Locked among inequalities: A study of children's digital experiences and digital divide during the Covid-19 pandemic

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This is an Accepted Manuscript of an article published by SAGE in New Media & Society on 12-03-2025, available online: https://doi.org/10.1177/14614448251321779

Proposed citation: Calderón-Gómez D, Ragnedda M and Ruiu ML (2025) Locked among inequalities: A study of children's digital experiences and digital divide during the Covid-19 pandemic. *New Media & Society* (OnlineFirst): https://doi.org/10.1177/14614448251321779

Abstract: This paper examines children's digital experiences during the COVID-19 pandemic as a specific aspect of digital divide. Utilizing a survey of 2,004 English parents aged 20 to 55, the study explores how various factors—including household living conditions, parents' sociodemographic status, and sociotechnical variables such as children's usage frequency and intensity, expenditure on technology, and parents' digital skills—affect different dimensions of children's digital experiences during the lockdown. These dimensions include academic performance, connectivity issues, social interaction, feelings of isolation, problematic use, and social support. The findings reveal distinct age-related trends, with older children more frequently engaging in online socialization. Additionally, the study highlights a correlation between more favourable household socioeconomic conditions and improved digital experiences for children.

Keywords: digital technologies; children; family; COVID-19; digital experiences; digital divide

Introduction

The unprecedented COVID-19 pandemic has compelled societies worldwide to acknowledge the critical importance of establishing a secure and stable digital infrastructure (Diop, 2020). The widespread lockdowns and restrictions across the globe led to an acceleration in the adoption of digital services and changed our way of life, social interactions and work dynamics (Perez-Brumer et al., 2022). At the same time, the digitalization of society raises several concerns, including increasing digital inequalities at both national and global levels (Beaunoyer et al., 2020), the gap in digital competencies (Robinson et al., 2021), the impact of online education (Calderón-Gómez et al., 2022), the environmental impact (Ruiu and Ragnedda, 2022), and the trajectory toward digitizing healthcare (Faraj et al., 2021). The COVID-19 pandemic has not only reshaped our daily lives but has also profoundly influenced how children engage with digital technologies (Ruiu et al., 2023).

This paper focuses on the complex landscape of children's experiences with digital tools during the pandemic, connecting them with available household digital resources, and the sociodemographic and sociotechnical profiles of their parents. The aim is to explore how household living conditions, parents' sociodemographic status, and sociotechnical variables—such as the intensity of children's technology use, expenditure on technology, and parents' digital skills—affected various aspects of children's digital experiences during the lockdown. By focusing our research on individuals with digital access this paper aims to underscore that the digital divide extends beyond mere access to the internet (the first level of the digital divide) to encompass inequalities in how individuals engage with and utilize digital technologies. Furthermore, the research examines not only the variety and nature of online activities but also how parental socio-economic and household factors influence children's digital usage. By examining these dimensions, we shed light on the broader inequalities that define children's digital experiences during the Covid-19 pandemic.

Methodologically, the study is based on a quantitative survey involving 2004 parents aged between 20 and 55 years old, with school-age children in England, conducted between March and April 2022. Aspects investigated included 10 variables about children's digital experiences, considering parental sociodemographic and economic factors, as well as sociotechnical variables related to household technological equipment, parental digital skills and children's frequency of use of digital tools. Like

other North European countries, England had high digitalization levels before and during the Covid-19 pandemic (Hutton, 2021). This resulted in "higher digital dependence in economy, employment, services" (Grishchenko, 2022: 13), which during the lockdown may have exacerbated digital divides, making it important to study digital experiences and inequalities.

Digital experiences and inequalities during the COVID-19 pandemic

The COVID-19 pandemic and subsequent lockdowns have not only transformed social interaction but also highlighted the necessity of digital tools (Robinson et al., 2021), for everyday life activities (Hopeton et al., 2024) and digital administration (public services, banking, administrative procedures, etc.) (Gabryelczyk, 2020). However, large portions of the population across the globe still lack the resources and expertise needed to take advantage of these opportunities (Hai et al., 2021). Digital inequalities refer to disparities in access to, engagement with, and benefits derived from digital technologies, which are influenced by individuals' and social groups' social, cultural, and economic characteristics (Norris, 2001; Warschauer, 2003). These inequalities manifest across various dimensions, including access to digital devices, internet connectivity, digital literacy, and the ability to leverage digital tools effectively. Such disparities often reflect and exacerbate existing social inequalities, as marginalized or disadvantaged groups may face greater obstacles in benefiting from digital advancements compared to more privileged groups (DiMaggio et al., 2004; Ragnedda et al., 2022).

Conceptualising these disparities involves several layers, known as the three levels of the digital divide (Ragnedda, 2017). Specifically, the first level refers to the inequalities in physical access to digital technologies and internet infrastructure (Attwell, 2001), while the second level refers to variations in how individuals use digital technologies, including the scope and nature of their online activities (Van Deursen and Van Dijk, 2014; Scheerder et al., 2017). Recent scholarship has increasingly focused on the third level of the digital divide, which focuses on outcome inequalities—disparities in the benefits and opportunities derived from digital engagement, such as educational, economic, and social advantages (Van Deursen and Helsper, 2015; Ragnedda, 2017). This research focus also addresses the uneven capacity to manage the negative consequences associated with digital use, highlighting the multifaceted nature of digital inequalities (Ruiu and Ragnedda, 2024). These inequalities are shaped by intersecting

factors such as socioeconomic status, educational attainment, geographic location, and cultural norms, thereby reinforcing broader social hierarchies and inequalities (Helsper, 2021).

The impact of socioeconomic status indicators has been a focal point in digital divide studies since the very beginning (Van Deursen and Van Dijk, 2014; DiMaggio et al., 2004). Existing literature on digital inequalities suggests the role of financial poverty as a key driver of global digital exclusion (Mubarak et al., 2020). Education emerges as another salient determinant in the literature (Mubarak et al., 2020; Pick and Nishida, 2015), highlighting the tendency of highly educated individuals to engage with the Internet with greater confidence and competence (Ofcom, 2018; Calderón-Gómez et al., 2022). Besides economic position and education, numerous studies have delved into the intricate relationship between sociodemographic characteristics and digital proficiency, including age (Asrani, 2020; Van Deursen and Van Dijk, 2014; Zillien and Hargittai, 2009), gender (Asrani, 2020; Elena-Bucea et al., 2021; Zillien and Hargittai, 2009) and residency area (Asrani, 2020; Song, Wang, and Bergmann, 2020), which have all emerged as relevant factors in understanding internet engagement and behaviour. These studies collectively contribute to a nuanced appreciation of how various sociodemographic factors shape individuals' experiences and behaviours in the digital realm.

Like social inequalities, digital inequalities are perpetuated across generations, affecting children who may face limited access to digital devices, infrastructure, or the skills required to optimize their digital engagement. Parents play a crucial role in shaping the development of children's digital competencies and usage patterns (Fidan and Olur, 2023). Parents with high levels of digital capital can employ their acquired knowledge to positively impact their children, particularly in the educational domain (Ragnedda and Ruiu, 2020). However, this dynamic also poses the risk of reinforcing and amplifying pre-existing inequalities in individuals' access and navigation of the digital landscape (Dong, Cao, and Li, 2022). The transmission of digital skills and knowledge from one generation to another has the potential to perpetuate existing social structures and inequalities (Ayllón et al., 2023). Children born into households where digital devices are used and digital competencies are rooted can leverage this advantage to excel academically and, in the long run, in their professional lives (Korkmaz, Erer, and Erer, 2022).

Conversely, those born into environments where there is a lack of digital devices and few digital skills may find themselves at a disadvantage (Sanz and Turlea, 2012). The risk is the generation of a self-reinforcing cycle, or double loop of inequalities (Ragnedda et al., 2022), where children from digitally adept families may excel, while those from less digitally privileged backgrounds may face greater challenges and limitations, widening social inequalities. Additionally, due to digital disparities, some students have unlimited access to online learning tools, while others have few possibilities (Jæger and Blaabæk, 2020). This unequal access has the potential to exacerbate existing gaps in academic performance and impede the acquisition of important digital literacy skills that are necessary for success in the modern world.

Recent studies have increasingly examined the role of families and parental attitudes toward technology in shaping children's digital experiences (Dong et al., 2022; Lewis et al., 2024). These experiences encompass the technological devices, tools and environments in which digital practices occur (Churchill et al., 2012), the internalized attitudes toward the use of digital tools (Choi and DiNitto, 2013), and the emotional and affective bonds attached to these practices (Ellis and Tucker, 2020). The COVID-19 pandemic, with its associated lockdowns, necessitated the use of digital technologies for many daily activities, reshaping how children learned, communicated, and played (Lazcano et al., 2022).

First, the shift to online education highlighted issues of connectivity and technological access, exposing the persistent relevance of the first-level digital divide (Robinson et al., 2021). It also led to feelings of helplessness, disengagement, and a lack of social support, closely tied to parental knowledge and digital skills (Coleman, 2021; Drouin et al., 2020). Second, children encountered challenges when using digital devices to maintain social connections with friends and family, a form of "expanded co-presence" (Costa et al., 2022) that could not fully replace face-to-face interactions (Wut and Xu, 2021). Experiences of social isolation, associated with depression and anxiety, were also reported in the psychological literature (Loades et al., 2020). Third, there have been reports of compulsive and problematic use of technology among children, particularly related to smartphones, social media, and gaming (Gupta et al., 2020; Elsayed, 2021; Pandya and Lodha, 2021). We refer to problematic use of technology, rather than digital addiction, because we focus on parental perceptions (Asghar and Ali, 2021), although

parents sometimes overestimate the risks and threads concerning children's digital practices (Pereira and Ponte, 2020).

The literature indicates that these experiences are not uniform across all children but are shaped by various factors, including household living conditions, the availability of technological equipment, the socioeconomic, cultural, and digital capabilities of parents, and children's digital practices, attitudes, and skills (Coleman, 2021; Robinson et al., 2021). First, age is a significant factor that influences digital experience, as research indicates that younger children tend to adapt more effectively to digital environments (Asrani, 2020; Van Deursen and Van Dijk, 2014; Zillien and Hargittai, 2009). Based on this, we propose the following hypothesis:

H1. Younger children encountered fewer negative experiences using digital technologies during the pandemic.

Moreover, economic living conditions have been associated with better digital experiences (Van Deursen and Van Dijk, 2014; DiMaggio et al., 2004; Mubarak et al., 2020). Therefore, we propose the following hypothesis:

H2. Children residing in socioeconomically disadvantaged households faced more challenging experiences using digital technologies during the pandemic.

Finally, sociotechnical variables also play a crucial role in conditioning children's digital experiences. Some aspects that reproduce digital inequality among children include technological accessibility (Ragnedda et al., 2022; Sanz and Turlea, 2012), parental digital attitudes, dispositions and skills (Bonal and González, 2020; Dong et al., 2022; Lewis et al., 2024), and children's possibilities of using digital devices during the pandemic (Loades et al., 2020). Consequently, we propose the following hypothesis:

H3. The effect of sociotechnical variables on children's digital experiences is more relevant than the effect of sociodemographic and socioeconomic variables. This hypothesis is divided into the following sub-hypothesis:

H3.1. Household digital accessibility (the first level of the digital divide) is associated with children's better digital experience.

H3.2. Parents' digital skills (the second level of the digital divide) are associated with children's better digital experience.

H3.3. Children's higher frequency of use of digital technologies is associated with a better digital experience.

Methodology

To investigate the digital experiences of children during the pandemic, a comprehensive survey was employed to capture the perceptions and insights of parents residing in England. The survey took about 25 minutes to complete and was designed to gather information about children's digital experiences, including sociodemographic characteristics, sociotechnical factors, and subjective evaluations of children's digital activities during the pandemic. We administered the survey online utilizing LUCID, a digital market research company. A randomized stratified sample of 2004 parents residing in England was targeted for this research (2.15% margin of error at a 95% confidence level). The selection criteria focused on parents aged between 20 and 55 years old, ensuring representation from a demographic closely tied to school-aged children. This age range was chosen to capture parents actively engaged in the childhood and education of their children during the pandemic. A pilot with 25 respondents was tested before final fieldwork, conducted between March and April 2022

Measures

Dependent variables

To assess children's digital experiences, we employed ten dichotomous variables, asking parents to respond based on aspects outlined in the theoretical background, including academic performance, social interaction and isolation, and connectivity issues.

- Got worse results at school.
- Received support from their school (e.g., for digital skills acquisition, purchase of devices).
- Were unhappy to learn from home.
- Had no problems accessing the Internet whenever they wanted.
- Being able to socialize through the Internet.
- Not got in touch with the rest of their family (e.g. grandparents, cousins, uncles).
- Preferred spending time using technologies rather than doing physical activity (compared to the pre-pandemic).
- Increasingly avoiding the members of the households (e.g., staying in their rooms).

- Increasingly gaming online (compared to pre-pandemic).
- Increasingly using social media (compared to pre-pandemic).

Control variables: sociodemographic and economic

The analysis considered various sociodemographic and economic variables. Some of these variables were related to the survey respondents (parents), others to the children's profile, and some focused on the household situation. We excluded the following variables from the analysis due to their lack of statistical association: (1) parents' education level, which showed no clear relationship with children's digital experiences; (2) income, which exhibited multicollinearity issues with household economic level and working conditions; and (3) habitat, as the attributes included in the survey presented challenges in result interpretation.

- *Age of parents* (20 to 34 years old; 35 to 44 years old; 45 to 55 years old).
- *Children age* (below 10 years old; 10 to 15 years old; 15 years old and more). If there was more than one child in the household, the average of their ages was estimated. While this limits the interpretation of the results, it was necessary due to the sample size being insufficient to analyse children's experiences on an individual level.
- *Household cohabitation:* Both legal parents living in the household; Single parent living in the household; Other situations.
- *Number of children:* One child; Two children; Three or more children.
- *Working condition (parent):* Working; Not Working.
- *Gender of parents* (Men; Women): We focus on the gender of the respondent, even though the other parents could live in the household.
- *Household economic situation* (Bad economic situation; Neither bad nor good economic situation; Good economic situation). Due to its stronger correlation with dependent variables and better fit to the data, we have opted for self-perception over annual income.

Control variables: sociotechnical

The following variables are related to household technological equipment and resources, parental digital skills and children's frequency of use of digital technologies.

- *Broadband access* (Has broadband access; Does not have broadband access). This variable relates to the first digital divide in terms of the access gap (van Deursen and van Dijk 2019).
- *Money spent on digital technologies* (monthly) (Less than £50; Between £50 and £150; More than £150): This variable relates to the first digital divide in terms of economic investment and maintenance gap (Gonzales 2016).
- *Digital devices used for online learning* (Smartphone; Computer; Tablet). Other devices were excluded from the analysis because of the low sample size. This variable is related to the second digital divide (inequalities in technology use) because research indicates that using a computer for learning produces better academic results than using a smartphone (Albó, Hernández-Leo, and Moreno, 2019; Simões, Oliveira, and Nunes, 2022; Sapci et al., 2021).
- *Parents' digital skills* (Low skills; Average skills; High skills). This variable relates to the second digital divide (inequalities in digital skills) and was calculated by using principal components and K-means analysis, from a list of 34 digital skills based on the UK *Essential Digital Skills Framework* (Department of Education, 2018).
- *Children's daily hours using digital technologies* (Less than 2 hours; Between 2 and 4 hours; More than 4 hours). This variable refers to the second digital divide (uses of technology), as evidence suggests that spending more time using digital technologies is associated with more problematic uses and experiences (Allen et al., 2019; Pandya and Lodha, 2021).

Statistical analysis

Descriptive analysis

We used descriptive bivariate analysis based on contingency tables between the children's digital experiences (dependent variables) and the sociodemographic and sociotechnical variables (independent variables). We used column percentages and chi-square tests to measure the statistical associations (Table IV and Table V, in Annex).

A simple correspondence analysis (Beh, 2010) was also used to compare children's digital experiences with the control variables (sociodemographic and sociotechnical). This analysis places categories from qualitative variables by proximity

and structures them by different dimensions, allowing an intuitive and visual interpretation of associations between categories. The first two dimensions, presented in a bi-dimensional chart (see Figures 1 and 2, in the results section), explain a total variance of 68.7%, 48.3% of it associated with dimension 1 (X Axis) and 19.7% of it associated with dimension 2 (Y Axis). X Axis separates attributes related to easiness using digital technologies (left) from attributes related to problematic use of technology and avoiding household's members (right). Y Axis relates to sociability, separating social isolation (top) from the rest of attributes (bottom).

Typology of children's digital experiences

A typology of children's digital experiences has been built by combining principal components analysis and K-means cluster analysis. In the first stage, a principal component analysis (Pituch and Stevens, 2015) was used to group children's digital experiences into a lower number of factors. This interdependence multivariate analysis uses variables' co-linearity (correlation between variables) to identify a lower number of latent factors which act as proxies of the variables. We establish a model of 5 factors that explain 61.6% of the variance of the 10 variables included. Since the original variables are dichotomic, the value of the determinant of the correlation matrix is higher than expected (0.597), but the Barlett sphericity test is significant (95%) and the KMO test of fitness is adequate (0.686). We applied an orthogonal rotation (Varimax) to maximize the contribution of each variable to only one factor. The variables associated with the 5 factors and their factorial punctuations are reported in Table I.

Table I. Principal components analysis. Factorial punctuations after rotation

Factors	Eigenvalues	Variance	Variable's factorial punctuation (higher)
Hyperconnection	1.690	16.9%	Increasingly gaming online (0.727) Preferred spending time using technologies… (0.718) Increasingly using social media (0.560) Increasingly avoiding the members of the household (0.518)
Discomfort	1.209	12.1%	Were unhappy to learn from home (0.787) Got worse results at school (0.674)
Easiness	1.172	11.7%	Had no problems accessing the Internet… (0.841) Being able to socialize through the Internet (0.644)
Support	1.078	10.8%	Received support from their school (0.891)
Isolation	1.012	10.1%	Not got in touch with the rest of their family (0.968)

In the second stage, a K-means cluster analysis (Jin and Han, 2011) was used to establish a typology of children's digital experiences, using the 5 factors derived from principal component analysis as input variables. This multivariate analysis, which considers the interdependence of cases based on the proximity of quantitative variables input, determines the number of groups (clusters) chosen by the analysis. We selected a model of 4 clusters due to the improved interpretability of the variables used to group the cases (Table II).

Table II. Cluster analysis. Final cluster centres and distribution of cases

	Average experience	Supported experience	Hyper-connected	Socially isolated
Hyperconnection	-0.252	-0.129	0.964	0.169
Discomfort	-0.279	-0.313	1.352	0.151
Easiness	-0.022	0.003	0.184	-0.161
Support	-0.585	1.449	-0.203	0.060
Isolation	-0.305	-0.284	-0.473	2.859
Total cases (N)	1045 (52.1%)	455 (22.7%)	298 (14.9%)	206 (10.3%)

Results

Results are divided into two sections. The first section provides a descriptive bivariate analysis of children's digital experiences, comparing them with the control variables, including both sociodemographic and sociotechnical aspects, and incorporating a correspondence analysis. The second section presents the typology of children's digital experiences, developed through multivariate statistical analysis – main components and K-means cluster.

Descriptive analysis

In terms of parents' perceptions, the overall experience of children using digital technologies appears positive. Nearly half of them (48.9%) encountered no issues accessing the Internet, and 46% were able to socialize by using digital tools. Additionally, there was an increase in technology usage during the pandemic, with one-third of children preferring digital activities over physical ones, and a similar proportion engaging more in online gaming. Around 21.5% of children increased their use of social media. Concerning learning experience, 30.6% of students felt uneasy with online learning, and only 27.2%

received support from the school. However, only 14.8% reported a decline in academic performance. Social isolation was relatively rare with 14.1% of children avoiding household members, and 1 out of 10 not interacting with other family members.

Regarding *sociodemographic variables* (Table IV, Annex), the following significative associations with children's digital experiences stand out:

- *Gender of parents:* Among women, there is a higher perception of their children's preference for spending time with technologies (40.8%), increasing gaming (35%) and dissatisfaction with learning from home (36.1%). Among men, they reported that their children received support from their school (30.6%)
- *Age of parents:* Parents' age is positively associated with the ability to socialize through the Internet and increased use of social media during the pandemic. This association might be a proxy association due to the link between these experiences and older children.
- *Children age (average):* Among older children (15 years old and older), there is a higher ability to socialize through the Internet (56.4%), increased use of social media (35%), and isolation from other family members (18.4%). Among children between 10 and 15 years old, gaming practices (37.6%) and receiving support from school (31.1%) stand out.
- *Household cohabitation:* Hyperconnectivity, including a preference for spending time with technologies, increased gaming, and use of social media, is higher among single-parent households and those differing from traditional nuclear families.
- *Number of children:* Households with three or more children have a higher prevalence of hyperconnectivity (preference of spending time with technologies - 41.2%, increased gaming - 37.5% and use of social media - 37.5%) and getting worse results at school (18.3%).
- *Working conditions:* Positive experiences like socializing through the Internet (47.1%) and receiving support at school (28.2%) are more common when parents are working. In labour situations, the preference for spending time with technologies (41.2%) and dissatisfaction with learning from home (36.5%) is more prevalent.
- *Household economic situation:* Positive experiences (ability to socialize through the Internet and receiving support from school) are more common in affluent

households, while hyperconnectivity, dissatisfaction, getting worse academic results, and isolation from other family members are more common in deprived households.

Regarding *sociotechnical variables* (Table V, Annex), the following significative differences are present:

- *Broadband access:* In households with broadband access, there is a higher presence of no connection problems (50.7%), the ability to socialize through the Internet (47.1%), a preference for spending time with technologies (37.8%) and increased online gaming (33.6%).
- *Money spent on digital technologies*: Spending more than £50 on technology is associated with children's better socialization through the Internet, higher hyperconnectivity, worse results at school, and isolation from the family.
- *Digital devices used for online learning*: Using a computer is slightly associated with fewer problems accessing the Internet and being able to socialize, but it is also associated with higher dissatisfaction with learning from home (35.7%). Additionally, using a smartphone and computer is associated with avoiding other members of the household and increasing the use of social media.
- *Parents' digital skills*: high levels of parental digital skills are related to a better digital experience for children, including a lack of problems accessing the Internet (59.5%) and the ability to socialize (52.3%)/ However, higher digital skills are also associated with more hyperconnectivity (preference for spending time with technologies - 39.8%), increased gaming - 35.5%) and use of social media - 24.3%) and dissatisfaction with learning from home (33.4%). On the other hand, low parental digital skills are associated with social isolation from other family members (14.3%) and more problems accessing the Internet.
- *Children's daily hours using digital technologies*: spending more than 4 hours is linked with hyperconnectivity experiences (preference for spending time with technologies - 51,5%, increased gaming - 49.2%, and use of social media - 40.5%), worse results at school (26.9%) and avoiding members of the household (29.2%). However, it is also associated with being able to socialize through the Internet (51.1%).

Finally, the visual representation of the correspondence analysis between children's experiences and control variables is presented in Figure 1 (sociodemographic variables) and Figure 2 (sociotechnical variables). Horizontally, X-Axis separates into two distinctive zones: on the left (Zone 1. Easiness), positive experiences are positioned, which include receiving support, lack of problems accessing the Internet and being able to socialize; on the right hand (Zone 3. Hyper connection), negative experiences related to an excess of connectivity (increasingly gaming online, increasingly using social media), avoiding other members of the household and getting worse results at school. Vertically, Y-Axis separates social isolation (Zone 2), on the top, from the rest of digital experiences. These 3 areas of the correspondence map are associated by proximity with some sociodemographic and sociotechnical variables. Dissatisfaction with learning from home has been placed in the centre due to its low association with control variables.

- *Zone 1. Easiness:* this area represents a comfortable experience of using digital technologies during the pandemic. It is linked with parents in a better socioeconomic position – nuclear families, male parents, working and in good economic situations. Regarding sociotechnical variables, it is linked with better access (broadband), monthly expenditures on technology of less than £50, high parental digital skills and children spending less than 2 hours a day using digital technologies.
- *Zone 2. Isolation:* This area places children who did not get in touch regularly with the rest of the family during the pandemic. It is not associated with any sociodemographic variable, but is significantly linked with low parental digital skills and children's lack of use of computers, smartphones or tablets for online learning.
- *Zone 3. Hyperconnection*: This area represents experiences linked with problematic and excessive connectivity, getting worse results at school and avoiding members of the household. It is linked with worse economic situations, single-parent households and other cohabitation situations, female parents, and children aged more than 10 years old.

Figure 1. Correspondence analysis. Digital expériences by sociodemographic variables

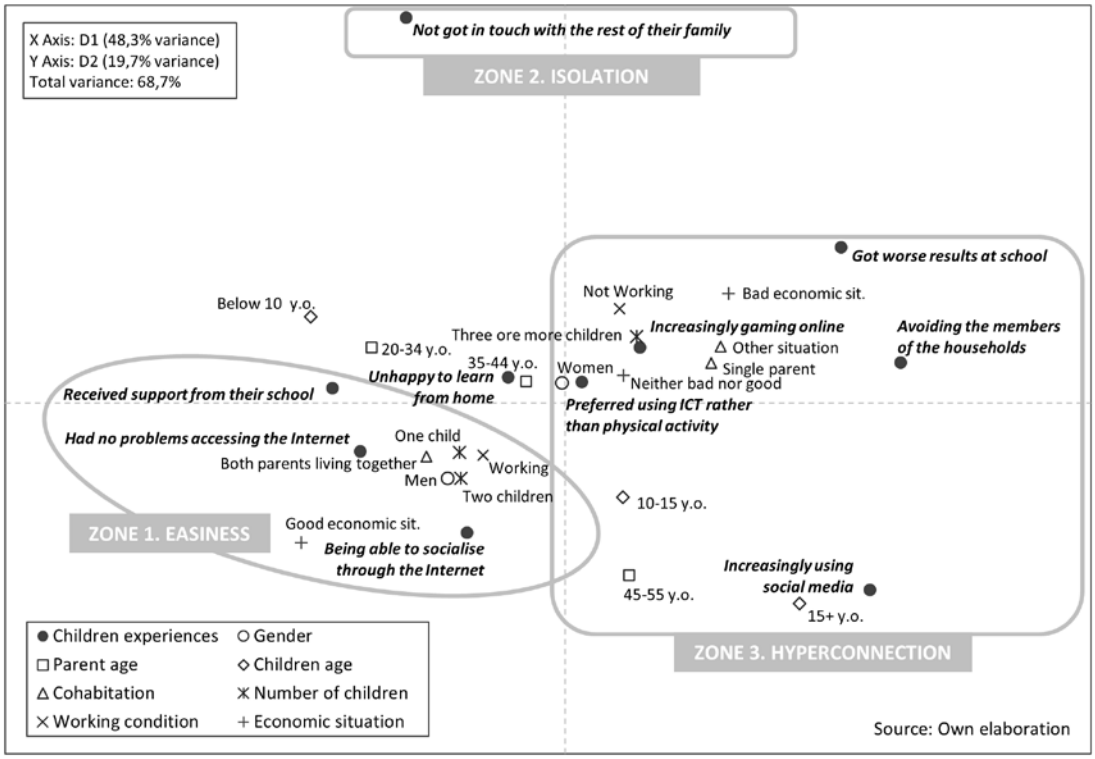
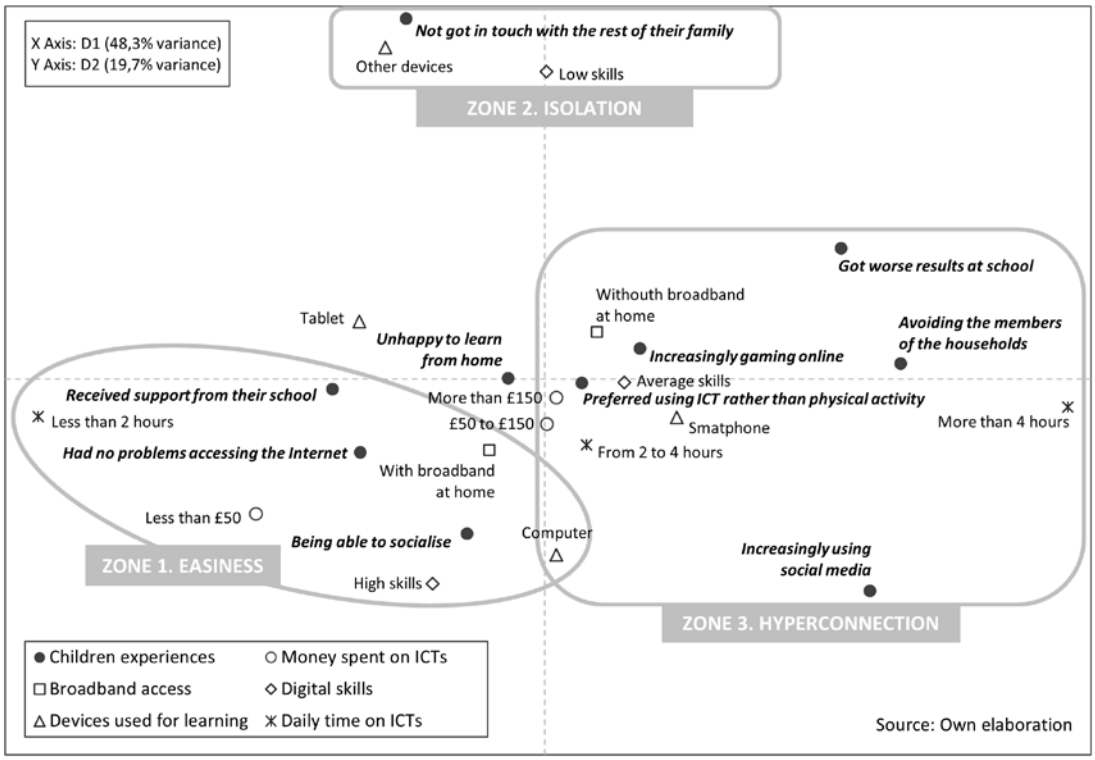


Figure 2. Correspondence analysis. Digital expériences by sociotechnical variables



Typology of children's experiences

Below, we describe the composition of the 4 types of children's experiences identified: factorial punctuation of each factor, sociodemographic and sociotechnical profile.

Average experience: This cluster comprises 52,1% of the cases with punctuation below average in all factors, except for easiness, where it is average. Therefore, they do not have problems of hyperconnection, discomfort or social isolation, and they did not receive support during the pandemic. In terms of demographics and sociotechnical profile, there is a higher proportion of children under 10 years old (55.7%) who use digital technologies less than 2 hours every day (42.6%).

Supported experience: This cluster, representing 22.7% of cases, is characterized by punctuations above average in receiving social support and average in easiness. It positions below average in hyperconnection, discomfort and social isolation. In terms of demographics and sociotechnical profile, it includes a higher proportion of male parents (59.5%), children age between 10 and 15 years old and households in good economic situations (52.1%).

Hyperconnected: This cluster groups 14.9% of the cases and exhibits high levels of hyperconnection and discomfort, but also of easiness. It positions below average in support received and especially in social isolation. Therefore, these children feel comfortable using digital technologies, but they present negative experiences related to an excess of connection, having worse results at home and dissatisfaction with learning from home. In terms of demographics and sociotechnical profile, there is a higher proportion of female parents (61.4%), children above 15 years old (21.2%) and households in bad economic situations (33.6%). Additionally, they tend to spend slightly above the monthly average on digital technologies and have a higher proportion of parents with high digital skills (53.7%). Additionally, children in this group spend more than 4 hours on digital technologies every day (22.8%).

Socially isolated: This cluster groups 10.3% of the cases. It presents extremely high punctuations in social isolation, above average in hyperconnection and discomfort, average in support, and below average in easiness. In terms of demographics and sociotechnical profile, there is a higher proportion of children below 10 years old and their sociotechnical profile is characterised by spending more than £150 every month on digital technologies (30.6%), and there is a higher proportion of parents with low digital skills (33.6%).

Table III. Cluster analysis. Sociodemographic and sociotechnical profile

Variables	Categories	Total	Average experience	Supported experience	Hyper-connected	Socially isolated	Sig. (chi-square)
Gender of parents	*Men*	49,5	48,7	59,5	38,6	47,6	0,000*
	Women	50,5	51,3	40,5	61,4	52,4	
Age of parents	*20-34 y.o.*	33,6	34,5	34,7	28,5	34,0	0,018*
	35-44 y.o.	39,2	40,2	38,5	35,2	41,3	
	45-55 y.o.	27,2	25,3	26,8	36,2	24,8	
Children's age (average)	*Below 10 y.o.*	51,3	55,7	47,8	39,4	54,0	0,000*
	10-15 y.o.	32,3	28,8	37,0	39,4	29,7	
	15+ y.o.	16,4	15,6	15,2	21,2	16,3	
Household cohabitation	*Single parent*	18,8	18,1	18,0	24,2	16,5	0,163
	Both parents	74,0	75,0	75,4	67,4	74,8	
	Other	7,2	6,9	6,6	8,4	8,7	
Number of children	*1*	30,3	30,3	32,6	27,6	29,2	0,178
	2	44,4	46,3	42,7	41,8	42,6	
	3+	25,3	23,4	24,7	30,6	28,2	
Working condition (parent)	*Working*	82,8	82,4	86,4	79,2	82,0	0,072
	Other situation	17,2	17,6	13,6	20,8	18,0	
Household economic situation	*Bad*	21,9	20,4	16,9	33,6	23,8	0,000*
	Neither bad nor Good	31,9	31,9	31,0	34,9	30,1	
	Good	46,2	47,8	52,1	31,5	46,1	
Broadband access	*Yes*	18,0	17,3	18,7	18,1	19,4	0,861
	No	82,0	82,7	81,3	81,9	80,6	
Money spent on digital technologies (monthly):	*Less than £50*	16,0	17,6	16,9	11,4	12,6	0,006*
	£50 to £150	56,4	55,1	56,5	61,1	55,8	
	More than £150	25,5	24,2	25,5	26,8	30,6	
Digital devices used for online learning	*Smartphone*	20,7	20,7	20,4	19,5	23,3	0,055
	Computer	39,4	38,6	40,0	46,3	32,0	
	Tablet	36,1	36,7	36,7	31,5	37,9	
Parents' digital skills	*Low*	23,8	25,1	22,0	15,8	33,0	0,001*
	Average	27,3	26,0	28,1	30,5	27,2	
	High	48,9	48,9	49,9	53,7	39,8	
Children's daily hours using digital technologies	*Less than 2 hours*	36,7	42,6	37,4	14,8	36,9	0,000*
	2 to 4 hours	50,1	46,4	51,6	62,4	48,1	
	More than 4 hours	13,2	11,0	11,0	22,8	15,0	

Discussion

The research findings offer a nuanced perspective on the digital experiences of children during the pandemic, shedding light on the intricate interplay of sociodemographic and sociotechnical factors. Firstly, we observe positive trends in children's digital experiences, as reported by parents. This challenges some concerns about the potential

adverse effects of increased technology use during the pandemic. Nearly half of the children experienced no difficulties accessing the Internet, indicating a relatively smooth transition to digital platforms. Socialization through digital tools also emerged as a prevalent aspect, highlighting the adaptability of children to the virtual realm. The observed growth in technology use during the pandemic, including increased online gaming and social media engagement, suggests a shift in children's leisure preferences.

Secondly, the examination of sociodemographic variables provides an understanding of the different experiences of children. Factors such as parental gender and age, economic situation and household dynamics like cohabitation and the number of children, contribute towards shaping children's digital experiences. These findings align with existing literature that underscores the importance of familial and environmental contexts in mediating children's technology use (Ewin et al., 2021; Geržičáková et al., 2023; Terras and Ramsay, 2016). H1 suggested that younger children would experience fewer negative digital experiences. The data indicate nuanced age-related trends, with older children engaging more in socialization through the Internet and increased use of social media. This challenges the assumption that younger children inherently have a smoother digital experience. The "Average experience cluster" and the "Supported cluster", which present average easiness in using digital tools and fewer negative experiences, include respectively high percentages of children under 10 years old and between 10-15 years old. However, also the "Socially isolated" cluster includes a high proportion of children below 10 years old. While this can depend on several factors, including restrictive parental mediation strategies (Livingstone et al., 2017), it further reinforces that the level of digital expertise of parents, which in this case is low, might contribute towards influencing the experience of young children. In fact, despite an average in support received from school, this group also presents issues of hyperconnectivity, discomfort in learning from home, and difficulty in accessing the digital realm.

H2, which suggested that children in socioeconomically disadvantaged households would have a worse digital experience, is supported by the "Hyperconnected cluster". Specifically, the data shows how economic disparities correlate with negative digital experiences, emphasizing the need for targeted interventions to bridge this gap. The "Hyperconnected" group includes children who feel comfortable using digital technologies, but face challenges related to problematic and excessive connectivity,

dissatisfaction with learning from home, and worse academic results. By contrast, the "Supported Experience" cluster, characterized by above-average social support and average easiness, is linked to households with good economic situations suggesting that economic contexts contribute towards shaping children's digital experiences.

Even though those in the "Hyperconnected cluster" are more likely to be economically disadvantaged, this group tends to spend money on digital technologies and a high portion of parents possess high levels of digital skills. This suggests that economic conditions cannot be considered the sole factor shaping both access and children's digital experiences. This might speculatively be explained by the long time that, in general, these households might spend online which is reflected in higher uses of digital technologies by children. Such an explanation is backed by studies that found how parental technology use predicts their children's technology practices (Terras and Ramsay, 2016).

H3 is partially supported. Hypothesis H3.1 stresses the role of household digital accessibility, emphasizing its association with a positive digital experience. The "Supported Experience" cluster, characterized by above-average support received and average easiness, is linked to households with good economic situations and moderate/high spending on digital technologies, suggesting a positive association between household digital accessibility and a better digital experience for children. This is in line with the literature that connects high socio-economic backgrounds with children's proficiency in IT activities and low socio-economic backgrounds with gaming and leisure activities (Harris et al., 2017). However, accessibility also favours the emergence of issues related to hyperconnectivity, which in turn is linked to worse academic results. The "Hyperconnected cluster" is, indeed, characterized by higher spending on digital tools, despite vulnerable financial conditions. Moreover, the "Socially isolated" cluster is likely to be characterized by good income and spending more than £150 per month on ICTs, but it experiences negative aspects related to isolation, discomfort and hyperconnection. This supports the notion that the digital divide cannot be comprehensively understood or addressed solely in terms of access to digital technologies. It also involves the acquisition of digital skills, dispositions, and attitudes towards technology (Van Deursen et al., 2011).

This is directly connected to H3.2, related to the second level of the digital divide, which assumes that parents' digital skills positively influence the overall digital environment for children. However, this hypothesis is only partially supported. The

"Socially Isolated" cluster is characterized by higher digital spending, but lower parental digital skills, suggesting that these can represent potential barriers to positive digital experiences. Nonetheless, the influence of high digital skills is not necessarily positively associated with children's better digital experiences, at least in terms of learning and school experience, as shown in the hyperconnectivity case. Children's problematic use of technologies has been connected to higher digital skills and longer time spent online by parents (Gupta et al., 2020). At the same time, the literature suggests that parents tend to apply less restrictive mediation when children spend more hours online (Nikken and Jansz 2014; Sonck et al. 2013), and more skilled parents also tend to adopt less restrictive approaches (Livingstone et al., 2017). It is interesting to notice that problematic and excessive connectivity has also been associated with social isolation, which is something that does not emerge in this group (Dishkova and Papancheva, 2019). At the same time, the "Socially isolated" cluster includes higher portions of parents with low-level skills. This group also shows the difficulty in using digital tools and problems of hyperconnection along with social isolation.

H3.3, related to the impact of children's frequency of digital technology use on a more positive digital experience, is not supported. The "Hyperconnected cluster", characterized by problematic connectivity and negative experiences, is linked to children spending more than 4 hours on digital technologies every day.

Conclusions

The research findings point to diverse age-related patterns, with older kids using the Internet more for socialization. Four clusters of digital experiences emerged, "Average experience cluster", "Supported cluster", "Socially isolated", and "Hyperconnected cluster". The "Average experience cluster" and the "Supported cluster", include respectively high percentages of children under 10 years old and between 10-15 years old. However, the "Socially isolated" cluster also includes a high proportion of children below 10 years old. Results also show that economic conditions are connected to different digital experiences and parents' possession of high digital skills is not necessarily associated with more positive children's digital experiences, at least in terms of learning and school experience, as shown by the hyperconnectivity case. Finally, the positive effect of children's frequency of digital technology use on digital experience is not supported, as evidenced by the "Hyperconnected cluster", characterized by longer

time spent online and negative experiences. In addition to these findings, this paper's main contribution lies in its nuanced exploration of the intersection between digital technology use and various socio-demographic factors. This research provides a more granular understanding of how different age groups interact with technology during a crisis. The approach of identifying and categorizing distinct clusters of digital experiences highlights the importance of not only addressing access and skills but also considering the broader socio-economic and educational contexts that shape digital experiences. In addition to these contributions, this research highlights the significance of understanding the role of parental gender in shaping perceptions of children's digital experiences, particularly in relation to hyperconnectivity. The observed differences between men and women in evaluating their children's online behaviour suggest that gendered dynamics within the household may influence digital engagement and parental mediation strategies. Moreover, this study underscores the need for further investigation into the alignment between children's actual digital practices and their parents' perceptions, offering a critical lens through which to explore intergenerational and gender-related digital dynamics.

This research comes with some limitations. Firstly, the article provides a depiction of children's experiences during the pandemic from the perspective of their parents, which could introduce bias into the analysis. For instance, results show that women have worse perceptions of their children's digital experiences than men, particularly in terms of hyperconnectivity, but more research is needed to compare children's digital practices with parental perceptions and dispositions about these. Secondly, longitudinal research is needed to prove which of the tendencies (such as hyperconnection, isolation or easiness using digital technologies) are kept after the lockdowns and the return of normal life. Therefore, the findings presented here necessitate further exploration, possibly through qualitative methods, to identify the precise skills, motivation, and support required for this cohort of users.

Thirdly, the analysis was limited by the sample size and heterogeneity, which restricted our ability to explore sociological variables crucial to digital divide studies, such as gender, race, ethnicity, disability, and single-parent households. Additionally, the lack of statistical significance observed for income, habitat, and education may be attributed to issues of collinearity and tolerance between variables, and the operationalization of gender and the average age of children might also biased the results.

To address these limitations, future research should employ a larger and more heterogenous sample. Furthermore, additional research is needed to examine the role of parental support in shaping children's digital experiences, particularly regarding the intergenerational transmission of digital dispositions and habitus (Ragnedda and Ruiu, 2020), which was beyond the scope of this study.

The findings have consequences for parents, educators, and policymakers. First, acknowledging the multifaceted nature of digital experiences means that interventions to mitigate digital inequalities, both at the level of access and on digital skills, should encompass both sociodemographic and sociotechnical dimensions. Secondly, educational programs targeting parents' digital literacy and strategies to bridge economic disparities in digital access can contribute to creating a more equitable digital landscape for children. Additionally, age-specific interventions considering the unique needs and preferences of older and younger children are warranted. This study not only expands our understanding of children's digital experiences during the pandemic but also underlines and emphasizes the need for nuanced, context-specific interventions to ensure positive, inclusive, and developmentally appropriate digital environments for all children. As we have underlined throughout this paper, digital inequalities exacerbate and are entangled with cultural, socio-economic and socio-demographic variables.

Overall, this study deepens our understanding of how parental digital behaviours and household living conditions influenced various aspects of children's lives during the lockdown, such as educational outcomes, recreational activities, social interactions, digital habits, and overall well-being. It emphasizes the importance of tailored, context-sensitive interventions that account for the intricate relationship between digital technology use and socio-economic factors.

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Disclosure statement

The authors report there are no competing interests to declare.

Annex

Table IV. Bivariate analysis: digital experiences by socio-demographic variables

	Total	Gender of parents		Age of parents			Children age (average)			Household cohabitation			Number of children			Working condition		Household economic situtation		
		Men	*Women*	*20-34 y.o.*	*35-44 y.o.*	*45-55 y.o.*	*Below 10 y.o.*	*10-15 y.o.*	*15+ y.o.*	*Single parent*	*Both parents*	*Other*	*1*	*2*	*3+*	*Working*	*Other situation*	*Bad*	*Neither bad nor good*	*Good*
Had no problems accessing the Internet whenever they wanted	48,9	47,9	50,1	48,4	47,6	51,4	49,4	48,2	48,8	45,4	49,4	53,1	49,4	49,6	47,0	48,6	50,1	46,7	46,7	51,5
Being able to socialize through the Internet	46,0	45,7	46,2	40,9	45,1	53,4	39,7	50,5	56,4	43,2	46,6	46,9	46,8	46,5	44,0	47,1	40,6	44,9	41,1	49,8
Preferred spending time using technologies rather than doing physical activity	36,3	31,8	40,8	34,6	34,9	40,4	35,3	38,6	35,6	37,4	35,1	45,5	33,3	35,8	41,2	35,3	41,2	44,9	35,9	32,4
Increasingly gaming online compared to pre-pandemic	32,5	30,1	35,0	30,7	33,4	33,6	30,3	37,6	30,4	39,3	30,3	37,9	33,8	29,2	37,5	31,9	35,7	38,3	35,9	27,5
Were unhappy to learn from home	30,6	24,9	36,1	30,4	29,3	32,8	30,1	31,7	31,3	32,9	29,9	32,4	25,7	30,6	37,5	29,4	36,5	39,0	32,8	25,2
Received support from their school	27,2	30,6	23,9	28,8	25,6	27,5	26,0	31,1	23,9	29,2	26,7	26,9	28,4	25,7	28,9	28,2	22,3	23,5	26,3	29,6
Increasingly using social media compared to pre-pandemic	21,5	21,3	21,7	16,2	20,4	29,5	13,8	26,9	35,0	24,7	20,1	26,9	19,6	21,0	24,9	21,6	20,9	23,9	22,7	19,5
Got worse results at school	14,8	13,2	16,3	12,8	16,1	15,4	12,2	15,7	20,9	20,4	12,8	20,0	13,3	13,7	18,3	14,2	17,4	21,9	16,1	10,5
Increasingly avoiding the members of the households	14,1	13,6	14,6	12,5	13,4	17,1	10,5	17,6	18,4	17,0	12,6	21,4	14,4	12,8	15,9	13,7	15,9	16,9	15,8	11,6
Not got in touch with the rest of their family	10,3	9,9	10,7	10,4	10,8	9,4	10,7	9,3	10,1	9,0	10,4	12,4	9,8	9,7	11,4	10,2	10,7	11,2	9,7	10,3

Source: Own elaboration / Data: column percentages (%)

Table V. Bivariate analysis: digital experiences by socio-technical variables

	Total	Broadband access		Monthly money spent on digital technologies			Digital devices used for online learning			Parents' digital skills			Children's daily hours using digital technologies		
		Yes	*No*	*Less than £50*	*£50 to £150*	*More than £150*	*Smart-phone*	*Com-puter*	*Tablet*	*Low*	*Average*	*High*	*Less than 2 hours*	*2 to 4 hours*	*More than 4 hours*
Had no problems accessing the Internet whenever they wanted	48,9	40,6	50,7	51,7	47,9	49,6	42,2	52,3	49,0	30,0	46,4	59,5	47,9	48,8	52,3
Being able to socialize through the Internet	46,0	40,8	47,1	42,4	45,6	50,6	46,0	52,2	40,2	35,4	43,7	52,3	41,4	48,0	51,1
Preferred spending time using technologies rather than doing physical activity	36,3	29,2	37,8	32,1	38,0	36,9	35,2	35,4	38,7	27,9	37,3	39,8	27,8	38,5	51,5
Increasingly gaming online compared to pre-pandemic	32,5	27,8	33,6	24,9	34,7	33,2	29,9	33,2	33,5	23,1	35,5	35,5	19,9	37,4	49,2
Were unhappy to learn from home	30,6	33,3	30,0	29,3	31,4	31,3	26,0	35,7	28,6	25,8	30,0	33,4	27,5	32,3	33,0
Received support from their school	27,2	30,0	26,6	28,0	27,3	27,5	26,0	27,6	27,8	26,2	27,8	27,3	26,4	28,9	23,1
Increasingly using social media compared to pre-pandemic	21,5	21,7	21,4	16,2	22,7	22,7	25,1	25,5	15,8	14,3	22,7	24,3	10,9	24,2	40,5
Got worse results at school	14,8	16,7	14,4	10,0	15,1	16,6	16,6	15,7	12,7	16,6	16,1	13,2	9,4	15,5	26,9
Increasingly avoiding the members of the households	14,1	16,7	13,5	10,9	14,0	17,0	16,6	16,1	10,5	13,0	17,2	12,9	5,7	16,2	29,2
Not got in touch with the rest of their family	10,3	11,1	10,1	8,1	10,2	12,3	11,6	8,4	10,8	14,3	10,2	8,4	10,3	9,9	11,7

Source: Own elaboration / Data: column percentages (%)