources is linked to an unequal access to digital technologies whose characteristics determine the nature and degree of access inequality, and which undermines participation in society. Such unequal participation reinforces unequal access and resource distributions and perpetuates the cycle. Recently, Van Dijk (2017) extended the focus on access to the other aspects of the digital divide, including attitudes, social support, usage, and skills; this conceptualisation is generally adopted in the research work on this topic.
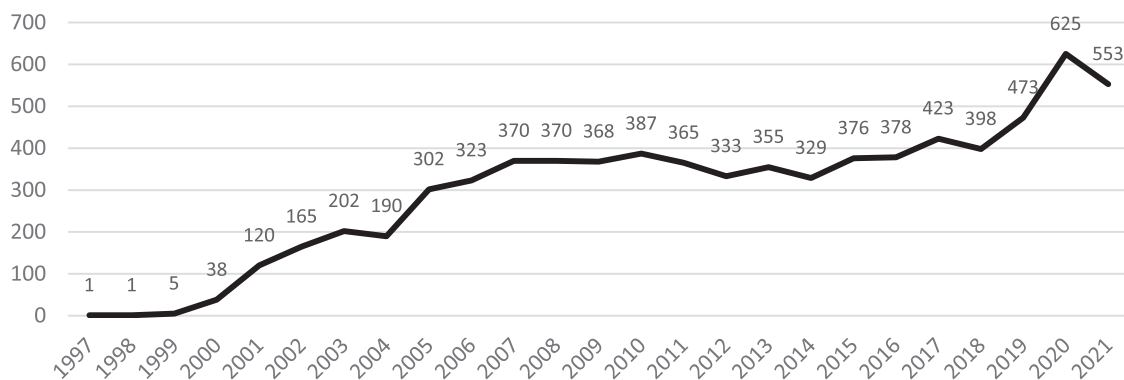
**Figure 1.** Number of documents per year returned with the search key 'digital divide' by Scopus.

The digital divide is broadly understood as a two-level model – access and usage (Scheerder, Van Deursen, and Van Dijk 2017). The four levels proposed by van de Werfhorst, Kessenich, and Geven (2020) can be collapsed into these two levels. Furthermore, their studies were quantitative (i.e. factor analysis of existing data) and focused on OECD countries as well as on formal educational settings. Understanding children's experiences, especially in informal learning settings, namely, home-schooling, would provide additional insight, as these played a dominant role in educating students being trapped at home during the lockdowns. With the aim of informing policymakers on the implementation of ICT, Pérez-Castro, Mohamed-Maslouhi, and Montero-Alonso (2021) also employed quantitative approaches to explore the relations between the human development index and ICT development index with the data from 17 Mediterranean countries in the pre-pandemic time. Their findings provided further evidence of the digital divide in those countries.

Qualitative work in this area is valuable, and one study by Jordan (2020) is aligned with our work, sharing a goal of investigating the extant as well as emergent role of educational technologies in sustaining children's learning during school closures caused by the pandemic in MWCs. Jordan applied the grounded theory

approach to analyse 122 documents published online between February and April 2020, with the majority being organisational blog posts; with a five-theme coding scheme being produced as the main output. Another related study by Ravi, Ismail, and Kumar (2021) conducted interviews with twenty adult participants in one MWC, India. Azubuike, Adegboye, and Quadri (2021) also collected primary data on the digital divide in one MWC, Nigeria, and used questionnaire as their research method. Results derived from 1000 responses of students and parents lent further evidence to the observation that the existing digital divide was significantly compounded by the pandemic.

Furthermore, the fact that digital divide was exacerbated by the pandemic could also be observed in Minority World Countries, as shown by the related report in the U.K. (Burgess 2020; Holmes and Burgess 2020). Accordingly, 22% of the people in the U.K. were reported to lack digital skills or access to the right technology that enables them to adapt to the new pandemic-induced norm of living digitally. The phrase 'feeding the children or paying the Wi-Fi' reflected vividly the conundrum faced by people under the poverty line, irrespective whether they reside in a high- or low-income country. Similarly, negative correlations between rurality and internet speed were found in an analysis conducted in the U.S. (Lai and Widmar 2021). With poor connectivity, households could not support multiple users. Staggered internet usage was impractical when parents were e-meeting with colleagues and children were attending live lessons at the same time. Nonetheless, access is not always the main concern in Minority World Countries. For instance, a survey study conducted by Kirsch et al. (2021) with 1773 children aged 6–16 years old in Luxembourg, Germany, Switzerland showed that usage and skills was the main concern; teachers' readiness for deploying educational technologies effectively was low. Furthermore, a study in Australia (Seymour, Skattebol, and Pook 2020) showed that challenges for charity

**Table 1.** Distributions of publications and internet speed by country.

| Country | Publications [a] 1997–2021 | | Publications 2020–2021 | | Internet speed (mbps) and rank [b] (2020) |
|---|---|---|---|---|---|
| United States | 2342 | 31.4% | 331 | 28.1% | 33.16 (23rd) |
| United Kingdom | 728 | 9.8% | 113 | 9.6% | 27.13 (31st) |
| South Africa | 244 | 3.3% | 43 | 3.7% | 8.24 (77th) |
| Brazil | 92 | 1.2% | 15 | 1.3% | 7.7 (83rd) |
| Pakistan | 46 | 0.6% | 13 | 1.1% | 1.33 (130th) |
| Turkey | 46 | 0.6% | 8 | 0.7% | 7.1 (86th) |
| Kenya | 22 | 0.3% | 2 | 0.2% | 3.29 (114th) |

Note: [a] source: Scopus as of 4 September 2021; [b] source: https://fairinternetreport.com/research.

organisations offering support to marginalised youth, who had already dis-engaged from education in the pre-pandemic time, were intensified.

In summary, a range of research evidence is now available to aid our understanding of the impact of the pandemic on the long-standing digital divide issue. Among these studies, questionnaires were the commonly used method. Additional qualitative data would allow deeper insights into the issue. To address this gap in capturing children's voices, our project adopted a qualitative design and involved five MWCs to allow multi-context insights.

## 3. Methodology

This section comprises two major parts, data collection (Section 3.1) and data analysis (Section 3.2). Overall, our methodological approach was qualitative and child-centred.

### 3.1. Data collection

#### 3.1.1. Context and participants

We selected countries that were broadly representative of the socioeconomic spectrum across MWCs (OECD 2016), i.e. Brazil, Kenya, South Africa, Pakistan, and Turkey. Within each country, a non-governmental organisation (NGO) acted as local project lead. These lead NGOs were identified through existing global youth mental health networks by the central research team {anonymised}. The NGOs were agencies that are well-informed about the social and cultural characteristics of the area and wider country and have developed trust with local communities. Particularly important is that the NGOs spoke the local language, and helped contextualise and translate the data collected. They also had good contacts and access to local schools, parents, and professional; this was critical for recruitment. Within each country, we selected an area of disadvantage, with the following characteristics:

- *Brazil:* Rocinha is Brazil's and Rio de Janeiro's largest favela, with residents living in a tightly packed area, mostly due to rural-urban migration. The extreme lack of space forces families to build houses on top of one another. Whilst challenged by structural inequality, poverty, and poor service delivery, Rocinha is considered one of the better developed favelas. It has a relatively better developed infrastructure and enjoys proximity to employment opportunities and services. The area does have transportation links as well as entertainment areas. Challenges include poor sanitation, with sewage running in a channel between houses, drug-related violence, and trafficking.

- *Kenya*: Kiti is one of the poorest residential areas in Nakuru city. The poverty experienced in this area has been compounded by rural-urban migration and influx of refugees (primarily Sudanese) to Nakuru in search of better living standards. Many people in the area face deprivation of basic needs (i.e. food, shelter, and clothing), social amenities (i.e. housing, electricity) and access to services.

- *South Africa*: Emandleni and Wattville are neighbouring areas in the Gauteng Province of Johannesburg. The former is made up of informal housing, whilst the latter is an established township with a mix of informal and built houses. Emandleni has regular water supply, low-cost electricity, and sewerage infrastructure, but no school. Wattville has established infrastructure like access to water, electricity and sewage, and several childcare centres and schools.

- *Pakistan*: Manzoor Colony Mehmoodabad is an underprivileged neighbourhood of Karachi East district. Fathers are mostly employed as labourers or work in low paid jobs. High rates of domestic violence, street crime, cultural conflict, and abuse are frequently reported. Like many low resourced areas in Karachi, most of the population depend on mobile data for internet connections, while very few have access to community services.

- *Turkey*: Karatay and Selcuklu areas are based in the city of Konya. Karatay is a low resourced area characterised by informal dwellings and apartments, and a high crime rate. Selcuklu is a more affluent area, with new developments, and families of both low-medium and high socioeconomic status. Both areas have large numbers of refugee families.

All five MWCs were hit hard by the pandemic; in four of the MWCs, schools of certain categories and levels were closed, while in South Africa full closures were enforced.

At the next stage, we adopted a purposive sampling strategy. Each host agency, through their local networks, invited children aged 8–10 and youth of 14–16 years through their parents. These age groups represented different developmental stages of childhood and adolescence, broadly referred to as 'children and young people (CYP)' in this paper. In total, 36 children and 37 young people took part in the study. The total number of participants per site ranged from 23 to 40 (Table 2). Recruitment relied on the dedicated involvement of CYP, parents, and professionals for one up to two months and the project had limited resources to run the empirical studies at a larger scale. However, consistent with a thematic design, saturation of data was

**Table 2.** Overview of the participants in the five MWCs.

| Attributes | Brazil | Kenya | Pakistan | South Africa | Turkey |
|---|---|---|---|---|---|
| Recruitment | Local music school NGO | Church leaders | Local School | Community-based organisations | Municipal teaching institution |
| Children (8–10 years old) | 8 | 4 | 9 | 7 | 8 |
| Teens (13–17 years old) | 7 | 7 | 10 | 7 | 6 |
| Parents/Carers | 6 | 7 | 12 | 10 | 8 |
| Professionals | 7 | 5 | 9 | 7 | 5 |
| | (5 teachers, 1 social worker, 1 researcher) | (church elder, teacher, counsellor, police officer, researcher) | (3 clinical psychologists, 3 educational psychologists, 3 counsellors) | (early childhood practitioners) | (1 clinical psychologist, 2 academic psychologist, 1 social worker, 1 teacher) |

achieved across groups and across countries whereby collectively the conceptual categories informing themes were fully developed (Hancock et al. 2016).

Ethics approval was obtained from {anonymised entity}. Written consent was provided by parents and additional verbal assent from children. The NGO leads acted as gatekeepers to the study, taking into consideration local ethics and child protection jurisdictions.

### 3.1.2. Process

In recent years, children have been increasingly viewed as key stakeholders in designing and implementing research and interventions that impact on their lives (Skauge, Storhaug, and Marthinsen 2021). Consequently, a range of participatory approaches have been developed to take into consideration children's developmental capacity along their cognitive, communication (expressive and receptive language), emotional and social domains. These approaches include a combination of individual interviews, focus groups, creative activities such as drawing and storytelling, social geography, and ethnography (Horgan 2017). As some of these data collection strategies (e.g. drawing) do not rely on verbal communication (like focus groups), they can be applied across sociocultural groups, including in MWCs {anonymised}.

To this effect, we facilitated a total of 20 focus groups, two per age group, at two time points in each country. Focus group topic guides explored children's experiences of their wellbeing in relation to socioecological levels, i.e. coping strategies, mental and physical health, family, education, peers, neighbourhood, community, technology, and services. In addition, we asked children to keep a diary over a period of one month. The diary captured real-time experiences and was used to elicit and stimulate a discussion during the focus group discussions. Participants were encouraged to write, draw, or use stickers into their diary.

Data were subsequently generated during focus groups, using the 'draw and talk' method. This creative approach is used to elicit rich visual and verbal data, and to encourage active participation (Angell, Alexander, and Hunt 2015). It is particularly engaging with children,

as it is enjoyable and allows participants to guide the session (Dodkowsky, Ungar, and Liebenberg 2010). Visual participatory methods position researchers and participants as collaborators, by minimising power differences between them, and respecting participants as knowledge holders and producers (De Lange 2008). These methods also create opportunities for participants to express, enhance, share, and analyse their knowledge and experiences, and to plan and act upon those (Mitchell 2008).

Between the two focus groups, children were prompted to interview elders (grandparents, other family elders, or neighbours) on their own experiences in dealing with adversities. Participating children interacted with researchers via in-person sessions as well as remotely (in Brazil), because of health and safety guidelines at the time. Focus groups and diary textual data were completed in children's language and translated to English. All focus groups except those in Brazil took place in-person in a community-based centre or an educational institution. In Brazil, the online platform Zoom was used. As existing studies show that in-person and online focus groups can generate similar content (e.g. Menary et al. 2021; Woodyatt, Finneran, and Stephenson 2016), it was considered legitimate to include data from Brazil. Figure 2 and Table 3 present an overview of the five-phase data collection process.

### 3.2. Data analysis

Diary textual and focus group audio-recorded transcribed data were collected in the children's native language, and subsequently translated to English. We utilised thematic analysis to attend to the focus group and diary data (Braun and Clarke 2012). We engaged with a codebook form of thematic analysis to allow for the conflation of inductive and deductive coding processes and ensured coder agreement through a multiple coding process. Two coders independently coded verbal data collated and transcribed from all the contexts. All data were then subjected to a thematic mapping consultation process by the research team, and conceptual categories were jointly
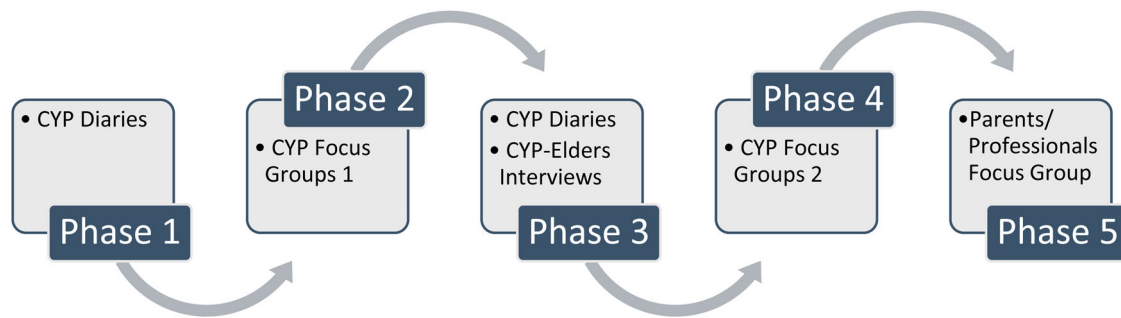
**Figure 2.** Workflow of the empirical activities (*CYP = Children & Young People).

agreed. Although this study was not framed as a comparative research design, the inclusion of five MWC sites could enable the identification of emerging cross-cutting or context-specific themes to inform child-centric interventions in other MWC settings. Note that we have not yet systematically analysed the CYP's drawings in their diaries for this paper (see examples in Appendix B), which entail specific techniques (e.g. Burkitt, Watling, and Message 2019) that we plan to apply in our future work. Nonetheless, as the CYP were asked to bring their diaries to the focus groups and share the contents if they wished (Table 4), the ideas behind many of the images were probably captured in the discussions of the focus groups.

## 4. Results

Analyses of the qualitative data resulted in a multi-level thematic structure. At the highest level is six impact areas – *Social, Health, Economy, Education, Environment, and Technology* – with each subsuming several sub-areas (Appendix A). We focus on the impact area of **Technology** for the purpose of this paper so we can fully account for the depth of this theme in relation to our aims and note that this theme consists of four subareas – *Access, Usage, Risk,* and *Future* – with each subsuming thematic categories and subcategories (Figure 3), which in turn include a set of topics. In the following subsections, we elaborate the categories.

**Table 3.** Description of the five-phase process.

| | Duration | Activity | Rationale |
|---|---|---|---|
| Phase 1: CYP Diaries | 1–2 weeks | • Keep notes or drawings of what happens in everyday life during the pandemic;<br>• Bring the diary to the focus group to facilitate sharing and discussion. | Encourage CYP to reflect on their experiences and thus improve their understanding of the unusual situation |
| Phase 2: CYP Focus Groups 1 | 1 h discussion for Children and YP each | • Discuss special things noted in the diary;<br>• Describe how things deemed important in the past changed during the pandemic;<br>• Share what was learnt from experiences in the pandemic to make one feel stronger in difficult situations in the future;<br>• Create a poster on what is discussed. | Engage CYP in collective sense-making of the current experiences, stimulating to co-construct aspirations for the post-pandemic future. |
| Phase 3: CYP Diaries + CYP-Elder Interviews | 1–2 weeks; interviews of any length | • Walk around the neighbourhood to note any important things;<br>• Interview a grandparent or an elder with whom one lives on past difficult situations;<br>• Identify an object that helped coping better. | Enable CYP to contextualise experiences in the broader socioecological context and learn from the elders' usable past of coping with hardship. |
| Phase 4: CYP Focus Groups 2 | 1 h discussion for Children and YP each | • Discuss special things noted in the diary and the object identified;<br>• Describe the usage of media and technology during the pandemic and comment on their helpfulness for coping;<br>• Create a poster on the post-pandemic future. | The same for Phase 2. Further, enable CYP to co-construct the understanding of inequalities in terms of the digital divide and identify ways to address the issues. |
| Phase 5: Adults Focus Groups | 1 h discussion for Parent and Professional group each | • Discuss impacts of the pandemic on children and supports provided, any regional differences;<br>• Identify what is important for making children feel stronger; helps from individual, family, community and country;<br>• Describe children's usage of media and their helpfulness for coping. | Enable parents and professionals to reflect on the nature and extent of supports that children had for coping in the pandemic and identify ways to improve such supports in the future. |

**Table 4.** The process of the qualitative data analysis.

| Step | Activity | People |
|---|---|---|
| Data Preparation | • Diary data: anonymise, digitalise and translate<br>• Focus group data: transcribe and anonymise<br>• Translate textual data into English | Local researchers in the five sites |
| Data Familiarisation | • Present data summaries in team meetings (online)<br>• Read individual datasets | Core project team + Local researchers |
| Initial Codebooks | • Compile CYP and PP data as two codebooks per site (i.e. 10 codebooks)<br>• Develop a common thematic structure with categories and sub-categories for both CYP and PP codebooks | Two social science researchers proposed the categories that were checked by the other team members |
| First Codebook Validation | • Merge all five CYP codebooks into an integrated one<br>• Merge all five PP codebooks into an integrated one<br>• Check the relevance of data to the (sub)categories (offline)<br>• Discuss issues identified and amend accordingly (online) | Core project team split into two sub-groups with each checking one of the two integrated codebooks |
| Second Codebook Validation | • Cross-check the two validated integrated codebooks<br>• Discuss issues identified and amend accordingly (online)<br>• Share the re-validated codebooks for comment (offline) | Two subgroups swapped the validated integrated codebooks for final checking |
| Codebook refinement | • Select relevant categories to define fine-grained codes<br>• Apply the coding scheme to the subset of qualitative data<br>• Refine the codes iteratively till a good level of agreement reached | Lead researcher with specific expertise selected the relevant categories and analysed the data with a subgroup. |

The CYP and adult (Parents and Professionals – PP) codebooks had a similar thematic structure for the theme Technology, given the comparable guiding questions to enable intergenerational comparisons. It should be acknowledged that the amount of PP data is lower than that of the CYP data, given the differences in the data collection activities (Table 4). Furthermore, the data collected from the focus groups were much richer than from diaries. Some CYP participants made a similar entry for several days such as 'When I got home, I did a few things, I played on my mobile, I watched a series and soon I fell asleep because I was very tired'. (YP, Brazil, Diary).
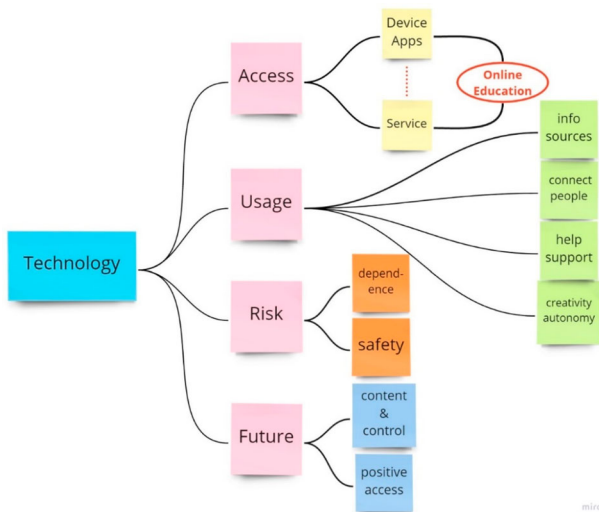


**Figure 3.** Categories and subcategories for the impact area Technology.

## 4.1. Access

The category 'access' is linked to device, application, and service, which CYP and PP have experienced or witnessed different degrees of inequalities and expressed their concerns. We present the findings for each of the concerns with relevant quotes from the source data.

### 4.1.1. Device and apps: restricted access and usage instigating negative emotions in CYP

- *Shared device and account*: Many of CYP did not own their personal ICT devices and had to share them (e.g. phone, laptop) with their parents, siblings, and/or friends. In some cases, CYP shared common social media accounts with their parents, i.e. combining the contacts of children and parents. There seemed to be no privacy concerns, but this may be seen as a mechanism for parents to monitor CYP's usage of online apps.… since I don't have a mobile phone, I only have a TikTok account and a Facebook and Instagram account that I use sometimes under my own name and sometimes under my mother's name. I have my friends' contacts on my mum's WhatsApp. (Child, Brazil, Focus Group)

Some CYP, who had no choice but to share devices with other household members, accepted this, whereas some yearned for greater independence.

> It's not bad as such but, anyway, how I wish I could have mine to avoid depending on theirs all the time. (YP, Kenya, Focus Group)

CYP were often given the used IT devices by parents or siblings. However, such devices typically had limited

features that did not support CYP to participate fully in the related activities such as online learning.

> … I have my father's old phone but no sim card. I can't attend the online lessons on it because it is so slow. (Child, Turkey, Focus Group)

Parents acknowledged the need for sharing the devices, given the financial constraint, and expressed a sense of helplessness. Parents additionally expressed concerns that their children experienced rejection and peer pressure when comparing with their 'have it all' friends. Professionals pointed out that the lack of digital skills on the part of parents was as compelling as the access issue.

> … comparing with their friends, and having the feeling of not getting those things that can be kind of make them feel deprived, feel rejected, feel low with the friends … the digital technology-based peer pressure is increased, in my opinion (Parent, Pakistan)

> … financial issues parents lost the job, or the mothers don't have the operational knowledge of laptop or mobile phone or applications (Professional, Pakistan)

- *Parental control on access and usage*: Parents, given their financial condition, could decide which CYP in the household would (not) own or share what devices. They might also regulate at which time what CYP could do with the device available, primarily for specific utilitarian goals such as doing homework. Such regulation or control could elicit a sense of unfairness and helplessness in CYP, who tended to compare their conditions with peers'.It doesn't feel good to know that my friends have all these devices apart from me. I may not know why my parents decide that way. My friends are not controlled how they use theirs. It feels bad that I don't have mine or access these but there is nothing that I can do. I know one day I will have them (YP, Kenya, Focus Group)

The common reasons for restricted usage are minimising distraction from study, minimising risks from exposure to undesirable materials (the vague term 'things' is used), and perceived risks from online paedophiles. Several parents described why and how they had controlled their children's access to devices and applications. One salient factor was their lack of trust in other online users, given past bad experiences.

> I do not let them use WhatsApp. I also do not let them go on Google. … I took everyone's access privileges away. If they want to download a game, I let them do it and then I take the internet access away. I also do not allow

WhatsApp because the former classmates had all sorts of bad ideas … He can use mine, with people who I also know. You can't trust them … (Parent, Brazil)

Furthermore, the access privilege regulated by parents was based on the age and role of CYP. It seemed that typically children of 8–10 years old were denied the privilege to own a device but expected to be given one when they grew older. This age-dependent device ownership could be attributed to financial reasons. In addition, the parental concern of introducing IT devices to children at a too young an age potentially doing more harm than good, might explicate these views.

> … they are still young, but when they are a little bigger, I will let them use it little by little. I didn't know much about computers, but I'm being forced to learn because of the children. I learned to check which software they access and how to block them, I keep guiding them, explaining that people can steal the data, see which pages they access. (Parent, Brazil)

A similar observation was noted at schools where young children were not permitted to use computers restricted for staff and their older counterparts. Such age-based privilege caused negative feelings in some CYP, whereas some accepted such a social norm with the anticipation of being given a personal device and/or allowed a broader scope of usage when they become older.

> I feel really bad that my siblings can use it, but I can't. (Child, Pakistan, Focus group)

- *Stark peer-group variations*. Participating CYP reported their observation of their limited access to technological devices differed palpably from their peers who had access to a range of facilities. A stark contrast between 'have all' and 'have none' where 'all' referred to computers, phones, tablets, television (TV), and the internet. The variations were noted by the CYP residing in the same region. Those CYP who were more affluent expressed empathy towards their less fortunate peers. Participating parents and professionals echoed the observation of intra-regional contrasts. Furthermore, some CYP showed an understanding of the financial constraints, whereas some exhibited anger, as observed by their parents.I don't have any of these devises. My parents don't have any TV, phones and computer because they can't afford to buy them. (YP, Kenya, Focus group)They [Children] ask why they don't have [cell phones] thus become angry … they deliberately misbehave so as to be given those cell phones. (Parent, Kenya)

### 4.1.2. Service: unstable and unaffordable internet disrupting CYP's social and learning activities

This concern affected CYP participants from all five countries. The instability of the internet connection was reported to be detrimental to their social and educational activities (Section 4.2).

> It was a lonely week. I was not able to socialize with my friends online. The network disappointed me. (YP, Kenya, Focus group)

High costs for paying the internet services and buying data are known to be a significant factor for the digital divide, and this was reflected in the data. CYP remarked that they needed to save meal money to buy data, a phenomenon epitomised by the phrase 'data vs. dinner'. The financial burden incurred by using the internet was compounded by the adverse economic impact of the pandemic, as felt by CYP, parents, and professionals.

> Our parents lost their jobs because of the pandemic that occurred in the whole world … they couldn't buy the things they usually buy for us as a family to keep us happy. When they lost their job, they didn't feel like they were parents enough because they would not support us financially as much as they did before. (YP, South Africa, Focus group)

### 4.2. Online education

The most direct and experienced impacts of the pandemic on CYP were the disruption of education. In-person classroom teaching was replaced by online learning (Dhawan 2020), when conditions permitted. However, such a shift to online education exposed the deeply entrenched issues of the digital divide. A significant number of CYP were disadvantaged by the divide, engendering negative experiences of frustration, failure, unfairness, and abandonment in CYP as well as in their parents. This sentiment can be well captured by a statement of a participating parent:

> [the] financial constraint was the biggest inequality factor, which was very very evident, especially in the times of covid-19, because definitely only the privileged class could avail this substitution of technology. (Parent, Pakistan)

Apart from the basic issue of access to devices (Section 4.1.1), several factors influenced the uptake and impact of online education, including the choice of platform, internet connectivity, readiness of teachers and parents, and inherent limitations of full-fledged online learning. We elaborate each facet in the following.

### 4.2.1. Limited access compromising learning opportunity and experience

The core issue of the digital divide – access to device, app, and service – caused severe disruption to CYP's education. It was distressing for parents and professionals to witness that CYP were deprived of the opportunity to learn because they did not have the basic tools to go online. CYP's learning experience was adversely affected, being interrupted in the process.

> My friends have a computer and tablet, they can attend online classes. I don't have it, I have to attend the online classes on the phone. I think my experience is more negative than theirs. (YP, Turkey, Focus group)

> … there are 2–3 children at home, all of them follow their classes on the internet and there is only one tablet at home, sometimes it does not exist, and only the mother has a smart phone. One of the children can use and then the other … There was no internet in the neighbourhoods with low socioeconomic level, children were walking around with tablets without internet in their hand. (Professional, Turkey)

The issue of the unstable and unaffordable internet service was discussed in Section 4.1.2. Apart from social interaction, the poor quality of the internet connection was detrimental to online learning. While some parents were sympathetic towards teachers whose effort was dampened by internet challenges, some teachers dismissed the issue as CYP's accounting for failure to engage in online learning. Mutual expectations could have been adjusted.

> … our internet connection is very poor, so, no matter how hard the teachers tried, there were a lot of interruptions, the connection dropped all the time. (Parent, Brazil, Focus group)

> The internet was gone. I could not attend my online classes. It didn't mean much. But my teachers were very angry, some of them did not believe my excuse. They even wanted to have official documents signed. Then I had to use my neighbour's internet. (YP, Turkey, Focus group)

### 4.2.2. Unpreparedness for online learning, lack of training and resort to conventional means

There was a lack of governmental digitalisation strategy or political willingness to make technology work for education in the pre-pandemic time and the consequence of the lack became acute during the pandemic. Online solutions were launched belatedly and CYP could not get timely support. Visible differences in the timeframe between state and private schools were observed in some of the five countries. But some schools, irrespective of their type, did not offer any online teaching until six months into the lockdown.

Some CYP expressed insecurity or uncertainty about the shift to online learning. For instance, they found the unanticipated use of social media for educational purposes confusing and intimidating.

> I didn't use Facebook before, I didn't think there was a purpose … There is a classroom group and a parent group on Facebook. So, they let us use it to find out about the school news … . At first, I felt a little out of place. I really wanted to have online classes because I like to study. But time went by, a whole year went by and nothing started … But now I am happy because I will finally have something to do, online classes, but at the same time, I am afraid I won't adapt well to this type of classes. People say it is very hard. (YP, Brazil, Focus group)

Furthermore, CYP and parents seemed given no choice but to adopt or find a means to learn to use the online tools chosen by teachers. No training was available for parents, although they were expected to support CYP to learn at home. Some parents and professionals discussed the use of conventional media like TV and radio to enable CYP to continue their education. However, the assumption that TV and radio would be available in a household was also questioned.

> The state schools did not communicate efficiently. … Some used Facebook, which is what parents use most, Facebook and WhatsApp, which they already master, so they sent the videos through these channels … . I found it weird that each school would use a different tool, but once you choose one, you'd better teach people how to use it. It is as if they were saying: "We are doing our part, but they are not accessing it". (Professional, Brazil)

> We are held helpless at the point where we were trying to restrict screening. Like, you know till previous year you hadn't given phone and now our school is in the phone. Because I was the type of mother who had never given gadgets in the children's hand, and now he loves about it. (Parent, Turkey)

Nonetheless, some CYP and parents adapted well and even preferred the online format, whereas others yearned the resumption of in-person teaching. Given the lack of the required infrastructure for online learning, CYP, teachers and parents were concerned that they had to resort to the use of printed learning materials and door-to-door collection of homework. Some teachers put in additional effort to ensure the continuity of CYP's education by delivering instructions and materials to their home in person.

> They [children] were wondering why they were not having online classes. Lots of students are in a vulnerable situation. … I asked the tutor if I could pick up some books, I went there and got them. (Parent, Brazil)

Online learning was for students who paid school fees, but with government schools it was a different story … They [teachers] come to our home to check the lessons and what to study. (Child, South Africa)

Notably, it was reported that CYP relying on this paper-based approach would fall behind when their peers could access the same materials much easier and faster via the internet.

> They can't take online classes either. They have to get a handout of the activities at school, I think. Then they do the activities and hand them back at school. It's much more complicated. (YP, Brazil, Focus group)

Furthermore, it was challenging to integrate the pedagogical framework such as systematic assessments into online learning activities. Failure to do so worried some parents who were keen to get proof of attainment to enable CYP to progress to the next academic level, and also worried professionals who were earnest to inform policy changes.

> They told us to read the book, there were classes being taught on television, but the recorded class, there was no evaluation, no assessment, they did not send us the materials to do it at home as they were supposed to. (Parent, Brazil)

### 4.2.3. Alternatives, initiatives, and attitudinal changes

It was encouraging to observe that joint efforts, though some were ad hoc, were undertaken to tackle the access issue that was hindering the uptake of online education. Examples are the private-public partnership for ameliorating the internet provision, broadcasting learning contents via national TV channels (e.g. Pakistan, Turkey), and charitable actions for donating devices.

> We managed to get computers for some. We also partnered with a local internet provider and made some hotspots available. Even though our centre was closed, we opened it up, so that the children could attend virtual classes inside, as they couldn't do so at home. We implemented initiatives without any planning, because the circumstances did not allow us to plan, so whenever we felt a need, we transformed it into action. Today, after 7 months of distance learning, we are more aware, we have a more specific plan to meet these demands and try to transform this into a legacy, in terms of access for them. (Professional, Brazil)

Furthermore, some regarded infrastructural improvement for addressing the need of distance learning as a proof of positive intervention from the national body.

> I also saw that in our national TV PTV, they were also conducting virtual class and they are still in progress. I

guess they do daily in the morning these classes about science and many other topics, and I strongly think the national initiatives is very supportive. (Professional, Pakistan)

The one-device-per-child policy, which sounds similar to a previous action (Section 5: Discussion), was hailed as an important change to be reinforced in the post-pandemic time.

Every student should have their own device, whatever it is; if they are going to school even right now, the school has already clearly instructed they should have their own devices. (Professional, Pakistan)

However, a rather controversial change was that parents expected teachers to be available round-the-clock, given the flexibility supported by the internet. Such unrealistic expectations should be adjusted to avoid communication breakdowns and frustration between teachers and parents.

The teacher became more accessible during this period. Parents could reach the teacher whenever they wanted. (Parent, Turkey, Focus group)

Nonetheless, it was interesting to observe that some CYP found online lessons more enjoyable than the classroom-based ones, and that some parents accepted and adopted the educational technologies.

So, now this technology has helpful in this in way that we adults who previously were not aware of these technologies, who didn't know how to use it, now they are showing interest and learning about these technologies, and it's a good thing that they now know how to use it and, in fact, it can also be helpful in monitoring their children's as well. (Parent, Pakistan)

I also think that I am learning more from online classes than I did from in-person classes. In online classes, teachers explain better, they can answer everyone's questions. (YP, Brazil, Focus group)

### 4.2.4. Drawbacks and limitations of online education

The potential and power of educational technologies have been clearly demonstrated during the pandemic, convincing their sceptics to become avid adopters (Dhawan 2020; Williamson, Eynon, and Potter 2020). Nevertheless, the long-term use of and heavy reliance on online education has also exposed its inherent drawbacks and limitations, including distraction by irrelevant activities (e.g. online gaming), lack of in-person social interaction, and challenges related to physical health issues (e.g. eye strain). Some CYP obviously were overwhelmed by the duration of online lessons

when they had to look at the screen for a sustained period.

The live lesson marathon started again. I'm so tired of getting up early in the morning. (YP, Turkey, Diary)

The children miss their mates a lot too. They are completing their primary education, they are at a stage when they are developing empathy, interacting with other children. Doing this remotely is just not the same. (Parent, Brazil)

One particular concern was that children with special needs may encounter more challenges with online learning, given the limitations on their sensorimotor skills. Their learning progress would be severely harmed because there seemed no specific strategies to support these children or their parents/carers (Yazcayir and Gurgur 2021).

The children with special need like autism, ADHD or Down syndrome or learning difficulties … Other children can do many other activities like using gadgets etc. But the children with these syndromes, they are not fully able to use these kinds of gadgets and they require full attention to play with. And the parents were so much frustrated of the situation, they were not able to cope with their children. (Professional, Pakistan)

### 4.3. Usage

In this section, we present the results on different purposes technologies were utilised during the pandemic (Figure 3) from the CYP perspective based on their hands-on experience and from the parent and professional perspective as observers.

### 4.3.1. More intense use for connecting people than the pre-pandemic time

The primary use of ICT is to keep people connected. Hence, it seems banal to state that social networking was one of the key technology uses during the pandemic. Some participating CYP mentioned the perceived compelling need to use technology to keep in touch with relatives and friends and, more intriguing, the changed attitudes of their parents towards this technology usage.

During the pandemic, my mother allowed me to use everything, but she used to tell me to use less phone and study more. (Child, Pakistan, Focus group)

… spending hours on my mobile, meeting new people … There was even this person who is studying the same topic I am, so we studied together, we helped each other. (YP, Brazil, Focus group)

### 4.3.2. Getting updates about the COVID-19 and resulting emotional responses

Another obvious usage of ICT is to receive information. For many of the CYP in our study, TV was the primary channel for keeping updated about the pandemic (e.g. infection rate, vaccination) and they usually watched news with family. While some CYP tried to remain hopeful from news, others reported that the coronavirus news elicited strong negative emotions in them.

> I used to watch the news at first, but I stopped because it was so sad. I couldn't even watch the Year in Review, after one minute I was already crying. My mum wanted to watch it, but she had to change channels because I couldn't take it. (YP, Brazil, Focus group)

> My number one negative news is those about the pandemic. … increased number of cases makes me feel bad … It destroys my desire to go out. (YP, Turkey, Focus group)

> I got all my news through TV because my father was watching it in our house … then I was afraid because many people died due to corona. (Child, Pakistan, Focus group)

### 4.3.3. Enhancing CYP's mental wellbeing, creativity, and global views

Digital technologies helped improve CYP's mental wellbeing by making them feel in control and calm, connecting as well as augmenting their social networks, sustaining their hobbies (e.g. listening to music, following favourite artists), overcoming boredom (e.g. gaming), and participating in religious activities (e.g. virtual church services).

> This afternoon as I was happy that I was able to watch church services on the TV even if I missed attending in the morning (YP, Kenya, Diary)

> Reading the news about the artist I am fan of makes me happy, … , and my favourite author published a book recently and I saw it on Instagram (YP, Turkey, Focus group)

> … So, this phone was special to me. It kept me calm and it kept me at home so that I did not catch the virus. (YP, South Africa, Focus group)

Another perceived positive incidental outcome from the use of digital technologies during the pandemic was the enhancement of creativity and autonomy, thanks to CYP's efforts in identifying different means to occupy their homebound time. Examples of creative undertakings were learning how to develop digital games, painting, and producing other artwork by following tutorials in YouTube.

> With this I also learnt many new skills such as E-gaming and new apps for learning science experiments. (YP, Pakistan, Diary)

> I like when I get bored, I searched for some art activities on YouTube, and I made a lot of paintings and artwork from YouTube. So, helpful it was. (Child, Pakistan, Focus group)

Furthermore, technologies enabled CYP to receive global as well as local news about the pandemic, thus making sense of the universality of the pandemic and the scale of global impact; as nobody was exempted from its effects.

> I think technology provide the children the sense of universality of the problems. When the child is socialised through technology, she can see that she is not the only one who experience these problems, her peers are going through the same processes. So, yes, technology can also be useful in this sense … maybe it is helpful in terms of the loneliness you mentioned. (Professional, Turkey)

### 4.4. Risk

Technology can have beneficial as well as harmful effects. It appeared that participating CYP were aware of different safety and other risks associated with deploying technology, including indecent contents, grooming by strangers, identity thefts, strains on eyes and back, and addiction to social media. Such awareness was already heightened in the pre-pandemic time, given ongoing parental control and regulation on the use of technology, as indicated by CYP and parents themselves. CYP, parents and professionals discussed various pandemic-related risks: transmission of virus through phone use; fake news on COVID-19; spread of anxiety on the virus via social media; guilt for lifting restrictions on CYP's technology usage; and challenge of sustained monitoring for online classes.

> My mother doesn't allow me to use my mobile phone in this pandemic, because she says it shows loads of bad things, as well as loads of fake news about COVID-19 … and when we hear a lot of negative and fake news about COVID-19, it makes us stressed. (Child, Turkey, Focus group)

> I personally saw people getting into depression and such that, to a point where I had to tell them to just like move off social media for a while, so they could just keep away from COVID, because with those stresses coming in through this information … Children were having mobiles and WhatsApp had created so much of anxieties. (Professional, Pakistan)

> So, initially parents guided [the use of devices] but, as it prolonged, it is really difficult for parents to monitor each and every child, if there are one or two children or more in their house and at the very same time,

they have their online classes and all that stuff. (Parent, Pakistan)

### 4.5. Future improvements

Having deployed different technological devices, apps, and services for an extended period during the pandemic, the users, especially those had been new to such tools prior to the pandemic, were expected to identify improvement suggestions for future usage. Nonetheless, only a few remarks were made by CYP in this regard. Improving the internet connectivity and providing teachers more control over Zoom to minimise potential harm of technology were mentioned. Parents and professionals, however, made some suggestions. Apart from the provision of internet connection in the wider neighbourhood and speed improvement, a major suggestion was to enhance the relevance, access and engagingness of educational contents delivered via mobile devices, but with emphasis that gaming should be separated from learning. Participants elaborated further in using augmented reality/virtual reality (AR/VR) for applied topics. Furthermore, granting parents more control in regulating which content could be accessible to children was highlighted. The sophistication of national television-based education networks was also called forth. Another suggestion was the use of hybrid (in-person and online) education settings.

> I think there are not enough educational activities in mobiles. You want to use your mobile, fine, but the tech guys should create more educational things that can draw children and young people's attention and take them away from gaming just for the sake of it. Or maybe use games to pull the family together, games that bring joy, because sometimes they cause sadness. (Parent, Brazil)

## 5. Discussion

The findings of our empirical study provide further support to emerging evidence that the digital divide had been exacerbated by the COVID-19 pandemic. This appears to be a universal phenomenon, predominantly influencing MWCs and, to a lesser extent, disadvantaged communities in Minority World Countries. The main target groups of our project, children and young people (CYP) aged 8–16 years old in MWCs, were affected by such exacerbation, especially the abrupt move to online education due to school closures. In the following sections, we consider impacts, insights, and implications drawn from the results.

### 5.1. Impacts and insights

#### 5.1.1. Issues of sharing devices: amplified negative emotions, problematic behaviours, and privacy

Many of the CYP involved in our study experienced a strong sense of frustration, anxiety, unfairness, and abandonment by being unable to participate fully in social and learning activities, due to the lack of access to technology. Such negative feelings became more acute when they contrasted their circumstances with those of their more privileged peers. For instance, a basic digital device like a mobile phone had to be shared among a household of four or even more members; younger children were often given much less use time, though their needs to socialise and learn were no less important than those of their older siblings. Sharing digital devices has been a common practice in resource-constrained settings in the pre-pandemic time (Ravi, Ismail, and Kumar 2021) and is regarded as a cultural expectation for women to fulfil in certain countries (Sambasivan et al. 2018). Nonetheless, the pandemic rendered the use of digital technologies indispensable, aggravating the problems of sharing digital devices or inheriting old ones. Intriguingly, the concern of potentially breaching personal privacy by using shared devices and accounts (e.g. email, social media) was not discussed by CYP in diaries or focus groups. Nor was this topic raised by parents or professionals. It could be that privacy was not a major concern for participants of our study or they might already employ certain privacy protection strategies, as shown by a study with samples of South Asian women concerning their approaches to addressing privacy in the context of shared mobile phones (Sambasivan et al. 2018).

Even when devices were available, a lack of, or a slow internet connection rendered them unusable. Some CYP were sympathetic to the undesirable financial situation of their parents, accounting for poor access to digital technologies. Nonetheless, other CYP, who were denied the ownership of a device and/or were under strict parental control on its usage, vented their anger at their parents. Apparently, tension was built up between CYP and parents on these issues, leading to potential power balance and communication breakdown (Hall 2001), as inferred from the empirical data in the diaries and focus groups. However, there was a lack of directly observable *in situ* data demonstrating such power negotiations (see Section 5.2 on Limitations).

#### 5.1.2. Compromising parents' gatekeeping role to digital contents

Many of the participating parents were put in a dilemma. On the one hand, they struggled with giving up their role of a gatekeeper to digital worlds which they perceived as highly contaminated with immoral,

unlawful, and indecent contents and activities. Such scepticism about internet usage is not uncommon among parents (Altarturi, Saadoon, and Anuar 2020; Sergi et al. 2017). On the other hand, they felt pressured to keep their children in education, who might otherwise lose their competitiveness for future opportunities. These sentiments were especially compelling among participating parents and professionals in Brazil. While it could be intriguing to observe any intergenerational contradictions, we did not match CYP with their parents, due to ethical concerns.

The frequency and intensity of cybercrimes and cyberattacks visibly increased during the pandemic (e.g. Lallie et al. 2021) such as the unauthorised use of webcam, phishing, and cyberbullying. As reported in Section 4, CYP spent extra time online for educational and social purposes, which inevitably made them more vulnerable than in the pre-pandemic period (Williamson, Eynon, and Potter 2020). Parents' concern that their role of controlling CYP's access to digital devices and the internet was compromised could be understood in this context (Tazi et al. 2021).

### 5.1.3. Cross-site commonalities and differences

Across the five sites, data from CYP, parents, and professionals indicated that they were facing similar challenges engendered by the digital divide, including restricted access to digital devices and internet services, thus hindering CYP from fully participating in online education and social activities. Particularly noteworthy were the practical and emotional responses aroused by the need to share digital devices, which were also observed in the study conducted by Ravi, Ismail, and Kumar (2021) in India. In close-knitted families, intra-household sharing is a norm (Calvi et al. 2021; Himmelweit et al. 2013). Some CYP accepted this norm, whilst others (especially younger participants) did not, who instead voiced their resentment on shared devices and parental control.

Most CYP expressed more concerns in terms of stark peer pressure, except those from Pakistan who did not have any concern on shared devices or parental control. This could be attributed to the fact that many CYP from Pakistan already possessed their own devices. To contextualise the differences across sites, it is relevant to look at the characteristics of the regions where the participants were recruited from (Section 3.1.1). Among the five sites, Kenya seems most deprived in terms of infrastructure. In contrast, Brazil and Pakistan were relatively better off, albeit with some intra-regional notable variations in wealth distribution. Apart from the objective data on the availability of certain institutions and facilities, we could have collected data

about the familial structure and spiritual backdrops of individual sites.

### 5.2. Implications

#### 5.2.1. HCI4D: one-device-per-child with quality interaction design and learning contents

The digital divide was manifested in various attempts of using educational technology to enhance the quality of education in Major World Countries (Dell and Kumar 2016). For instance, the project *One Laptop Per Child (OLPC)* was aimed to bridge the gap of technology access (Section 4.1) by providing each child with a low-cost computer (Kraemer, Dedrick, and Sharma 2009). Unfortunately, without proper pedagogical and technical support to utilise the laptop for effective learning, children could not benefit from just possessing the device; consequently, OLPC was considered as unrealistic for roll-out (Ames 2019). Interestingly, ideas similar to OLPC were proposed by some participants of our study. However, these views broadened the concept of *One Device Per Child*, where Device can be a mobile phone, tablet, or laptop. The provision of the device should be accompanied with high-quality interaction design, whilst considering a community's cultural beliefs and attitudes (Gitau and Marsden 2009). For instance, mechanisms should be integrated into a shared device to protect individual users' privacy, while respecting the culture of sharing upheld by the community to which the users belong (Sambasivan et al. 2018). In addition, digital educational contents should be relevant and engaging, grounded in robust pedagogical principles, to sustain CYP's motivation to learn (Beetham and Sharpe 2019).

Furthermore, digital literacy, rather than only access, is relevant to the digital divide. Training should be offered to CYP and teachers to utilise educational technologies more effectively. Parents should also receive training (cf. Madaio et al. 2020), thus enabling them to support their children to deploy the device for educational goals. People who harbour fear, anxiety, and scepticisms about digital technologies should be supported to enhance their awareness of benefits and risks associated with different usage, especially cybersecurity and cybercrimes (Lallie et al. 2021).

#### 5.2.2. ICTD: private–public partnership for the internet service affordability

The field of ICTD targets various sectors (Baduza and Khene 2019), including education, for which the uptake of planned interventions critically relies on internet availability. The issue of poor internet connectivity was experienced and reported by CYP and

parents from all five sites. This is a global issue affecting not only people in MWCs but also in Minority World ones, especially those living in disadvantage. Echoing Burgess's (2020) remark that, if access to the internet is a universal entitlement, then it should not be left to the market to determine the price, thus undermine the potential for equal access. Indeed, the affordability of the internet service can be improved with co-ordinated efforts of the private-public partnership (PPP), e.g. between telecommunications companies and education ministries. Specific low-cost or free packages can be offered to schools and associated user accounts. It is necessary for governments to develop long-term and practical strategies for building the infrastructure to enable citizens to utilise digital connectivity with reasonable broadband speed, especially in hard-to-reach premises and rural areas. To tackle data poverty, communities can be mobilised to donate data to those in need, realising the notion of 'data gifting' – a service enabling people to gift data bundles to others (Lucas, Robinson, and Treacy 2020). Furthermore, regarding the provision of online education, alternatives independent of the internet service such as national education television networks were already launched in some MWCs (e.g. EBA TV in Turkey and Pakistan). To relieve the dependency on stable internet and electricity supply, records of learning contents can be pre-loaded onto mobile devices (phones/tablets) prior to distributing them to CYP (Ravi, Ismail, and Kumar 2021).

### 5.2.3. The digital divide undermining the mental wellbeing of CYP

The COVID-19 pandemic was detrimental to the physical and mental wellbeing of many populations worldwide (United Nations 2020). The digital divide was one of the contributing factors for such adverse impacts. A salient observation based on our empirical data was that CYP's emotions engendered by the digital divide (Section 4.1). CYP, especially the younger ones, were frustrated and distressed by being deprived of the opportunity to continue their learning and social activities because of the lack of access to digital technologies. Some directed resentment at their parents and exhibited undesirable behaviours. In addition, viewing tragic (and often selected) news on the pandemic broadcast via TV caused stress and anxiety in CYP. It is deemed critical to study systematically whether such negative emotions will have long-lasting effects on CYP's mental wellbeing and what timely interventions should be introduced.

### 5.2.4. Future work: other impact areas and theoretical framework

This paper focuses on 'technology' as one of the six impact areas (Appendix A). All these areas are intertwined. Taking 'technology' and 'health' as an example, some participating CYP and parents expressed their concern about the impact of excessive use of technology on physical health such as eyestrain and lack of exercise. These views corroborate with the observations reported in recent work (Liu et al. 2021; Liu, Chen, and Dang 2021). We intend to further explore the relations between technology and other impact areas such as health and social. Another item in our research agenda is to develop a theoretical framework linking the digital divide, ICT ownership and learning experience. Specifically, we will explore how formative (i.e. lack of access to ICT) and substantive (i.e. lack of meaningful interaction with ICT) forms of digital divide will influence educational outcomes (Liu 2021). Theoretically, ICT ownership may not only enhance a sense of autonomy (Mertens and d'Haenens 2010) but also enable personalisation of learning process (Major and Francis 2020), hence strengthening motivation and learning effect. Depriving ICT ownership may lead to opposite effects. Furthermore, drawing upon theoretical models from Human–Computer Interaction (HCI) (e.g. Rogers 2012) to inform interaction design can enhance the meaningfulness of interaction with ICT. We aim to verify these theoretical assumptions empirically in our future research work.

### 5.3. Reflections and limitations

After the project had been completed, the co-ordinators of individual sites were asked to provide feedback based on their observations and interactions with CYP. Several positive points were highlighted about CYP, who:

- gained confidence in sharing their experience and perceptions through focus groups;
- were stimulated to reflect on the tools (digital and non-digital), activities (e.g. gaming artwork), and resources (e.g. family) they deployed for sustaining their mental wellbeing during the pandemic;
- felt more in control and engaged in the process through interviewing elders in their family; and
- were motivated to think positively about the post-pandemic future, as they were collectively facing similar challenges;

Nonetheless, there were some negative indications too: some CYP found the process time-consuming and effortful, especially writing diaries. As what CYP

shared in the focus groups was partly based on the diary entries, the contents of the two data collection processes overlapped to a certain extent.

We also need to acknowledge certain limitations in the interpretation of the findings:

- *Lack of in situ interaction data*: The data collected were the narrative accounts of the participants. It would be intriguing to complement such self-reported data with *in-situ* observations to understand more real-life interactions among the stakeholders, especially CYP and parents in households.
- *Variations in research implementation*: The research protocols for the empirical study were well-defined, as presented in Figure 2. Instructions and focus groups topic guides were discussed with local researchers and were monitored throughout data collection. Nonetheless, local researchers were also given leeway to adapt the protocols to the requirements of local contexts. Consequently, there were inevitably some deviations, for instance in the extent of diary entries.
- *Gendered access privilege*: Due to ethical safeguards, we anonymised all personally identifiable information before data analysis. Hence, we could not surmise whether gender played a role in determining digital technology access privilege. Nevertheless, it was reported that the pandemic had amplified gender inequalities, with female CYP becoming more disadvantaged than their male counterparts (Ravi, Ismail, and Kumar 2021). This is a compelling concern that needs to be further examined.

Despite these limitations, the methodology and findings of this study contribute to emerging knowledge. In particular, rather than through adults' voices and views, the first-person accounts of CYP provide stronger and more compelling evidence about the necessity and urgency of addressing digital divide issues.

## 6. Conclusion

Access to resources typically offered in person was severely undermined by the COVID-19 pandemic. Alternatives are viable, thanks to increasingly sophisticated ICT, especially mobile apps. However, a key challenge is the stability and strength of internet connectivity, which inadvertently compounds inequality manifest as the digital divide. Other challenges are human-oriented. Users, be they children or adults, lack requisite knowledge and skills to operate the technology to benefit from its use, and no training is provided to bridge the gap.

Our multi-site project involving five MWC yielded qualitative data that provided depth and richness, which further substantiated the evidence for the digital divide and its exacerbation during the pandemic. Among others, the issue of data poverty urgently needs the strategic co-ordination of benevolent and robust actions between governmental bodies and private enterprises to tackle it. Nonetheless, due to the characteristics of the participating sites and participants, the findings are not necessarily generalisable to other MWCs, indeed to other areas or communities of the five countries involved in this study.

Overall, it is encouraging to observe that some changes to ameliorate the digital divide were undertaken, so that disadvantaged CYP could overcome hardships and sustain their education and other adaptive life functions following the COVID-19 pandemic. Clearly, much more needs to be done to narrow the gap. Optimism and courage expressed by the CYP offers hope that a brighter future can be built in partnership with key stakeholders, including CYP themselves.

## Note

1. http://covid19.uis.unesco.org/wp-content/uploads/sites/11/2021/07/National-Education-Responses-to-COVID-19-Report2_v3.pdf.

## Disclosure statement

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## Appendices

### Appendix A. Six COVID-19 impact areas with example categories

We displayed the four subareas of the Social to illustrate: Home Life, Friends & Events, Community & Support Networks, and Influences of Elders. In this paper, we focused on the impact area of Technology (i.e. the thick red lines), which consists of four subareas – Access, Usage, Risk and Future (cf. Figure 3 above). As technology pervades every walk of life, there are links between this and other areas (i.e. the red dash lines).

### Appendix B. Sample drawings from CYP diaries

Here are two sample drawings taken from CYP diaries. Most of the drawings are not related to the theme of the digital divide (Figure B1); some did but they were self-explanatory (Figure B2). We have not carried out any systematic analysis of such drawings. It entails specific methodological approach that is beyond the scope of this paper.
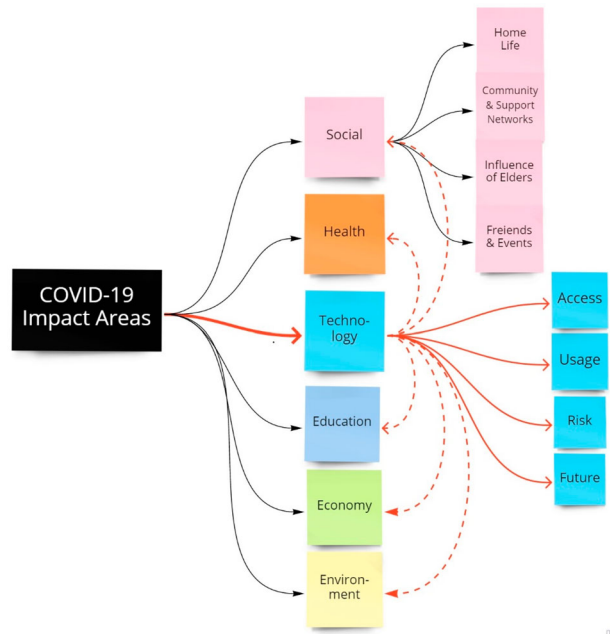


**Figure B1.** A drawing about the post-pandemic future in a child's diary in Pakistan.
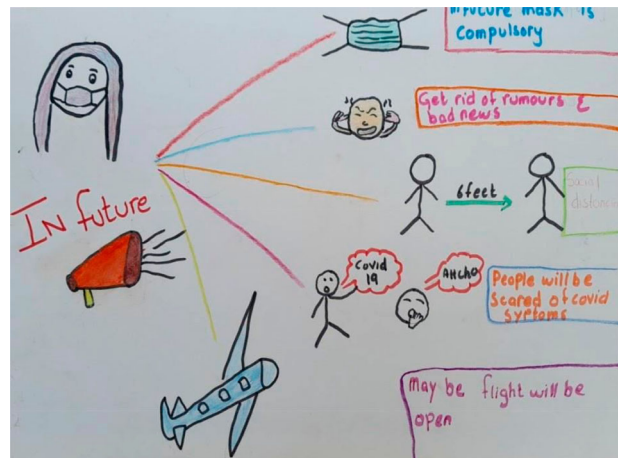


**Figure B2.** A drawing about the Zoom meeting in a child's diary in Brazil.