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The self-reinforcing effect of digital and social exclusion: The inequality loop

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ABSTRACT

Since an increasing number of daily activities are carried out online, an exclusion or limited access to the Internet prevent citizens from entering a world full of opportunities that cannot be accessed otherwise; in this sense, inclusion in the digital realm is strictly connected to social inclusion. Digital inclusion is not conceived as a mere dichotomy, access versus no access, but in terms of the degree to which e-inclusion improve wellbeing for individuals, community and society. Using a quantitative method based on a multivariate analysis, multiple correspondence analysis and cluster analysis, applied to a representative sample of UK citizens, this article sheds light onto the gradual process of digital inclusion, highlighting how social and digital inclusion are intertwined and how people who have one or more social or economic vulnerabilities are more likely to be in the group of those who are digitally excluded.

1. Introduction

This paper contributes to the digital divide research by conceptualising digital inclusion as a result of the combination of the three levels of the digital divide and suggesting a need for multidimensional approaches (both online and offline) to tackle the rapidly changing digital inequalities. By using data from an online survey - stratified by age, gender, income, and level of education - conducted in the UK (N = 868), it investigates the socially inclusive use of the Internet in the UK and how this is related to socio-demographic and socioeconomic features. Although there exist multiple definitions of digital inclusion, a commonly accepted definition comes from the International Telecommunication Union (ITU, 2019), which refers to digital inclusion as all the different initiatives implemented not only to provide citizens with equal access but also to provide them with the competencies that they need to benefit from digital technologies. These are commonly recognised by scholars as the three levels of the digital divide related to the inequalities in access to ICT, digital skills and life chances (Ragnedda, 2017). Even though the number of ICT has constantly increased in the UK, forms of digital exclusion persist among those who access the internet. Digital inclusion is not limited to closing the gap in accessing the Internet in itself (first level of the digital divide), but also comprises a certain level of digital competencies and motivation to use digital technologies (second level of the digital divide) to improve personal wellbeing (third level of the digital divide). An estimated 11.7 million (22%) people in the UK, despite access to the Internet, do not possess the digital skills needed for everyday life (Lloyds, 2020). Given the intertwined relationship between social and digital exclusion (Clayton and Macdonald, 2013; Alam and Imran, 2015) the digital divide increases the risk for socially disadvantaged groups of being "left behind", thus widening social

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inequality gaps. Understanding digital inclusion has become essential due to the increasing number of activities - e.g., learning, shopping, paying bills, keeping in touch with friends and family, and working – migrated online (Good Things Foundation, 2021; Townsend et al., 2020. Therefore, exclusion or even limited access to the digital arena means missing chances, resources, and opportunities in different areas of daily life, which cannot be accessed otherwise. The main axes of social inequalities, such as socio-economic status, gender, age, and level of education (Van Dijk, 2020; Bol et al., 2018; Van Deursen et al., 2021) influence the ways individuals access ICTs, use the Internet and their digital competencies to get benefits/outcomes from the digital experience.

This paper interprets digital inclusion by conceiving the digital divide as a multi-layered phenomenon, which involves technological access, differentiated uses, competencies, social contexts, support, and measurable outcomes (Helsper, 2017; Gangneux, 2019).

Rooted in this approach, this paper investigates what contributes to creating multi-layered levels of digital inclusion and how such digital inclusion is related to social inequalities. In analysing the different degrees of digital inclusion, we will focus on the second level (digital competencies) and the third level (tangible outcomes) by paying particular attention to socially disadvantaged categories. It is indeed widely accepted that socially disadvantaged individuals also tend to be discriminated against via digital technologies (Ragnedda et al., 2020; Pérez-Escolar and Seale, 2022), further marginalising their position in society (Helsper and Reisdorf, 2017; Reisdorf and Rhinesmith, 2020; Goedhart et al., 2019).

This paper, therefore, tries to understand how socially disadvantaged individuals, such as the elderly, uneducated people, and those with low incomes, are discriminated against when using the Internet in the UK. Through a multivariate analysis approach, based on multiple correspondence analysis and cluster analysis, we shall identify those social groups who have the highest level of digital competencies and, therefore, benefit the most from using the Internet. More specifically, this paper explores the social benefits that disadvantaged groups get from the Internet in five different contexts: political, economic, social, cultural, and personal. While plenty of research on the lack of digital skills and different types of Internet use exists (Blank and Groselj, 2014; Brandtzæg, 2010; Helsper, 2010; Van Deursen and Van Diepen, 2013), not as many studies analyse the relationship between socially disadvantaged populations and social inclusion through the lens of the "benefits" obtained by using the internet. To fill this gap, the paper will first introduce the phenomenon of the digital divide by focusing specifically on the concept of digital inclusion. It will then describe the methods adopted to analyse the data collected through an online survey. The third section will report the results of the analyses, with particular focus on some groups who are at high risk of social exclusion. The final section will discuss the results of the research and formulate some conclusions.

2. Theoretical background

Since the very beginning of ICTs studies, the Internet has been seen as a tool to access services, information, resources and help in different areas of social life, from economy to political engagement, from socialization to educational activities (Castells, 2000; Chen and Wellman, 2004; Norris, 2001). Inclusion in the digital arena could, therefore, provide the possibility of increasing individuals' job opportunities, business activities, political and civic engagement, education, and socialisation (Townsend et al., 2020; Reddy et al., 2020). The process of digital inclusion has gradually become vital for policy actions aimed at tackling social inequalities and reducing social disparities (European Commission, 2018). It emerged quite quickly that socio-economically disadvantaged groups, such as older people, uneducated, ethnic minorities, and citizens with disabilities, tend to have limited capacity to access ICTs and elementary digital competencies (Armitage and Nellums, 2020). At this point, studies on the digital divide mainly adopted a binary perspective in terms of those who have access ("haves") and those who have not ("have-nots"). Therefore, these preliminary efforts focused on physical access (e.g., devices) and Internet access (e.g., penetration, costs, infrastructure, etc.). However, even though scholars have been paying less attention to the first level of the digital divide, given the increasing penetration of the Internet, especially in developed countries (Helsper, 2012; Brandtzæg, 2010), more recent studies have shown that this level of digital divide still requires attention according to differences in material access (Van Deursen and Van Dijk, 2019). In fact, even though the "haves" might have outnumbered the "have-nots", there is still a disparity issue in relation to accessing the rapidly changing technologies that provide different experiences (and outcomes) of the online arena (Gonzales, 2016; Van Deursen and Van Dijk, 2019). While scholars return to the roots of the digital divide by redefining this first level, the increasing diffusion of digital technologies has led to increasing attention to the second level of the digital divide (Ruiu and Ragnedda, 2020), which is directly connected to differences in terms of skills possessed by the Internet users. From this point, researchers have increasingly focused on analysing the complex interconnection between ICT usage and existing socio-cultural and economic backgrounds (Dobrinskaya and Martynenko, 2019; Robinson et al., 2015; Goedhart, et al., 2019). Policymakers and researchers pointed out how traditional axes of social inequalities such as gender (Arroyo, 2020;), class and status (Hassan and Beverly-jean, 2020; Yoon et al., 2020; Ragnedda and Muschert, 2013), age (Calderón Gómez, 2019; Walker et al., 2020; Yoon et al., 2020), level of education (Haddon, 2000), and race (Elena-Bucea et al., 2021; Walker et al., 2020) have a strong impact on digital inequalities. All these socioeconomic and sociodemographic dimensions influence the degree of e-inclusion, and the depth and breadth of Internet use (Al-Muwil et al., 2019; Zdjelar and Hrustek, 2021).

Evidently, given the complexity and multifaceted nature of digital inclusion (Borg and Smith, 2018; Katz and Gonzales, 2016; Mubarak, 2015), many other features need to be taken into consideration while analysing the digital inclusion process, such as experience and differentiated uses of the Web (Ruiu and Ragnedda, 2020), the autonomy of use (Asmar et al., 2020), motivation (Borg and Smith, 2018; Van Dijk, 2005), and digital skills (van Laar et al., 2020). Digging deeper into the relationship between the socio-economic dimension and digital inequalities, scholars found how individuals from lower socioeconomic statuses tend to use simpler applications for communication and entertainment compared to their counterparts who, by contrast, use the Internet for educational, economic or service-oriented purposes (Van Laar et al., 2020). This brings our attention to the replication and reproduction of inequalities through the use of the Internet. Several sociological studies over the years have pointed out, for instance, how socioeconomic inequalities and social and cultural capital are maintained and transmitted across generations in a family (Bertaux, 1981; Bourdieu, 1984; Biblarz and Raftery, 1993; Putney and Bengston, 2002). In the same vein, individuals' dispositions toward digital technologies as well as their knowledge and skills are also transmitted within families (Dulay et al., 2019) and reproduced across generations (Straubhaar et al., 2012).

To help disadvantaged groups to overcome other social inequalities and be prepared for the digital society (European Commission, 2020; European Commission, 2016), digital inclusion policies have proliferated at both national and international levels. The UN's Sustainable Development Goals (SDGs), for instance, include a commitment to 'Leave No One Behind' which pays particular attention to already disadvantaged citizens. In the same vein, the 2016 World Development Report on 'Digital Dividends' pointed out different ways of adopting digital technologies to increase income levels and empower citizens around the world (World Bank, 2016). Following this strategy, since the end of the millennium, UK governments have implemented digital inclusion policies aimed at bringing every citizen, company, and school online (Cabinet Office, 2012). The overall aims are to provide all citizens with the digital competencies needed to be fully engaged citizens in a digital society. They advocate a focus on the most marginalised populations (van Deursen and van Dijk, 2014), such as women, low skilled or elderly people (Arroyo, 2018), because those at the margins of society and the most vulnerable categories need to be at the core of the digital inclusion process (Alam and Imran, 2015; Menger et al., 2015; Pérez-Escolar and Seale, 2022). In this vein, as underlined by the Department for Communities and Local Government (DCLG) in the UK, 'digital equality matters because it can help mitigate some of the deep social inequalities derived from low incomes, poor health, limited skills or disabilities' (DCLG, 2008: 5), by promoting a society where everyone benefits from digital technology, mitigating digital inequalities and empowering citizens through the use of digital technologies.

The UK Digital Strategy 2017 (Department for Digital Culture, Media and Sport, 2017) still advocates for simultaneously providing both access and skills to the UK population. Programmes that aim to simultaneously tackle both access and lack of skills have shown to be successful in providing those basic skills necessary to gain the basic benefits of the digital realm (Good Things Foundation, 2019). In 2019 the Good Things Foundation highlighted that the Online Centres Network realised thanks to the Future Digital Inclusion programme (funded by the Department for Education) supported more than 1 million people to learn basic digital skills. However, beneficiaries of such programmes also showed to have short-term goals in mind when they first attended online training. By contrast, the rapidly changing state of digital technologies requires a constant and continuous engagement with digital skills. Moreover, such programmes recognise the need for "one to one" support for personalised needs (and this need increases with age, lower educational attainment, and unemployment) and this requires further resources and support from public bodies, especially in terms of consistency of support.

While digital technologies are often depicted as a way to reduce traditional inequalities, they have been frequently found to replicate and amplify existing inequalities (Fleming, Mason and Paxton, 2018; Van Deursen and Helsper, 2015; Ragnedda and Ruiu, 2020), further underlining how barriers to digital inclusion are connected with social exclusion (Clayton and Macdonald, 2013). This is directly connected to the identification of the third level of the digital divide, which is intertwined with the different opportunities provided by ICT access and usage (Ragnedda, 2017; Scheerder et al., 2017).

Moving across these lines, this paper will shed light on this inequality loop in which those already (socially) marginalised have limited chances to use the Internet as a tool of social inclusion, thus being further marginalised.

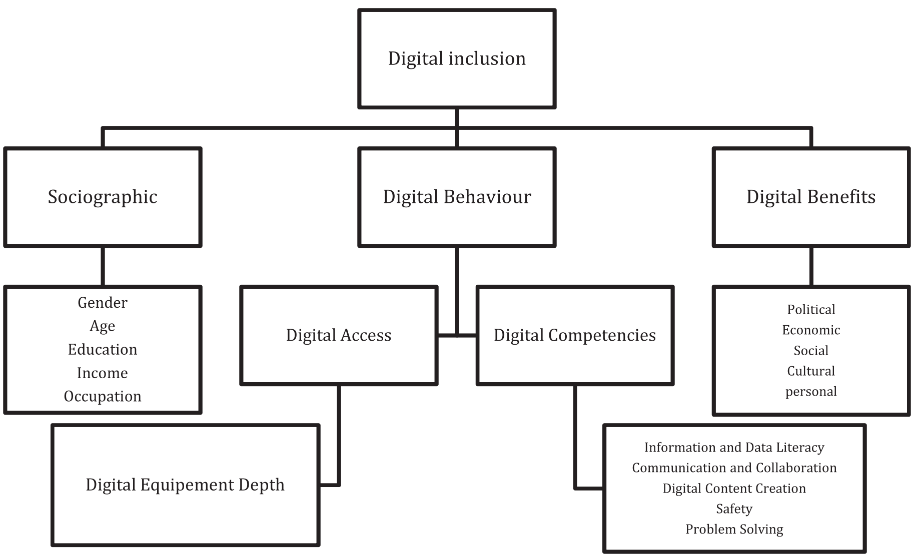

Fig. 1. Digital inclusion conceptual map.

3. Research design and data collection

This study explores how digital inclusion varies among people and how social and economic factors may help to understand its variation. The definition of digital inclusion adopted here considered the three levels of the digital divide. Specifically, we included digital behaviour - how people stay online in terms of *access* and *skills* used to perform online activities - and the digital benefits - what *advantages/outcomes* people have gained by being online. This led us to formulate two research questions aiming at both grouping users according to their level of digital inclusion and investigating the relationship between these clusters and some socioeconomic and sociodemographic factors.

RQ1: How can users be grouped according to different levels of digital access, digital competencies, and digital benefits?

Table 1
Operational definition of digital competencies.

Component	Description	Operational Definition	Response Options	Measure
Information and data literacy	Browsing, searching, filtering data, information and digital content	I am confident in browsing, searching and filtering data, information and digital content	- Not at all true of me	Ordinal
Cronbach's Alpha = 0.713	Evaluating data, information and digital content	I regularly verify the sources of the information I find	- Not very true of me	
	Managing data, information and digital content	I regularly use cloud information storage services or external hard drives to save or store files or content	- Neither true nor - untrue - Mostly true of me - Very true of me	
Communication and collaboration Cronbach's Alpha = 0.778	Interacting through digital technologies	I actively use a wide range of communication tools (e-mail, chat, SMS, instant messaging, blogs, micro-blogs, social networks) for online communication	- Not at all true of me	Ordinal
	Sharing through digital technologies	I know when and which information I should and should not share online	- Not very true of me	
	Engaging in citizenship through digital technologies	I actively participate in online spaces and use several online services (e.g. public services, e-banking, online shopping)	- Neither true nor - untrue	
	Managing digital identity	I have developed strategies to address cyberbullying and to identify inappropriate behaviours	- Mostly true of me - Very true of me	
Digital content creation	Developing digital content	I can produce complex digital content in different formats (e.g. images, audio files, text, tables)	- Not at all true of me	Ordinal
Cronbach's Alpha = 0.828	Integrating and re-elaborating digital content	I can apply advanced formatting functions of different tools (e.g. mail merge, merging documents of different formats) to the content I or others have produced	- Not very true of me	
	Copyright and licences	I respect copyright and licences rules and I know how to apply them to digital information and content	- Neither true nor - untrue	
	Programming	I am able to apply advanced settings to some software and programs	- Mostly true of me - Very true of me	
Safety	Protecting devices	I periodically check my privacy setting and update my security programs (e.g. antivirus, firewall) on the device(s) that I use to access the Internet	- Not at all true of me	Ordinal
Cronbach's Alpha = 0.732	Protecting personal data and privacy	I use different passwords to access equipment, devices and digital services	- Not very true of me	
	Protecting health and well-being	I am able to select safe and suitable digital media, which are efficient and cost-effective in comparison to others	- Neither true nor - untrue - Mostly true of me - Very true of me	
Problem solving	Solving technical problems	I am able to solve a technical problem or decide what to do when technology does not work	- Not at all true of me	Ordinal
Cronbach's Alpha = 0.903	Identifying needs and technological responses	I can use digital technologies (devices, applications, software or services) to solve (non-technical) problems	- Not very true of me	
	Creatively using digital technologies	I am able to use varied media to express myself creatively (text, images, audio and video)	- Neither true nor - untrue	
	Identifying digital competence gaps	I frequently update my knowledge on the availability of digital tools	- Mostly true of me - Very true of me	

RQ2: Is there a relationship between the digital inclusion typology and gender, age, education, income, and occupation?

The originality of our conceptual framework relies upon the fact that we included the three levels of the digital divide (access-usages-benefits) in a holistic model. Specifically, our research considers access to multiple devices important to determine the level of digital inclusion. Secondly, our conceptual model adopts the European Digital Competence Framework for Citizens", named DigComp 2.1 to identify the different levels of digital competencies. The focus on specific macro-dimensions is further justified in the following section by focusing on the literature on the relevant aspects to be included in digital inclusion research. Finally, it includes also the digital benefits, namely how respondents take advantage of the access and use of the Internet. The dimensions considered in our conceptual model are shown in Fig. 1.

1. Digital Behaviour: the operational definition of digital behaviour relies on two sub-dimensions, a) Digital Access and b) Digital Competencies. Digital Access takes into account the number of digital devices owned by respondents, which we define here as the depth of the digital equipment (Murphy et al., 2016; Napoli and Obar, 2014; Ragnedda et al., 2020; Van Deursen and Van Dijk, 2019; Van Dijk, 2005). Digital Competencies was developed upon the proposal from "The European Digital Competence Framework for Citizens", named DigComp 2.1 (Carretero et al., 2017). We identified five areas of competence: (a) information and data literacy, (b) communication and collaboration, (c) digital content creation, (d) safety, and (e) problem-solving;
2. Digital Benefits: this dimension explores if and how respondents took advantage of the Internet experience by evaluating externally measurable outcomes in five areas: political, economic, social, cultural, and personal.
3. Sociographic: information about social and economic characteristics (gender, age, education, income, and occupation).

3.1. Sampling

The unit of analysis is represented by individuals living in the UK, aged over 18, who can connect to the Internet and perform at least some basic digital activities. The UK context is an appropriate setting to study digital inclusion processes because it is characterised by a high Internet penetration but varying degrees of adoption and digital competencies. The sample adopted in this study is stratified in terms of age, gender, income, and education, and was selected by Toluna digital market research group. The sample size (868 respondents) was calculated as having a 3.33% margin of error at a 95% confidence level. Toluna recruited this sample online by extracting respondents from its panel members (participation rate 98%). Software checked for missing responses and then prompted users to respond. An online pre-test survey was conducted with 20 Internet users over two rounds. Amendments were made based on the feedback provided. The average time required to complete the survey was 25 min. In total, 868 responses were collected in January/February 2019.

3.2. Data collection

We measured users' digital competencies by focusing on five areas of competence (DigComp 2.1). Relying on previous research (Ragnedda et al., 2020), we adopted a different set of statements about the use of the Internet, and respondents were asked to indicate how accurate the statements were on a five-point Likert-type scale, from "Not at all true of me" to "Very true of me" (Table 1). The reliability of each scale was tested with the Cronbach's Alpha: all the values are over 0.7, which implies that there is an overall adequate internal consistency and that the measures could be considered reliable (Cortina, 1993; Taber, 2017). As regards the validity, using the simple factor structure criterion (Garson, 2016), we performed a factor analysis for each set of items: results showed that all the variables composing a scale highly contribute to one factor. These results suggest that each set of items could be considered a reliable measure of the areas they are intended to represent.

Each area of competence was transformed into a single variable by combining the answers of the respondents into a composite index. Five indexes were then created: information and data literacy (IDL), communication and collaboration (CC), digital content creation (DCC), safety (S), and problem-solving (PS); each index has three modalities: Basic experience (majority of answers are "not at all true of me" and "not very true of me"), Intermediate experience (the answers are mixed) and Advanced experience (majority of answers are "mostly true of me" and "very true of me").

The operational definition of digital access took into consideration differences in material access (Gonzales, 2015; Van Dijk, 2005), by including different devices used to access the Internet, such as desktop PC, smartphones, tablets, and Smart TVs (Table 2). Digital

Table 2
Operational definition of Digital Access.

Component	Description	Operational Definition	Response options	Measure
Digital equipment	Depth, i.e., number of devices used to access the Internet	Multiple responses	- Smartphone - Notebook - Tablet - Desktop PC - Media player - Game player - Smart TV - Other devices	Nominal

access was then operationalised as multiple response variables: respondents were asked to indicate as many devices as they wanted. The digital access variable was then created by counting how many devices each respondent has specified; four options were created: 1) one device; 2) two devices; 3) three devices; 4) four or more devices.

The DISTO model (Helsper et al., 2015; van Deursen et al., 2016) and the Digital Capital Index (Ragnedda et al., 2020), led us to identify the digital benefits falling into five areas: social, political, economic, cultural, and personal. As a consequence, the operational definition of digital benefits relies on five different sets of items (Table 3), measured with a 5-point Likert scale from "Strongly Disagree" to "Strongly Agree". The respondents were asked to evaluate how much they agree or disagree with each statement concerning how the use of the Internet may have improved their capacities in performing several online activities.

The results of the reliability assessment show high Cronbach's Alpha values (over 0.8) for each set of items, suggesting internal consistency. In terms of validity, the results of the simple factor structure criterion procedure show that, in each scale, all the items converge on a unidimensional meaning.

As with digital competencies, digital benefits were summarized into variables by developing five different composite indexes - Political benefits (PoB), Economic benefits (EB), Cultural benefits (CB), Social benefits (SB), and Personal benefits (PeB) - each one with three modalities: Low (the majority of answers are "strongly disagree" and "disagree"), Medium (the answers are mixed) and High (the majority of answers are "strongly agree" and "agree").

3.3. Data analysis

RQ1 was investigated by adopting the "French way" to multivariate analysis (Di Franco, 2006; Holmes, 2007; Migliaccio et al., 2011); this approach originated from the "Analyse des Données" developed by Benzecri (1973) and was made well-known by Bourdieu (1984).

RQ1 required a clustering procedure, and the French approach offers an effective way of achieving this goal by applying two multivariate techniques in sequence (Di Franco, 2006; Delli and Addeo, 2011): first, a multiple correspondence analysis (MCA) to synthesise nominal variables into single factors, then a clustering method to group cases according to the MCA results. The result of this procedure is a typology of respondents according to their level of digital inclusion.

To analyse the relationships between digital inclusion and sociodemographic features - gender; age; education; income – and answer the RQ2, we performed a multinomial logistic regression analysis. The choice of this analysis strategy depends on the nature of both the independent and dependent variables, which are categorical with more than two levels (Hosmer, Lemeshow, and Sturdivant, 2013). The multinomial logistic regression allows us to estimate the probability of categorical membership.

Data analysis was carried out using two software packages, SPSS 23 for data cleaning, univariate and multinomial regression analysis, and SPAD to perform the multivariate analysis.

4. Results

To respond to RQ1 a digital inclusion typology was created by performing the MCA and then the Cluster Analysis. The first step

Table 3
Operational definition of Digital Benefits.

Component	Operational Definition	Response Options	Measure
Political	Look for information about national government services	Strongly disagree	Ordinal
Cronbach's Alpha = 0.897	Look for information about an MP, local councillor, political party or candidate	Disagree	
	Ask a representative of a public institution for advice on public services	Neither agree or disagree	
	Organize a claim and or protest	Agree	
	Launch or sign a petition	Strongly agree	
Economic	Sell something I own	Strongly disagree	Ordinal
Cronbach's Alpha = 0.816	Expand my business activities	Disagree	
	Look for information on insurance policies	Neither agree or disagree	
	Look for information on interest rates	Agree	
	Look for a better job	Strongly agree	
Cultural	Find a course or course provider	Strongly disagree	Ordinal
Cronbach's Alpha = 0.899	Interact with and understand other cultures	Disagree	
	Check others' opinions about a course or place to study	Neither agree or disagree	
	Learn or practice a new language	Agree	
	Read new books or articles	Strongly agree	
Social	Keep in touch with family who lives further away	Strongly disagree	Ordinal
Cronbach's Alpha = 0.851	Keep in touch with friends who live further away	Disagree	
	Enlarge my network and meet new friends	Neither agree or disagree	
	Look for information on clubs or societies	Agree	
	Interact with people who share my personal interests and hobbies	Strongly agree	
Personal	Improve and change my lifestyle	Strongly disagree	Ordinal
Cronbach's Alpha = 0.870	Improve my fitness	Disagree	
	Ask others about a training program	Neither agree or disagree	
	Improve my understanding about problems or issues that interest me	Agree	
	Consult others' opinions on problems or issues that interest me	Strongly agree	

implemented in the MCA was to select the active variables, i.e., those having an active role in defining the factors (Delli and Addeo, 2011). Specifically, the MCA was carried out using the following active variables:

1) Depth of possessed digital equipment as a proxy of digital access;
2) The five variables representing digital competencies: IDL, CC, DCC, S, PS;
3) The five variables representing digital benefits: PoB, EB, CB, SB, and PeB.

The MCA extracted two factors, reflecting the 30.5% of inertia (a concept similar to variance in the Factor Analysis), which is a satisfying value considering the high number of options involved in the analysis (Di Franco, 2006). After the extraction, we ran a procedure called "Description of Factors" (DEFAC) to refine the interpretation of the extracted factors through a selection of the most representative options according to their test value.

The first factor (Table 4) recalls the distinction between basic and advanced digital competencies; in fact, a closer look at the most representative modalities underlines a contrast between the highest value (positive semi-axis) and the lowest value (negative semi-axis) of the four variables representing the following skills: Problem-solving, Digital content creation, Communication and Collaboration, and Information and Data Literacy.

The second factor (Table 5) represents the digital benefits dimension, as it emerges from the comparison between the negative semi-axis (mostly the middle modalities of the benefits' variable) and the positive axis (highest modalities of the benefits' variables) (Table 6).

The two factors were then used as criterion variables to carry out the cluster analysis; the procedure applied to group the respondents is called SEMIS, i.e., a clustering procedure based on an algorithm that applies first a non-hierarchical technique and then a hierarchical one. We used the clustering procedure to have three solutions with 3, 4, and 5 clusters (Table 7).

The evaluation of the number of clusters took into account the criterion of achieving the best compromise between parsimony, intelligibility, and sharpness of the cluster solution. Therefore, when choosing the number of clusters, we observed that the increase in variance did not compensate for the loss of parsimony (Biorcio, 1993; Di Franco, 2006).

The solution with three clusters seemed to be the most reliable both from a semantic point of view (the groups appear homogeneous within them and heterogeneous to the others) and for the reduced share of inertia explained by the solutions with 4 and 5 clusters. In fact, from three clusters – 70.9% of inertia – to five clusters – 77.9% of inertia – there is a net gain of 7.0% that could be considered not sufficient to justify additional clusters (Biorcio, 1993; Di Franco, 2006). Moreover, following the French approach (Di Franco, 2006), cluster 4 and cluster 5 are a subset of the 3-cluster solution, and therefore, do not add valuable insights to the interpretation of the phenomenon under study (Table 8).

Below is the detailed analysis of each cluster. More specifically, VALUE TEST is a significance measure: the highest is the most significant as a modality. The Value Test threshold is 2, all the values higher than 2 are significant; CLA/MOD % is the percentage of the overall respondents with a specific modality and who are actually in the cluster; MOD/CLA % indicates the percentage of people in the cluster that have been classified into a modality; GLOBAL % indicates the overall percentage of respondents in the whole sample assigned to a specific modality; MODALITY is the modality of the variable that characterises a cluster, and finally, VARIABLE indicates the variable the modality comes from.

The first group, the largest one, comprises 43.8% of participants who are at the midpoint for digital inclusion: throughout their life, they have acquired an adequate level of digital competence; they also evaluate as 'good' the digital benefits developed from their online experience. This cluster is completely characterised by the middle values, "intermediate" or "medium", of all the active modalities: for example, 73.13% of respondents in the overall sample classified as "intermediate" on the Problem-Solving Index belonging to this cluster.

The second cluster (28.9%) comprises respondents with a high level of digital inclusion: they have a high level of digital access, as they use four or more devices to connect to the Internet; they have been classified as "Advanced" in all five indexes created to measure digital competencies; moreover, respondents from this cluster are those who have been classified as high achievers in all five indexes to measure digital benefits.

Table 4
First Factor Description. Distinction between Basic and Advanced Experience in relation to skills.

NEGATIVE SEMI-AXIS		
Test value	*Modality*	*Active Variable*
−19.24	Basic experience	Problem solving
−19.23	Basic experience	Digital content creation
−18.38	Basic experience	Communication and collaboration
−18.11	Basic experience	Information and data literacy
CENTRAL ZONE		
POSITIVE SEMI-AXIS		
Test value	*Modality*	*Active Variable*
17.05	Advanced experience	Digital content creation
17.34	Advanced experience	Problem solving
17.66	Advanced experience	Communication and collaboration
18.88	Advanced experience	Information and data literacy

Table 5
Second Factor related to Digital Benefits.

NEGATIVE SEMI-AXIS		
Test value	*Modality*	*Active Variable*
−15.51	Medium benefits	Cultural Benefits
−14.81	Medium benefits	Social Benefits
−14.36	Medium benefits	Problem solving
−14.32	Medium benefits	Personal Benefits
CENTRAL ZONE		
POSITIVE SEMI-AXIS		
Test value	*Modality*	*Active Variable*
9.87	High benefits	Social Benefits
11.03	High benefits	Cultural Benefits
11.20	High benefits	Personal Benefits
11.44	High benefits	Political Benefits

Table 6
First Cluster: Intermediate experience with ICTs.

VALUE TEST	CLA/MOD %	MOD/CLA %	GLOBAL %	MODALITY	VARIABLE
12.53	73.13	56.58	33.87	Intermediate	Problem-solving
12.19	67.29	66.05	42.97	Intermediate	Communication and collaboration
11.17	67.36	59.74	38.82	Intermediate	Information and data literacy
10.45	70.15	49.47	30.88	Intermediate	Digital content creation
10.33	65.22	59.21	39.75	Intermediate	Safety
9.98	63.71	60.53	41.59	Medium	Social Benefits
9.93	64.97	57.11	38.48	Medium	Cultural Benefits
9.69	63.23	59.74	41.36	Medium	Personal Benefits
8.78	62.65	54.74	38.25	Medium	Economic Benefits
4.86	55.52	42.37	33.41	Medium	Political Benefits

Table 7
Second Cluster: Advanced experience with ICTs.

VALUE TEST	CLA/MOD %	MOD/CLA %	GLOBAL %	MODALITY	VARIABLE
17.51	69.63	74.90	31.11	Advanced	Problem solving
17.05	65.12	78.09	34.68	Advanced	Information and data
16.83	72.46	68.13	27.19	Advanced	Digital content creation
16.59	81.01	57.77	20.62	High	Personal Benefits
16.17	63.85	75.30	34.10	Advanced	Communication and collaboration
14.68	56.29	78.49	40.32	Advanced	Safety
13.59	57.23	70.92	35.83	High	Social Benefits
12.42	57.09	64.14	32.49	High	Cultural Benefits
11.43	50.00	71.31	41.24	High	Economic Benefits
11.38	64.48	47.01	21.08	High	Political Benefits
7.47	42.86	60.96	41.13	4 or more	Devices

Table 8
Third Cluster: Basic experience with ICTs.

VALUE TEST	CLA/MOD %	MOD/CLA %	GLOBAL %	MODALITY	VARIABLE
19.18	82.41	69.20	22.93	Basic	Communication and collaboration
18.03	64.47	82.70	35.02	Basic	Problem-solving
17.91	58.24	89.45	41.94	Basic	Digital content creation
17.59	73.04	70.89	26.50	Basic	Information and data literacy
14.22	72.83	53.16	19.93	Basic	Safety
14.04	54.55	75.95	38.02	Low	Personal Benefits
13.61	67.35	55.70	22.58	Low	Social Benefits
12.69	58.33	62.03	29.03	Low	Cultural Benefits
12.21	65.73	49.37	20.51	Low	Economic Benefits
8.44	64.15	28.69	12.21	1 device	Devices
8.09	40.76	67.93	45.51	Low	Political Benefits

The third cluster encompasses 27.3% of respondents and is populated by those who are on the edge of digital exclusion. As evidenced by the traits that characterise this cluster, respondents within this group have restricted digital access, 64.1% of them use only one device to connect to the Internet; the general level of digital competence is very unsatisfactory: most users with basic digital skills belong to this cluster. Moreover, people from this cluster are by far the ones who have obtained the fewest digital benefits from their online activities. Table 9 summarises the distribution of the digital inclusion typology. Therefore, this group is sitting on the wrong side of the digital divide, in terms of access (first level), in terms of digital competencies (second level), and finally in terms of digital benefits (third level).

To explore the confounding effects of socio-demographic variables (gender, age, occupation, education and income) on each cluster, we performed a multinomial logistic regression (Table 10). The occupation variable was excluded because it was not significant (and it is likely to be already captured by the income variable) and the goodness of fit table showed statistically significant values for both the Person chi-square statistic and the Deviance, suggesting that the model did not fit the data well. The category "basic experience" was adopted as a reference.

For "intermediate experience", holding age, education, and gender constant, income does not play a significant role in differentiating intermediate and basic experiences. The same applies to gender, which in the multivariate analysis does not have a significant distinctive effect. Considering age, the multinomial log-odds for users who are equal or under 55 years old to belong to the intermediate experience cluster instead of basic, would be expected to increase by 7 times for the age group 18–24, 5 times for the age group 25–34, 3 times for 35–44 and 2 times for 45–55. The multinomial log-odds for a user with some high school qualifications (compared to a user with a master's degree or a PhD) to belong to this group compared to basic skills are expected to decrease by 74% ($b = -1.337$). This suggests that the lower the education qualification the more basic will be the online experience.

Considering the cluster "advanced experience", and considering incomes while holding the other variables constant, those users with an income less than £10000 have 81% ($b = -1.666$) fewer chances to have an advanced experience compared to those with higher incomes. As for the intermediate experience, those who are equal to or younger than 55 years old are more likely to be included in this cluster compared to basic experience. Moreover, the chance to have an advanced experience decreases for those less educated users by 80% ($b = -1.583$) compared to the basic experience. Also, in this case, there is no significant difference between female and male digital experiences.

5. Conclusion and discussion

This paper investigated how inclusive the use of digital technologies is amongst some socially disadvantaged categories in the UK. We first carried out a multivariate analysis following the "French Way" - first MCA and then a cluster analysis - to create a typology with three different types of users according to their level of digital inclusion, and then we explored the role of some social and economic vulnerabilities in interpreting the differences among the clusters.

This analysis showed the different ways in which users exploit the Internet to increase their social inclusion through, for instance, reinforcement of existing offline social relationships, purchase of essential goods, and updates on current affairs. The results reinforce the idea of an intertwined relationship between social and digital exclusion and how socially disadvantaged people are the most affected by digital exclusion (Pérez-Escolar and Seale, 2022; Reisdorf and Rhinesmith, 2020; Goedhart et al., 2019).

More specifically, this research is in line with those studies that underline how, despite their access to the Internet, those at risk of social exclusion (especially less educated, older and low-income users) are more likely to have a digital experience that does not fully exploit the possibilities that the Internet can offer. At the same time, it suggests that the three levels of the digital divide are profoundly interconnected and generate a vicious circle that might be difficult to break if each level is considered separately and independently from the offline backgrounds. In fact, weak competencies, deriving from scarce opportunities to improve individual digital literacy, will inevitably affect the outcomes of the Internet experience.

At the same time, our study did not consider the qualitative value added to the first level of the digital divide in terms of material access to the internet (Van Deursen and Van Dijk, 2019). This is an aspect that deserves further investigation to show how stratified material access to ICTs might affect a stratified configuration of outcomes in terms of benefits. In this direction, in a qualitative study, Grošelj (2021) found that different accesses to the Internet correspond to diverse roles played by internet technologies in individuals' daily lives. However, Grošelj's study focused on specific types of access and the value that users attribute to them. There is still a need to explore the concrete outcomes in socio-economic terms and how these outcomes stratify users also in relation to pre-existing conditions. In this direction, our preliminary findings reveal that digital inclusion should be tackled as a complex interplay between different inequalities at multiple levels. Furthermore, our study shows that those individuals who are already socially marginalised and need the Internet the most to become socially included are also those who experience a low degree of digital inclusion.

This paper argues that policymaking should focus on traditional socially disadvantaged categories (such as less educated and

Table 9
Digital Inclusion of users included in each cluster.

Digital Inclusion	Frequency	Percentage
Basic experience of ICTs/users on the edge of exclusion	237	27.3
Intermediate experience of ICTs/average achievers	380	43.8
Advanced experience of ICTs/higher achievers	251	28.9
Total	868	100.0

Table 10
Effects of socio-demographic variables on clusters (95% CI).

Characteristics	Intermediate Digital Experience	Advanced Digital Experience
Income Group		
Over £100000	ref	ref
Under £10000	0.463 (0.103, 2.091)	0.189** (0.43, 0.835)
£10000-£25000	1.151 (0.280, 4.720)	0.371 (0.094, 1.456)
£26000-£50000	1.221 (0.303, 4.924)	0.511 (0.134, 1.952)
£51000-£10000	1.506 (0.350, 6.480)	0.701 (0.170, 2.883)
Age Group		
Over 55	ref	ref
18–24	7.118* (3.157, 16.046)	19.069* (8.033, 45.266)
25–34	4.702* (2.485, 8.895)	15.370* (7.680, 30.763)
35–44	2.999* (1.714, 5.247)	8.101* (4.287, 15.308)
45–55	1.815* (1.146, 2.875)	3.987* (2.277, 6.981)
Education		
Master or PhD	ref	ref
Some high school, no diploma	0.263* (0.112, 0.616)	0.205* (0.077, 0.550)
High school graduate	0.466 (0.212, 1.021)	0.444 (0.189, 1.044)
Some college credits	0.591 (0.269, 1.299)	0.559 (0.240, 1.303)
Bachelor's degree	0.530 (0.245, 1.146)	0.630 (0.278, 1.429)
Gender		
Female	ref	ref
Male	0.949 (0.665, 1.352)	1.501 (0.991, 2.273)

Note: The reference category is Basic Digital Experience. Model Fit: chi-square = 195.480 ($p < 0.001$); Goodness of Fit: Person chi-square = 340.989 (p =.160); Deviance chi-square = 338.920 (p =.180); Nagelkerke = 0.228.

economically disadvantaged users), not only to facilitate their access to the Internet/devices and the acquisition of advanced skills but also to create favourable offline conditions that facilitate the continuous update and the access to opportunities in both online and offline realms (Townsend et al., 2020). Therefore, this suggests that digital policies need to be embedded in a wider strategy that combines efforts from different Governmental Departments to develop concerted plans of action that simultaneously tackle offline and online inequalities.

The *Levelling Up* whitepaper announced by the Government (Gov.uk, 2022), introduced 12 "missions" to address geographical, economical, and societal inequality by 2030, however, it only superficially addresses the importance of technologies to societal progress and the reduction of inequalities. The Digital Poverty Alliance emphasised that Mission 4 focuses on broadband, and 4G and 5G coverage, but it does not consider issues such as broadband affordability and device accessibility. Moreover, Mission 1 related to levelling up education should also consider the acquisition of digital skills as essential together with achieving the basic standards in reading, writing and maths (Drinkwater, 2022).

Furthermore, the acquisition of basic skills in a specific moment (through occasional intervention) cannot itself ensure the success of the intervention if cultural, economic and social conditions do not create the foundations for independent personal development.

The introductory sections of this paper highlighted that some programmes in the UK have been successful to provide basic skills and recognise the need for tailored support, especially for older, less educated, and unemployed users to adapt to the rapid pace of technological change. This requires resources and support from public bodies, especially in terms of consistency of support.

While the Government strategy is that of mimicking the approach taken for adult literacy and numeracy training (Gov.uk, 2017), technological advances might require "boost programmes" that work in multiple directions to avoid some categories will be left behind.

The UK Government has created various partnerships with private bodies (such as Lloyds Banking Group, Barclays, Google, BT, Accenture, HP, Cisco and IBM), but these partnerships have a specific focus (e.g., promoting cybersecurity or organising summer schools) that might support those who already have intermediate digital skills and access to valuable information.

By highlighting how various levels of digital inclusion are related to socioeconomic and sociodemographic features, this paper contributes to reinforcing the idea that offline social structures and practices influence individuals' ability to use digital technologies as an empowering tool for social inclusion. This is in line with Dobrinskaya and Martynenko (2019) who emphasise how the first level of the digital divide can stratify according to different uses of ICTs, but differences in access alone cannot create social inequality. By contrast, digital inequalities are intertwined with social inequalities, social mobility, and life chances.

Socially disadvantaged citizens, even when they access the Internet, tend to not fully exploit the benefits offered by it, therefore missing the opportunity to use the Internet as a tool of social inclusion. Being online, therefore, is not an end in itself, but it is the first step to being a fully participating citizen in an increasingly digital world (Ragnedda, 2020).

Specifically, in the COVID-19 and post-COVID-19 era the role of digital technologies is more important than ever. Therefore, any policy interventions thought to improve wellbeing must take into consideration the role and effect of digital technology in an individual's everyday life. This poses some challenges for policy intervention, in light of today's necessities for digital inclusion, especially for those most vulnerable, in that to be effective digital technology needs to provide transformative wellbeing benefits. The results of this research might help policymakers to identify the interconnections between different levels of the digital divide, and what digital competencies need to be reinforced.

This study does not come without limitations. Our model of digital inclusion looks at the three levels of the digital divide and, therefore, incorporates digital access, digital competencies, and meaningful uses of digital media to obtain tangible outcomes. Providing and measuring a full spectrum of accesses, competencies, and benefits individuals might get from using the Internet has been a challenge and is acknowledged as a limitation. Furthermore, in line with most of the research on digital skills (Litt, 2013), we asked our respondents to evaluate their level of competence. This, as suggested by van Dijk (2006), introduces a validity problem. Finally, this paper set the background for further research development in the COVID-19 era, which might have exacerbated the gap between digitally equipped and digitally excluded users.

In conclusion, our results show that socially disadvantaged individuals in the UK (mainly in terms of income, education, and age) are those who are disempowered, with less digital competencies and fewer benefits acquired by using the Internet. This self-reinforcing effect of digital and social exclusion is what we have defined as the inequality loop. The level of digital inclusion is a key factor in terms of (re)producing social inequalities. At the same time, digital inclusion may help reduce social inequalities and improve life chances and the overall quality of life. The paradox is that even though socially disadvantaged categories are those that more than anyone else would benefit from socially inclusive use of the Internet (e.g., to find a job, a public service, or resources), they are those who are the least digitally included.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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