



# Populations Digitally Excluded from Education: Issues, Factors, Contributions and Actions for Policy, Practice and Research in a Post-Pandemic Era

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## Abstract

This conceptual paper draws on a wide range of research and policy literature, providing a contemporary view of issues, factors and practices that affect education for digitally excluded populations. Concern for how education for digitally excluded populations can be supported is focal to this paper, with different sections offering key related perspectives. From an analysis of issues, factors and practices, actions for policy, practice and research are identified. Given a key finding that power issues can have major effects on plans, implementation processes and outcomes when addressing needs of education for digitally excluded populations, the paper concludes by offering frameworks to support and enable key discussions, to involve representatives from an excluded population as well as those from policy (government and industry), practitioners (teachers and learners) and researchers.

**Keywords** Educational exclusion · Educational inclusion · Digital education · Digital exclusion · Digitally excluded populations · Addressing digital exclusion

## 1 Introduction

Addressing a key research question – ‘How do we include digitally excluded populations, providing access to education and optimizing learning in a post-pandemic era?’ - calls for focal attention to a primary area of concern – ‘inclusion’ – and how we relate this to ‘excluded populations’. In this paper, we take a broad view and definition of ‘excluded populations’ that considers educational exclusion through digital exclusion (relating, for example, to lack of access and uses in particular countries or ethnic groups, remote, rural or low socio-economic areas, or those with disabilities). In a similar way, for ‘inclusion’, we are concerned with a definition of ‘educational inclusion’ that concerns access to and uses of

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digital technologies. Whilst our outcomes are concerned with the post-pandemic period, our findings could well be applicable in times of future crisis or pandemic situations.

The research question driving this conceptual paper is: what issues, factors, practices and actions need to be considered when seeking to address educational digital exclusion of populations in a post-pandemic era? Pre-pandemic data indicates that there were populations internationally (e.g., in rural areas, low-income areas, and in ethnically isolated communities) who were digitally excluded. Whilst the pandemic encouraged online digital uses, the post-pandemic period sees continued digital exclusion in similar populations. For agencies and groups seeking to address educational digital exclusion in these populations, it is important that key issues and factors are identified, deploying appropriate work practices to allow successful forward movement.

In this paper, we initially consider the relationship between digital exclusion and digital inclusion and how digital exclusion might be assessed (Sect. 2), evidence of how digital inclusion has previously been addressed (Sect. 3) and its relationship to digital accessibility, agency and empowerment (Sect. 4), then we identify key factors of digital exclusion in populations with socio-economic divides (Sect. 5) and in those with special educational needs (Sect. 6), followed by perspectives of how power structures can affect access and accessibility (Sect. 7), factors to optimize learning (Sect. 8) and opportunities arising post-pandemic (Sect. 9), and finally we identify future issues and challenges (Sect. 10), actions needed (Sect. 11) and offer a concluding framework outlining support priorities in cross-stakeholder activities (Sect. 12).

Much existing research in this field has focused on inclusion for individuals; however, evidence shows that educational exclusion with digital technologies has multiple dimensions (Passey, 2014). To accommodate this within a contemporary focus, identifying and understanding fundamental and key dimensions of ‘excluded populations’ must be a key concern of any proposition, plan or argument, such as those proposed in this paper. ‘Access’ needs to be considered beyond just physical technology access, to involve and ensure aspects of digital accessibility, agency and empowerment. These aspects relate to a definition of access that focuses on the needs of individuals, to develop and possess digital agency, capabilities and abilities, to select applications appropriate to purpose, and to create applications for purpose, as discussed, for example, by Helsper (2021) and Passey et al. (2018). Taking a wider concern for digital access into consideration, ‘optimizing learning’ highlights a need to focus on technological access and provision that will enable successful outcomes (over a reasonable period of time). As the intention of this paper is to explore approaches and actions for the ‘post-pandemic’ context, it is important that we explore potentials for learning of communication technologies as well as information technologies, as these have been used increasingly during the pandemic period and are particularly pertinent to current needs, actions and practice; hence, a wide gamut of digital technologies should be considered in this context. Whilst exclusion factors should be identified and addressed for any specific population or community so that inclusion can be accommodated and ensured, inclusion should not, however, be implemented as an imposition from an external power structure perspective; some populations may not wish to use digital technologies (Wetmore, 2007), or may have certain concerns about aspects of digital technologies. In this respect, there is a need to acknowledge the importance of both diversity and agency (at digital and wider levels).

## 2 Assessing Digital Exclusion

Defining the terms digital exclusion and inclusion is itself a challenge, as the gap between – those who have access to and use Internet connectivity, digital literacy skills and Internet-enabled devices and those who do not – varies the world over, due to diversity of communities, thereby reflecting a mosaic of social, economic and cultural inequalities such as gender, age, race, income, and capabilities. Thus, access to digital technologies becomes multi-dimensional in nature. It necessitates that digital exclusion and inclusion needs be envisaged in the milieu of physical, spatial, cultural, demographic, socio-economic, human and environmental aspects respectively. Addressing educational digital exclusion in these contexts may further augment the process of achievement of sustainable development goals (SDGs) (particularly SDG 4 – quality education) in many respects (UN, 2024).

A Human Development Report (UNDP, 2001) emphasized the uneven diffusion of information and communications technology, i.e., the digital divide, while reiterating that bridging this divide is now a global objective. However, digital exclusion still remains a challenge to policy. Defining ‘digitally excluded populations’ or ‘digital exclusion’ must be based on a ‘human-centric approach’ rather than having a universal or macro-level definition for making the definition more inclusive in nature. A World Development Report (World Bank, 2016) discusses how “the Digital Economy transcends the [information and communication technologies] ICT sector, encompassing most sectors of the economy and society. Yet many governments continue to treat the Digital Economy as a sector, with exclusive emphasis on developing ICT infrastructure and creating an information technology (IT) workforce” (p.1). Similarly, it can be argued that the ‘Digital Economy’ is interweaving rapidly as a major transformative force linking individuals, communities, societies, businesses, markets and, in turn, nations, encompassing all sectors of human life. Thus, digitally excluded populations must be included from such perspectives in the course of their assessment.

Global projects such as those considered in the Human Development Report (UNDP, 2022) present the status of a nation-state against the human development index. While useful in assisting with identification of a country’s global position in relation to other countries, in the absence of a theoretical underpinning, it does not easily translate to an understanding of the extent of digital exclusion across the population or at the local and individual level. While there exist several theories or frameworks which may be employed to support an assessment of needs of digitally excluded populations, recognition of the multidimensional and systemic nature of social inequality must guide the selection (Carmo, 2021). Theories and frameworks include, but are not limited to, the work of Therborn (2012), Mills (1958), Maslow (1958), and Bourdieu (1977).

Therborn’s (2012) three kinds of inequalities - vital, existential and material - while discrete, are also interdependent. This categorization of inequalities, in conjunction with the processes that produce them - distanciation, hierarchization, exploitation and exclusion - afford a multidimensional framework to inform the interrogation and analysis of social inequality at both local and nation-state levels. Although focused on the ‘Power Elite’ in the cold-war era in America, Mills’s theory (Mills, 1958; Mills & Wolfe, 2000) presents a construct to investigate present-day inequalities across America as well as possible power elite parallels in other nation states (Domhoff, 2006; Mizruchi, 2017; Okonofua, 2013). When positioned within the context of the ‘Power Elite’, Therborn’s (2012) processes of inequality production present another dimension through which to explore present-day inequalities,

enabling a shift beyond acknowledging the power elite to discerning how they engender social inequalities such as digital exclusion.

Maslow's (1958) theory of human motivation presents a hierarchy of needs which enables an assessment of the gratification of lower-order needs in the first instance. From an inclusion perspective, lower order needs may well need to be satisfied for excluded groups before educational digital inclusion can be supported at the higher levels. Having achieved satisfaction of physiological, safety and love needs, the individual may be more motivated to activate higher-order needs (Winston, 2016). However, if deprivation of needs, e.g., access to education or digital resources exists across the broader community, a multi-dimensional assessment of the cause might also include Therborn's kinds of inequality and associated production processes (Therborn, 2012).

When situated within the broader 'Theory of Practice' (Bourdieu & Nice, 2020), 'Forms of Capital' (Bourdieu, 1986) offers another multidimensional framework through which to explore social inequalities. Digital capital is an emerging term currently in use as a theoretical underpinning to digital divide research (Ragnedda et al., 2019). Inclusion of the additional 'Theory of Practice' constructs of habitus and field affords a framework to support analysis of digital exclusion of individuals or specific cohorts.

These frameworks offer us a view of underpinning factors that can influence social exclusion and social inclusion. As will be seen in successive sections of this paper, these can be considered as potentially important factors to be addressed for educational digital inclusion.

### 3 Supporting and Addressing Digital and Wider Educational Inclusion

Regarding the state of the art of digital technologies and their uses in supporting educational digital inclusion, there is no doubt that digital technologies have a strong potential for digital and wider inclusion (Passey, 2014). For example, distance learning can facilitate access to education and training for learners whose geographical situation (e.g., learners living in rural areas), professional commitments (e.g., full-time workers), political circumstances (e.g., learners temporarily displaced in refugee camps), or medical conditions (e.g., learners infected by Covid-19) would otherwise prevent them from attending in-person classes (Freire et al., 2021). Additionally, assistive technologies can effectively support learners with learning disabilities or those experiencing cognitive or physical disabilities (e.g., dyslexia), without which their learning and social experience would be limited (Fernández-Batanero et al., 2022).

However, beyond the state of the art, the state of the actual draws a more realistic and accurate portrait of digital technologies for educational inclusion. It reveals that implementing the inclusive potential of digital technologies is often challenged by social, political, and historical contexts that shape digital technologies (Warschauer, 2003). For instance, social and educational inequalities manifest in the digital realm through unequal digital access, usage, skills, and outcomes between different educational environments and learners (Van Dijk, 2020). Digital technologies thus tend to digitally perpetuate or even amplify patterns of inclusion and exclusion that exist within educational and social contexts, which can be influenced by power structures.

It is thus possible to conclude that technologies are not inherent drivers of inclusion. Rather, the educational, social, political, and historical contexts in which they are designed

and used empower them to be more or less inclusive or exclusive. Policies can play a pivotal role in ensuring that technologies promote inclusive practices. If policies do not clearly demonstrate strong and explicit commitments to addressing digital inequalities and promoting digital inclusion, it is unlikely they will contribute to changing the status quo. Unfortunately, since the 1980s, increasing educational policies worldwide have been driven by ‘New Public Management’ (Hood, 1991), which directly imports economic principles into education, including cost reduction, increased productivity, and accountability. Historically, central goals of education, such as democratization and inclusion, are thus being replaced by industrial and managerial principles that prioritize educational efficiency and student and parental satisfaction. To ensure digital technologies support educational digital and social inclusion, we need first to reaffirm emphatically and collectively that education is not a commodity but a common good.

#### 4 Digital Accessibility, Agency and Empowerment

Whilst digital technologies should be used to develop education as a common good, the global discourse about technology-enabled education usually focuses on access to the digital in terms of provisioning, i.e., material availability of tools, resources and services (ITU, 2023; Sharma, 2022). However, emerging literature (Mulla et al., 2023) shows that while material access to digital resources is an essential first step to alleviate deprivation and exclusion, mere provisioning does not necessarily lead to meaningful engagement, let alone empowerment. Due to design, features and costs, digital tools and media can be extremely inaccessible and unaffordable, leading to exclusion and digital divides. Therefore, it is important that digital access is designed to provide accessibility, foster agency and empower learners and teachers. Here, accessibility refers to availability of digital tools, technologies and services in an inclusive manner so they work for all people, including those with a diverse range of physical and cognitive disabilities. Accessibility is about removing barriers for all and ensuring inclusion for all. Standards such as Web Content Accessibility Guidelines (W3C, n.d.) and Universal Design for Learning (CAST, 2018) provide specifications (for example, for audio output, text layout and webpage formats) through which educational digital access can be possible for all learners.

Digital Agency (DA) — consisting of digital competence, confidence and accountability — refers to an individual’s ability to control and adapt to a digital world (Passey et al., 2018). While arguing for including excluded populations for optimal access to digital learning opportunities, the agency aspect provides a necessary check to address the question of technological determinism. Therefore, when digital access is designed to foster DA, it empowers learners with power to exercise choice and freedom. Furthermore, when an empowering design of digital technologies for education thoughtfully leverages pedagogical affordances of the digital, then it potentially extends the action space for learning, paving the way for innovations and new practices (Mulla & Nagarjuna, 2023; UNESCO-MGIEP, 2019). Research also shows that, when access to devices and digital resources is complemented by support structures enabling teacher and learner agency, it is then that digital access is actualized as a holistic enabler (TISS, 2020; UNESCO, 2021). Therefore, it is important that the discourse on technology-enabled education or ICT in education should depart from a narrow definition of access in terms of provision of devices and resources,

but rather holistically consider access as a multi-dimensional indicator involving aspects of accessibility, agency and empowerment.

## 5 Relationships to Socio-Economic Divides

Digital agency and diversity have similarly been related in the literature to socio-economic divides. The economic situations of disadvantaged populations can prevent individuals and communities from accessing digital world benefits (Park et al., 2021). The digital divide, defined as the readiness of individuals and societies, in terms of access, skills, attitudes, usage, power structure and culture to benefit from technology, continues to exist (Isotani et al., 2023), and which side of a divide individuals and societies fall is determined in large part by socio-economic factors (Ali et al., 2020; Chen & Li, 2022). Those who enjoy socio-economic advantage also enjoy digital inclusion and its related benefits, while those who are already socio-economically marginalised tend to be digitally excluded (Gudmundsdottir, 2010; Ntebutse & Collin, 2018). Within advantaged economies, digital connectivity can give greater access to education and healthcare, and contributions to women's empowerment, environmental sustainability, and government transparency and accountability (World Economic Forum, 2023). Despite rapid growth in Internet connectivity world-wide, people's educational uses of and benefits from digital information, services, and products is neither equal nor equitable (ITU, 2022). For example, absence of electricity or alternatively-powered devices in some regions excludes online access, while misinformation or fake news (Allcott & Gentzkow, 2017; Lazer et al., 2018) could also lead to a digital divide where there is lack of digital agency and criticality.

Teachers and learners can feel a digital divide's effects on their opportunities for teaching and learning, particularly if there is lack of preparation of teachers either during pre-service or in-service. In Nigeria, for example, government and private schools differ substantially in their levels of access to digital resources (Azubuike et al., 2021). More government schools report problems learning online than do private schools, as private school students have greater access and levels of connectivity. Even democratizing technologies like distance education are less inclusive than originally intended. One South African experience showed students in rural areas less able than their urban counterparts to take advantage of distance learning as rural areas had more limited Internet access (Lembani et al., 2020). In terms of distance learning, the pandemic has not in all cases positively affected this divide (Li, 2022).

Mobile Internet has been suggested as a solution to digital divides, but disparities can still exist (Vimalkumar et al., 2021). While this technology provides access to people who might never otherwise access the Internet, the number, complexity, and types of activities that users can perform are fewer than those that users can perform with personal computer (PC)-based Internet (Correa et al., 2020). Mobile-only Internet seems best suited for social activities and entertainment, but less suited for educational work. A question then arises as to whether those whose only access to the Internet is through mobile telephones develop a narrower set of skills and are unable to achieve depth in information seeking, content creation, and other skills.

A latest domain in which digital inequality's impact is felt is artificial intelligence in education (AIED). AIED presupposes contexts with one-to-one devices and Internet connectivity, and a technologically sophisticated user-base. To support one-to-one access, 'Bring

your own device' (BYOD) schemes have been used to facilitate digital access within some schools and with some groups, but issues can arise for those from lower income backgrounds (Adhikari et al., 2015). Indeed, recently, more and more AI applications have been based on large language models (LLMs) that are proprietary and charge fees per use (Nye et al., 2023). These LLMs have large memory footprints, high computational requirements, and require real-time responses from a stable Internet connection. High-income students from highly-resourced schools stand to benefit more from AIED than low-income students whose schools and homes may lack basic infrastructure, such as electricity supply or Internet access (Isotani et al., 2023). In response to this situation, these researchers proposed an 'AIED Unplugged' approach, encouraging creation of AI-based educational innovations not requiring changes to infrastructure, stable Internet connectivity, and increased digital skills. It could be argued that this approach avoids an infrastructure divide, providing education more equitably.

## 6 Special Educational Needs and Digital Inclusion

One cannot discuss digital divides and inclusion without relating to special education and associated barriers. Digital inclusion aims to increase digital world access for disadvantaged groups, including those with disabilities. International educational policies can promote inclusive curricula to provide suitable accommodations (Ainscow, 2020; UNESCO, 2017). However, a key barrier is whether disadvantaged populations have access to a required infrastructure, such as electricity supply and Internet provision. Those with special needs in low socio-economic situations, in rural or underserved areas, for example, may well lack sufficient infrastructure for Internet access and digital devices. Post-pandemic, countries worldwide have started to prioritize establishing and developing digital infrastructure throughout their areas (Carmi & Yates, 2020).

Using digital technologies effectively requires building relevant skills and knowledge. Digital inclusion aims to design accessible digital products and services so that individuals with disabilities can participate fully in the digital world. To achieve that, those with disabilities need to be equipped with necessary skills and literacy, including developing basic computer skills, learning online navigation, and gaining understanding of how to use digital tools and applications. Building these technology usages and digital literacy skills is a key part of digital inclusion efforts. Providing individuals with disabilities with training and knowledge to utilize digital resources helps fulfill the promise of an inclusive digital society, supported by regional directives (e.g., EU, 2016; UN, n.d.).

In recent years, many advancements have been made in accessible technologies to promote digital inclusion for individuals with disabilities (Oncins & Orero, 2021). More learning resources have become accessible, and communication aids such as augmentative and alternative communication (AAC) software have been developed to help individuals communicate and participate in educational and social activities effectively. Vital assistive technology devices and software have been provided (Danial-Saad et al., 2012) that include speech-to-text, text-to-speech, or alternative input methods for those with physical disabilities. Additionally, greater awareness and provision of psychological and technical support services are provided.

In conclusion, digital inclusion should create an inclusive digital society where everyone can participate, engage, and benefit from digital technologies' opportunities (Vyrastekova, 2021). Governments must continue working to overcome remaining social and economic disparities through inclusive digital development. However, power structures (albeit unintentionally) may hinder this.

## 7 Power Structures Affecting Digital Access and Accessibility

To understand how societal power structures shape digital access and accessibility, we must first examine how power dynamics form in societies. In democracies, these structures often mirror a prevailing socioeconomic landscape. For instance, economic elites and corporate interest groups can wield significant influence over government policies (Gilens & Page, 2014). Moreover, lower-income individuals participate less in politics and are less informed, leading to bias in public opinion, favoring the affluent (Erikson, 2015). Those from lower social strata, despite recognizing the importance of political engagement, often shy away from it, making them less likely to pursue influential roles (Belmi & Laurin, 2016). In essence, in capitalist democracies, power is often skewed by socio-economic factors.

Power structures can influence digital access and accessibility. Castells (2011) emphasizes that network power is exercised not by excluding individuals but by setting inclusion rules, meaning dominant socio-economic groups are more likely to influence by shaping these inclusion rules. Building on this, van Deursen and Helsper (2015) argue that to understand the impact of power structures truly, we need to consider disparities in how different groups benefit from the Internet. For example, those who are less educated or have a disability may spend more time on the Internet than those who are more educated or employed (Van Deursen & Van Dijk, 2014). However, more access does not necessarily equate to true benefits for the socially vulnerable. They might be guided by the power to act in their favor online, becoming mere tools in a digital world shaped by influential groups.

The influence of power structures on digital access and accessibility may be challenged in the future. One significant shift has been the perception of Internet post-pandemic. The pandemic underscored the Internet's role as a public good, leading to heightened concerns about issues like low adoption rates in rural areas, infrastructure costs, and the feasibility of service delivery due to insufficient long-term public investment (Lai & Widmar, 2021). This renewed focus on the Internet's public nature could prompt more scrutiny of those setting digital access rules, potentially spurring demands for greater democratic participation. Additionally, while online platforms still favor the elite during entry, there is a growing emphasis on merit when assessing work quality (Martindale & Lehdonvirta, 2023). Such shifts in online labor dynamics hint at the potential for innovations to disrupt established power hierarchies in the digital realm.

## 8 Supporting Learning Uses of Digital Technologies

Power hierarchies can also affect and influence digital learning environments. Among others, mobile devices, tablets and smartphone applications are widely used, and hence are desired for accessing education digitally (Sousa & Rocha, 2019). However, the digital divide



separates those who can afford devices and connection from those who cannot, and access to digital facilities at school only may not be enough to develop adequate digital skills. Teachers (in both pre-service and in-service) need updated understandings of educational uses of digital technologies (Gottschalk & Weise, 2023; OECD, 2016; World Bank, 2021).

Design and interface are also important access factors. The design and the tools need to include and represent diverse populations, cultures, languages and ways of learning by involving users in design processes and providing options for interface personalization. Refugees and foreign minorities can be supported and integrated through interface and lessons offered in native languages, using subtitles during online learning, literacy lessons in target languages, combined with visuals for expressing and overcoming language and culture barriers (Blayone et al., 2017; Gottschalk & Weise, 2023; Vassilakopoulou & Hustad, 2023). Indeed, from the perspective of inclusive education and digital accessibility for all, facilities such as video subtitles and captions should be accessible to all (e.g., as regulated by EU directives (n.d.)). In this context, digital development programs must consider inclusivity and accessibility for all genders, learners with disabilities, as well as cultural backgrounds and economic contexts of learners (Antonio & Tuffley, 2014; Vassilakopoulou & Hustad, 2023). Offline or affordable Internet browsing, or icon-based interfaces and ‘Internet lite’, can help overcome connectivity barriers (Gottschalk & Weise, 2023; World Bank, 2021; USAID, 2020), and there are examples where digital support is provided cost-free as a way to reach lower-income communities (Gottschalk & Weise, 2023), or even through provision of scholarships to disadvantaged students to pursue careers in ICT industries (UNESCO et al., 2015). In other excluded contexts, (e.g., school drop-outs), many ‘second-chance’ programs work and support individuals, for example, in developing basic and complementary ICT skills (OECD, 2016). Such programs are similar to other interventions supporting lower-educated communities to upgrade labor skills, often to adapt to the digital workforce (OECD, 2016).

## 9 Learning from the Post-Pandemic Era

In terms of adaptation, learning uses shifted for many during the pandemic period. The pandemic forced sudden shifts to online and emergency remote teaching as schools and educational institutions closed their doors (UNESCO, 2022). This revealed great variation in teachers’, students’, and infrastructure preparedness for online learning. The crisis accelerated online pedagogies training, acquisition of new hardware and platforms, and development of new educational technology solutions. Remote and hybrid instruction increased access to collaborative learning across geographic boundaries, with telecollaboration between institutions expanding intercultural exchanges while reducing travel costs (Hiroyuki, 2021). National systems promoted digital integration through flexible policies enabling context-specific online integration (Shonfeld et al., 2013).

Overall, these shifts accelerated educational technology integration whilst also underscoring needs to address educational inclusion and social-emotional learning. Closures and emergency remote teaching amplified gaps in student technology access and teacher readiness. Impacts were greatest where differently-abled students required specific support, as was also the case with their teachers. The pandemic impacted groups unequally, despite shared experiences. Moving to an online format using conferencing technology in some

cases increased digital exclusion (e.g., for students with disabilities, learning difficulties and those with low socio-emotional functioning). Research raised concerns about online shifts for young people during the pandemic period (Hodges et al., 2020; Selwyn et al., 2020) as well as for older adults (Rasi-Heikkinen & Doh, 2023).

Post-pandemic, educational institutions have taken varying approaches: rejecting technologies to combat pandemic fatigue; retaining online practices; or blending online tools with in-person instruction (Backfisch et al., 2020; Bang & Luft, 2013; Gao et al., 2011). Infrastructure improvements like public technology hubs continue providing Internet access to previously excluded populations. However, access alone does not address all equity issues. Scholarship shows that digital inequality manifests on two levels: access; and abilities to fully utilize technology (Jamil & Muschert, 2023).

Some previously excluded groups now benefit from greater technology access, devices, connectivity, and digital skills. While online learning existed for decades, virtual opportunities have very recently expanded, benefiting students who struggle in traditional classrooms, with those with health issues/disabilities, in remote areas, or facing bullying/discrimination, preferring flexible/self-paced learning. With continued support, modalities can provide opportunities to improve educational quality, flexibility, and accessibility for populations once excluded. But persistent gaps in access and skills must still be addressed.

## 10 Future Issues and Challenges

In the future, education in general, and the inclusion of excluded populations, face serious challenges in our fast-changing technology era. The gap between ways technology is reshaping people's lives and work on the one hand, and the pace with which educational institutions are developing, may be widening. New technologies are emerging and shaping life potentially faster than current educational organizations and structures can comprehend, evaluate, and make decisions regarding technological integration into educational processes.

Education is needed, to prepare next generations for life and work, beyond just fast integration of innovations, but with a deepening of basic human values - respect, equality, empathy and caring for humanity and the environment. This requires deep thinking and time-consuming processes, unlike the increasing culture of 'short' and quick distractions. Educators are increasingly facing this challenge and seeking ways to capture learners' attentions.

Accepting this scenario, digitally excluded populations have opportunities to access basic digital devices faster than appropriate educational processes, which can result in surface-level uses of digital environments without fully gaining the potential of technology for personal and societal development. While we can observe directions and educational processes moving towards competence-oriented education in more developed societies, excluded populations may still be lagging behind, in a linear process of seeking Internet connection for traditional educational approaches. For excluded societies, even in having Internet connection and devices, gaps can still exist related to quality content, advanced systems and safety tools. Addressing these challenges can be a priority for governments and major digital companies, as they have the power to influence and direct investments. But

**Table 1** Key aspects identified from the critical review

Inclusive concern	Key aspects
Approach	Human-centric; relatable educational goals Income; age; socio-economic background; individual needs and disabilities Affordability; accessibility Power independence Public good
Technological	Infrastructure; electricity supply or alternative power sources Internet connectivity; Internet-enabled devices Digital resources to meet circumstances and needs
Supportive	Physiological and safety needs Physical; spatial arrangements Policy frameworks enhancing power independence Tutor or training support Social and cultural capital Developing and maintaining digital agency, skills and capabilities

power dynamics play significant roles in either widening or narrowing various gaps between populations in general and in education specifically.

Overall, through reviews in preceding sections, we have identified key aspects that should be considered by those developing educational digital inclusion with excluded populations, presented as a framework in Table 1, when confronting the research (and practice) question ‘How do we include digitally excluded populations, providing access to education and optimizing learning in a post-pandemic era?’.

## 11 Actions Needed, and by Whom

Coping with new educational realities for educational digitally excluded populations, bridging gaps and exploring new possibilities for a better educational future, requires different stakeholder levels (i.e., policy, practice, and research) to work together and in parallel.

At the level of policy:

- Advocacy of government regulatory mechanisms should ensure development of digitally inclusive and responsible technologies for education of digitally excluded populations, with due consideration for ethical collection and use of data, respecting power independence, privacy and individual choice.
- Implementation of policy should provide digitally excluded learners with infrastructure support and technology-enabled resources.
- Develop metrics to assess educational technology provisions for inclusivity and equity of excluded populations.
- Representatives of digitally excluded populations should be involved at all policy stages.

Governments must enable and sustain digital accessibility, identifying scopes of populations involved, for example, for marginalized communities and individuals (through appropriate infra-

structure, equipment, systems and competence-developing programs) and put in place regulation and accountability of educational technology companies - or potential incentivization through a rating/metrics system. In this context, it is vital that appropriate long-term planning and actions are considered and in place, as short-term projects or plans must be appropriately sustained over time (Passey et al., 2016). Competencies should be developed and maintained so that learners and teachers practice critical thinking and awareness when using and applying digital technologies; the same is needed of educational technology platform companies, as their systems and products may become more widely adopted, integrating AI and data collection, with the potential for surveillance and privacy harm. The General Data Protection Regulation (GDPR.EU, 2023) may provide a model to develop this type of policy.

At the level of the teacher and learner:

- There is need to raise awareness of and develop critical thinking regarding limitations and pedagogically appropriate uses of emerging technologies such as AI-based applications and extended reality tools for digitally excluded populations.
- Guidelines should be developed to assess pedagogical appropriateness of technologies by researching teaching and learning uses in appropriate ways.

Teacher development should be directed towards competence development, especially critical thinking, awareness of technological bias and discrimination. Additionally, teacher preparation programs should foster a lifelong learning mindset that enables teachers to adapt to changing technologies and new evidence-based practices to support learner variability and power independence (Passey & Lee, 2020). As existing and increasing teacher shortages will continue to impact learners, particularly vulnerable populations, teachers should receive development and support on how technology can help avoid workload burdens.

At the level of research:

- There is need for development of appropriate technologies to enable effective uses in low-resource environments, with under-served digitally excluded populations, co-created with stakeholders.
- Research on implementation of emerging technologies when used with digitally excluded populations regarding *what works, when, for whom and how* should be supported and sustained.
- Vignettes of outcomes of innovative cases that explore uses with digitally excluded populations in diverse contexts should be developed.

Research should be undertaken to measure competence development, government digital equity, companies' ethical alignment and developing reputation systems that can rate educational technology companies on aspects including digital inclusiveness, caring for privacy, power independence and transparency, as well as criteria that protect users and support marginalized communities. Much research in the field of educational technology has taken techno-centric/ techno-solutionist perspectives that measure benefits of using technology, but less has focused on potential harms. This paper calls upon researchers to focus on the potential for technology to create or perpetuate digital inequities.

**Table 2** Factors and contributions for preliminary cross-stakeholder discussions

Excluded population representatives	Policy stakeholders (government and industry)
Discussing digital infrastructure limitations	Accommodating power independence
Discussing digital onsite or offsite needs including remote and hybrid possibilities	Considering the importance and effects of physical, spatial, cultural, demographic, socio-economic, human and environmental aspects of the population
Discussing digital skills limitations	Discussing digital infrastructure enhancements to support education purposes
Discussing digital attitude limitations	Supporting onsite or offsite needs, including remote or hybrid possibilities
Discussing digital usage limitations	Discussing digital attitude enhancements including language and culture accommodation
Discussing digital privacy and security concerns	Mechanisms to ensure digital privacy and security
Discussing digital accessibility needs	Supporting accessibility needs including those related to design and interfaces
Outlining physical, spatial, cultural, demographic, socio-economic, human and environmental aspects of the population	Considering digital agency limitations
Discussing digital agency limitations	Considering digital shifts over time and population digital agilities
Discussing digital agility	
<b>Practice stakeholders (teachers and learners)</b>	<b>Research stakeholders</b>
Discussing digital skills enhancements in the context of digital agency and critical thinking	Assessing physical, spatial, cultural, demographic, socio-economic, human and environmental aspects that affect the population and individuals
Enhancing power independence	Identifying a framework to assess shifts and developments in digital agency and power independence over time
Discussing digital attitude enhancements	Identifying digital usage needs
Discussing digital usage support	Analyzing the ethic and social responsibility of educational technology companies regarding their motivations and interest in digital inclusion when designing technologies for education
Supporting accessibility needs accommodating uses of different designs and interfaces	Developing effective digital technologies for low-resource environments
Supporting digital shifts over time and accommodating population digital agilities	Researching effective usage cases and disseminating these to practitioners

## 12 Conclusion

This paper provides evidence that addressing issues of educational exclusion, digital inequality and digital divides in our post-pandemic period requires more nuanced approaches to policy, practice and research. Factors to address and contributions to be made should be considered more holistically, importantly involving excluded populations with those in policy, practice and research. Identifying and agreeing factors to address and contributions to be made should rely upon shared discussions of the four stakeholder groups. Table 2 identifies key factors and contributions for those cross-stakeholder discussions, offered as a starting point, prior to action being taken. When addressing the research (and practice) question ‘How do we include digitally excluded populations, providing access to education and optimizing learning in a post-pandemic era?’, these details should inform planning and implementation from the outset, rather than being considered at a later stage, as this is shown often to be counter-productive.

Table 2 identifies key factors and contributions to lead to more effective implementation processes for those seeking to address educational digitally excluded populations. What is clear from the case argued within this paper is that power structures can play a key role that can be both negative and unintended. The contribution that this paper makes in this field is to offer frameworks (in Tables 1 and 2) that seek to address this potential issue, to inform a

more secure future for all stakeholders involved, whether they be in the digitally excluded population, in policy, in practice or in research.

## Declarations

**Conflict of interest** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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