Opportunities and threats for adolescent well-being provided by digital transformations

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Abstract

Adolescents are growing up in an increasingly digital world. Whilst their access to – and engagements with – the digital world are diverse, adolescents' direct and indirect experiences of digital environments, and the technologies which mediate these interactions, are increasingly important determinants of adolescent well-being.

In this background paper, we explore digital transformations – the process of integration of digital technologies and data analytics into all areas of life – across five domains of adolescent well-being: connectedness, positive values, and contribution to society; good health and optimum nutrition; safety and a supportive environment; learning, competence, education, skills, and employability; and agency and resilience. We identify ways in which digital transformations can support or undermine adolescent well-being in each domain and underscore some implications for policy and programming.

Digital technologies and the data they generate offer enormous potential for improving adolescent well-being through increasing adolescents' access to services and information,

and creating new opportunities for communication, learning, self-expression, and civic participation. At the same time, poorly designed and governed digital tools can undermine adolescents' rights and expose them to multiple forms of exploitation and harm.

To ensure that all adolescents can benefit from digital transformations, the digital divide must be closed. Digital environments and tools also need to be (re)designed with adolescents' rights and well-being put ahead of commercial interests. Equipping adolescents and their caregivers with digital literacy and skills will enable them to better prepare for an increasingly digitally-connected society and to manage risks inherent to life online.

As more adolescents are connected around the world, and the influence of digital transformations on their lives increases, the case for stronger governance of digital environments, technologies, and data will continue to grow. National, regional and global governance frameworks and safeguards are required to provide adolescents with adequate personal and data protection in the digital environment whilst maximising opportunities to use technologies and data to improve adolescent well-being.

Organisations driving and governing digital transformations must recognise adolescents from all backgrounds as change agents, innovators and rights-holders with a vital role to play in shaping the digital world. Adolescents, in all their diversity, must be enfranchised and supported to drive digital transformations so that the well-being of current and future generations of adolescents is fully realised.

Acknowledgements

1. Introduction

Adolescence in the digital age

Today's adolescents are growing up in a progressively digital world, with technology and computing becoming an inseparable part of their personal lives and wider society. Unlike previous generations, adolescents with digital access live simultaneous online and offline lives and use the internet to not only explore the world around them, but also find their places in it.

Devices which provide access to platforms and services powered by data analytics, machine learning, and other forms of artificial intelligence (AI) are adolescents' main gateways to digital environments. Virtual and augmented reality technologies offer opportunities for even deeper immersion into virtual worlds.

For an increasing number of adolescents, well-being is now intimately connected with direct and indirect experiences with digital environments and technologies which facilitate and mediate these interactions. (1) As we describe in subsequent sections, digital experiences and habits beginning in childhood and adolescence can positively and negatively impact the journey to adulthood. This extends to adolescents not yet online, through the secondary

effects of accelerated digitalisation within public, private, and non-governmental sectors and services.

Unequitable access and diverse lived experiences of the digital world

Adolescence – defined as the period between 10 and 19 years – spans a time of substantial development and change. The ways in which adolescents use digital technologies and interact with digital environments change dramatically as they mature and gain greater independence. (2)

Adolescents are not a homogeneous group. In addition to changing over time, adolescents' experiences of the digital world differ according to a range of intersecting factors including gender, sexual orientation, disability, education level, physical location, and socio-economic status. Weak information and communication technology (ICT) infrastructure, plus high costs of connectivity and devices can be major obstacles to access for many adolescents. Access challenges can be further compounded by parental attitudes and wider structural and systemic barriers such as gender inequality. (3,4)

Disaggregated data on adolescents' internet access around the world remain scarce. It is estimated that 69 percent of 15–24-year-olds globally are online using mobile or broadband internet, but only 38 percent in least developed countries. (5) Two-thirds (2.2 billion) of children and young people do not have internet access at home. (6)

Digital technologies and adolescent well-being

Discussions about adolescent well-being in the digital age tend to focus on the opportunities and threats associated with specific digital technologies, such as debates over screen time and use of social media platforms. Existing literature on the relationship between digital technologies and adolescent well-being suggests that the effects of technology use are neutral to small and depend considerably on how the technologies are used. (7–9)

Despite their evolving capacities, studies show that the effects of digital technology use on adolescents are comparable to adults. Whilst new risks have emerged in digital environments, evidence to date suggests that adolescents' vulnerabilities to harm online reflect their vulnerabilities offline. (10)

In this background paper, we explore digital transformations - the process of integration of digital technologies and data analytics into all areas of life - across five domains of adolescent well-being: connectedness, positive values, and contribution to society; good health and optimum nutrition; safety and a supportive environment; learning, competence, education, skills, and employability; and agency and resilience. (11) We identify ways in which digital transformations can either support or undermine adolescent well-being in each domain as well as underscore implications for policy and programming.

Existing evidence on this topic has several limitations. Published literature is predominantly focused on adolescent experiences in high-income countries (HICs) and older adolescents. Many studies depend on self-reported and subjective assessments of technology use and well-being by adolescents, and these may not always be accurate as they are subject to the

respondents' biases and honesty. Finally, as a relatively new area of research, there are few large-scale or long-term studies to help us fully understand the impacts of digital transformations on adolescent well-being.

2. Connectedness, positive values and contribution to society

Adolescence is recognised as a time when children become "biologically, emotionally, and developmentally primed for engagement beyond their families." (12) Digital platforms and tools provide adolescents with channels through which they can realise this readiness and fundamental need for social connection and engagement with wider society.

Building connections

Adolescents who are online use a range of tools such as social media, video and gaming software, and messaging services to stay in touch with family and friends. (13) Since the COVID-19 pandemic, digital platforms have become an even more predominant means of communication for adolescents restricted by physical distancing policies. Even prior to the pandemic, a UNICEF study of 18-year-olds found that 90 percent considered socialising and communicating with their friends online to be important. (14)

Digital communication platforms can be helpful for adolescents who find face-to-face interactions difficult. They also provide opportunities for adolescents to connect with others who share similar experiences and interests. Through the internet, adolescents can expand their knowledge of different subjects, communities, and viewpoints, enabling them to nurture positive values such as tolerance, empathy, and respect. Concomitantly, increased online activity may expose adolescents to radicalising content that promotes hatred or violence, and to sources of mis- or disinformation. (15,16)

Parents and others have expressed fears that spending too much time on mobile devices prevents adolescents from developing or maintaining 'real' relationships; however, most research to date has not supported this concern. While time spent online does displace time spent with friends and family, adolescents have expressed that virtual communication strengthens the quality of existing relationships. (17)

Participating in civic and democratic processes

Increased availability of information, coupled with digital means of communication, provides unprecedented opportunities for adolescents to develop their civic literacy and engagement, and to catalyse social change. The use of digital media to find, share, discuss, and mobilise around political issues is now a critical part of the repertoire of a digital citizen's civic and political engagement. (18,19)

In digital environments, the distance between information and action is reduced. Adolescents can learn about an issue and immediately take action. Online, they can engage with policymakers and people in power on a more equal footing and directly hold them to account. Digital technologies also provide new mechanisms for adolescents to collect data and conduct or contribute to research on issues important to them. (20)

Always connected

Online friends and communities can be important sources of social support and provide adolescents with affirmation and a sense of belonging. However, social media and other digital platforms are deliberately designed to encourage extended and repeated use, thereby perpetuating a feeling amongst users that they must always be connected and gain approval from other internet users. Pressures on adolescents to be available 24/7 and to constantly share updated information about themselves can be difficult to manage. (21) As adolescents increase their online presence and express their views in the public domain, they may find themselves exposed to rejection and negative reactions which harm their well-being and deter positive civic engagement.

3. Good health and optimum nutrition

Digital transformations influence the various social, commercial, and economic determinants of adolescent health and nutrition. In addition, an individual's ability to access and effectively navigate digital environments is increasingly recognised as a determinant of health in its own right. (22)

Digitally-enabled health systems

The effectiveness and efficiency of health systems in all countries are being strengthened through increased digitalisation. Use of digital technologies to support health service delivery, diagnostics, research and information systems is also expanding rapidly with the potential to accelerate progress towards universal health coverage (UHC), including for traditionally underserved adolescents and their communities such as rural populations, refugees and asylum seekers, adolescents with disabilities, poorer adolescents, and sexual and gender minorities. (23) Advancements in genomics and AI offer the potential for more personalised and predictive medicine that can identify and mitigate health risks during childhood and adolescence.

Telehealth and eHealth services enable adolescents in remote and rural areas to consult with health professionals. Frontline health workers who provide adolescent health services can enhance the coverage and quality of their care by using mobile applications to connect with patients, refer to specialists, and utilise opportunities for online training. (24,25) The COVID-19 pandemic has accelerated the shift in many parts of the world from facility-based healthcare to digitally-enabled care pathways that are centred around the patient, wherever they are located. (26)

Tools for self-management of health and nutrition

Beyond innovations in the formal health sector, digital tools are being used by adolescents with digital access to take greater control over their own health and nutrition. They can search the internet to learn about different health topics and use mobile applications and activity trackers to monitor and manage their physical and mental health. The added confidentiality offered by digital tools allows adolescents to seek information and advice on potentially embarrassing or stigmatising health issues such as sexual and reproductive health and mental health. Adolescents also actively use social media and publishing

platforms to create their own health-related content and establish communities of support. (27)

Governance challenges

The proliferation of digital tools for health and nutrition present risks as well as opportunities for adolescent well-being. Adolescents' top concerns include the quality and trustworthiness of health information online and the privacy of their personal data. (28,29) Regulation of digital health tools in most countries is weak, particularly of tools categorised as supporting fitness, well-being, or self-care. This therefore makes it difficult for adolescents to assess the quality of the many digital health tools now available.

The huge volumes of personal health and health-related data made available by digital technologies present great opportunities for researchers and policymakers looking to improve health outcomes. Health data is also a rich source of information for private companies wanting to better understand their customers, generating concerns about the growing number of technology companies entering the healthcare market to further their commercial interests. (30)

Marketing of unhealthy foods is particularly concerning for adolescent health as it has been shown to increase risks of obesity and affect lifelong eating habits. Digital media and new data-driven advertising practices substantially increase the frequency and duration of adolescents' exposure to marketing of unhealthy foods. Techniques, such as micro-targeting and the use of social media influencers to promote unhealthy foods, amplify the power of marketing to young audiences who may not recognise the commercial nature of content. (31)

Negative health effects of technology use

Adolescents' experiences in digital environments can influence their body images and perceptions of what an 'ideal' body should look like. (32) Whilst the internet offers copious amounts of resources for adolescents keen to maintain healthy diets and lifestyles, there are also a growing number of resources and communities available for adolescents looking to self-harm, for example through eating disorders or self-mutilation. (33) Other forms of unintentional self-harm amongst adolescents have also resulted from internet challenges that encourage participants to engage in risky behaviours and post about it on social media. (34)

The intentionally persuasive design of online games and social media platforms encourages adolescents to spend as long as possible in front of their screens. (35) Excessive and, particularly, night-time use of social media have been associated with poor sleep quality, increased incidence of self-doubt, anxiety, low self-esteem, and aggressive behaviour among adolescents. (36) Addiction to gaming has been recognised as a medical illness in the International Classification of Diseases (ICD-11) and there is increased awareness that excessive internet use can also generate a form of addiction. (21)

4. Safety and a supportive environment

To reach their full potential, adolescents require a safe and supportive environment that fulfils their physical and emotional needs and protects them from harm. Whilst digital transformations in different areas of adolescents' lives can enhance their environment, discussions related to this dimension of adolescent well-being are dominated by concerns about potential threats to their safety. Not all online risks will translate into actual harm and most risks will be encountered by only a minority of adolescents. However, the potential severity of online harms demands greater action by policymakers and industry to make the digital environment safer for adolescents.

Preventing and responding to harms

The digital environment offers adolescents access to information that can help them stay safe both on- and offline. In addition to teaching them about their entitlements and ways to secure a safe and supportive environment, the internet can also provide sources of advice on positive behaviours and knowledge and skills to challenge harmful norms and practices.

Digital technologies offer alternative sources of support to adolescents who experience abuse or neglect via online discussion groups and virtual counselling. These forms of communication can not only offer safe spaces and support for adolescents who cannot access traditional support services, but also allow them to participate on terms they are comfortable with. (37–39)

Digital innovations are being effectively deployed to tackle violence against adolescents. For example, AI is used to prevent online sexual exploitation and abuse, and to bring perpetrators to justice. (40) AI can be used to detect and filter harmful content to protect young children and adolescents using the internet, and alert users if the person they are chatting to online is unlikely to be who they claim.

Risks in the online environment

Whilst digital technologies are being used to protect adolescents, they can also be exploited by offenders wishing to cause harm and often leverage the anonymity offered by the internet. Pre-existing forms of bullying, stalking, harassment, and sexual abuse have now extended online with consequences for adolescent well-being ranging in severity from upsetting interactions to life-threatening abuse and suicide. (41) Populations of adolescents whose behaviours may be stigmatised or criminalised, such as LGBTQIA+ adolescents, are at particular risk of harm from having their personal data revealed.

Many online risks are outcomes of children playing in adult spaces without the developmental capacity to negotiate adult-designed content, behaviour, or interactions. (2) Time online may increase an adolescent's contact with strangers and expose them to age-inappropriate content such as pornography, and content that incites sexual exploitation, suicide, or self-harm. (10,15)

The proliferation of the 'Internet of Things' (IoT) - physical objects, including toys, that are connected to the internet - has created a new set of risks for adolescents' privacy and

security. Adolescents' data generated by these technologies can unknowingly be used for surveillance purposes by parents, educators, or even strangers with nefarious motives. (42) 'Sexting' or the sharing of self-generated sexualised content via mobile devices, is another relatively new risk which allows adolescents to explore their sexuality but may expose them to extortion, harassment, and humiliation.

Commercial exploitation

As previously noted, companies - from social media platforms to education providers - harvest adolescents' personal information and sell it to third parties who subsequently use the data to inform their digital marketing content and strategies. (43) To maximise advertising revenue, digital platforms can manipulate adolescent behaviours online by rewarding certain actions and discouraging others. Increasingly, sophisticated AI techniques are employed within games and social media platforms to learn about an individual's preferences and target them with tailored marketing content. (44)

Commercial practices online can exacerbate inequities and increase discrimination. For example, predictive analytics used by social media platforms and advertisers group people according to their assumed interests or traits and only show them certain products or services. (43) Automated decision-making with opaque algorithms and non-transparent nudge techniques based on personal data can impact adolescents' access to information and diversity of experiences. (45)

Challenges of age verification

Adolescents' evolving maturity, understanding, and capacity entitle them to special rights under the UN Convention of the Rights of the Child, but this is rarely recognised or reflected in the digital environment. (2) Few online services distinguish between child and adult users, and in most social media platforms, anyone over the age of 13 (in line with the US 1998 Children's Online Privacy Protection Act) is treated as an adult online. Furthermore, age verification techniques are easy to falsify which results in adolescents being continually subjected to both harmful content and sophisticated data collection and marketing practices. (46)

5. Learning, competence, education, skills and employability

Adolescence is a critical time for acquiring new knowledge and skills which will be pivotal for the adult roles that adolescents are destined to fulfil. In addition to the academic education that adolescents may receive, they learn how to better manage emotions and relationships, and gain attributes which will be essential for future employment.

Digitally transformed learning environments

Digital transformations in education have changed the environments in which adolescents learn over the last few decades. The use of video technologies and online platforms in educational settings (known as 'e-learning') allows teaching within traditional primary, secondary, and higher education settings to be augmented and has also enabled adolescents to learn outside of traditional physical classroom settings, regardless of their level of physical or mental ability. (47)

Recent innovation has seen a boom in the number of education technology (or 'EdTech') start-ups and learning apps in this space, providing online courses to students in more flexible and personalised formats. (48) The rapid proliferation of massive open online courses (MOOCs) has gained substantial media attention for its potential to disrupt the traditional modes of education through provision of easy access (free or low-cost) content delivery, enabling students from even the most underserved regions to access quality higher education and develop skills. (49) Outside of traditional learning environments, digital platforms, such as game-based learning frameworks, can help adolescents to expand their knowledge and develop practical life skills. (50)

Increasing accessibility to education

Digital transformations can allow underserved populations and out-of-school adolescents to learn when school and universities are closed or inaccessible. Assistive digital technologies, for example, can help to make education more inclusive for adolescents with disabilities or impairments.

An estimated 1.5 billion children and adolescents experienced interruptions to their education during the COVID-19 pandemic. Adolescents who already had reliable internet access, plus digitally-connected and proficient teachers, have been able to continue learning, whereas those without have been significantly disadvantaged. (51) Failure to address the digital divide and make digital educational platforms more inclusive exacerbate inequities in learning outcomes.

For many adolescents, especially those living in communities characterised by endemic violence, schools function as places of safety and security as well as sources of essential services and social support. Therefore, even with increased access to remote, online learning platforms, adolescents must continue to be able to access traditional learning environments. (47)

Development of digital literacy skills

Technologies and increasing digitalisation have permeated nearly every aspect of many adolescents' daily lives, necessitating their need to develop skills to navigate such environments. The future workforce is expected to have the skills required to live, work, and thrive in a digital society. As such, for schools to ensure their students are employable, educational programming needs to form a solid foundation of 'digital literacy' starting in the classroom.

Many schools' abrupt move to remote learning in 2020 may have ultimately strengthened the digital literacy practices of students and teachers, harnessing previously untapped potential. Digital literacy, however, does not just mean being proficient with ICT systems. It also requires critical thinking skills, cognisance of online etiquette and safety, and an understanding of the social issues surrounding digital technologies. Only with these tools can adolescents truly become active digital citizens: individuals who responsibly and safely use technology to interact with the world around them.

Teachers play a crucial role in educating young people in digital citizenship and in programming innovative classroom activities to emphasise it. Teachers and educators, particularly in LMICs, should be supported to build the requisite capacity in digital educational content development and educational technology use. (52)

Challenges presented by digital transformations in learning environments

While there is boundless potential for digitally-enabled and online platforms to support learning and education, policies and programmes must seek to democratise such opportunities and increase digital inclusion. The COVID-19 pandemic has drawn much-needed attention to the importance of connectivity, both at school and at home, as well as to the ways in which lack of digital access can exacerbate pre-existing vulnerabilities for marginalised and disadvantaged children. (53) Many schools across the world lack access to the infrastructure and hardware to make effective use of e-learning. (54) Without sufficient support, students face major barriers for online learning such as lack of community, technical problems, and difficulties in understanding instructional goals. (55)

Several key concerns persist when considering the integration of digital technologies in learning environments. These include implications of AI in assessing learning outcomes; online student profiles and publicly available data which may affect future employability; and ethical concerns about use of automated monitoring and surveillance in education settings. As a growing number of critics are beginning to argue, adolescent's life chances and access to opportunities are increasingly becoming shaped by the types of social sorting afforded by dataveillance. (42)

6. Agency and resilience

Adolescence is a time of profound identity exploration accompanied by growing expectations of autonomy. (18) Increasing digitalisation can facilitate and unlock the potential of adolescents to develop a sense of agency, identity, purpose, resilience, and fulfilment. (56–59)

Platforms for youth-led innovation

Adolescents can leverage a range of digital technologies to innovate, create, and pursue their interests and passions. Initiatives such as social entrepreneurship challenges, 'hack-a-thons' (60), and youth innovation hubs, allow for co-creation, ideation, and innovative thinking to surface, and allow for adolescents to be directly engaged in designing the solutions they need.

The COVID-19 pandemic has shown the extent to which adolescents are turning to digital platforms to gather information about the pandemic and to access tools for self-care and well-being. And, with increasing online use, further exploration into developed digital typologies among adolescents can help to inform the development of more tailored prevention and supportive services. (61)

Harnessing the expertise and knowledge of adolescents

When designing interventions to help adolescents improve their well-being and unlock their potential, it is important to remember that they are the experts on their own needs, the technologies they use, and how they access information. Furthermore, adolescents' lived experiences of interacting with digital technologies differ significantly. Therefore, as there is no 'one size fits all' approach, contextual differences need to be taken into account by technology developers and policymakers when designing interventions aimed at improving adolescent well-being.

For adolescents to truly have agency in relation to digital technologies and approaches for which they are the intended end users or beneficiaries, they need to be enfranchised, rather than just engaged, in every step of the process: development, implementation, and evaluation. (62) Adolescents from diverse backgrounds should be consulted – in the spaces that they already occupy, rather than creating new spaces – on the kinds of on- and offline services they need to support their well-being. Only through this amplification of adolescent voices and 'participatory methodology' – with adolescents as co-creators, collaborators, problem solvers, champions, and change agents – will adolescents harness the full potential of digital technologies.

Youth social accountability

Much of what occurs online is public, or has the potential to be, raising concerns about privacy and the lasting effects of data collected during childhood and adolescence on an individual's agency. (17,63) As such, adolescents need to be able to trust digital services, particularly if they involve the collection and use of personal data. New Zealand's Algorithm Charter for Aotearoa demonstrates a government commitment to transparency and accountability to ensure citizens can have confidence in algorithms and public use of their data. (64)

As systems increasingly digitalise, they need to be responsive to adolescents' needs and rights, improving quality and equity of services for adolescents, as well as promoting youth leadership, enfranchisement, and positive youth development. 'Youth social accountability' (YSA) in digital environments allows adolescents to be lead advocates for their health, rights, and well-being as well as demand transparency and hold systems and policymakers accountable, and much of YSA takes place on social media platforms. Partnerships with adolescents and adolescent-led organisations as well as collaboration with other sectors and actors at multiple levels of health systems are key to strengthening and sustaining YSA mechanisms, particularly when it comes to digital transformations in health.

Digital resilience

'Digital resilience' is the socio-emotional literacy and digital competency required to positively respond to and deal with risks one might be exposed to online. Building such resilience amongst adolescents is critical for them to confidently navigate both digital and non-digital environments as well as to 'bounce back' quickly from difficult online encounters. (65)

Studies have demonstrated that adolescents are cognisant of the social, moral, and ethical dilemmas posed by online communication, and that they exercise discernment regarding the quality of content shared by peers. (66) They also value being able to talk to their peers who share similar experiences, as it can strengthen their support networks and self-esteem. Therefore, to build adolescents' digital resilience, it is important to develop online spaces, behavioural prompts, and tools which provide quick and easy access to informed support from peers and professionals as well as enable adolescents to manage their own mental health and well-being more effectively. (65)

Barriers and challenges to achieving agency

There are numerous household, societal, structural, and systemic barriers for adolescents when it comes to self-expression and exercising agency. (67) There is a weak enabling environment for adolescent-led content, design, and innovation as well as many gaps in the existing evidence base when it comes to the effectiveness of interventions for adolescents to develop agency and resilience. Analytics systems also appear to distribute decision-making to automated, proprietary systems where adolescents have little opportunity for involvement in the handling or use of their personal data. Even so-called 'technology for social good' projects often exclude adolescents from different communities from meaningful leadership opportunities. Furthermore, as adolescents get older, their priorities change; this calls for programmes which are adaptable and sustainable, beyond one tool or application.

7. Implications for policy and programming

Universal access to safe and affordable internet connectivity is now widely recognised as essential for achieving the Sustainable Development Goals and realising human rights. (68) To ensure all adolescents worldwide can benefit from digital transformations, policymakers should prioritise connecting every household and school to the internet and removing barriers to equitable digital access.

Industry and governments must work together to design and adapt digital environments to not only make them safe and accessible, but also to ensure they enhance the well-being of its users. Adolescents' best interests must always precede any commercial interests. Measures to mitigate online risks should be balanced with an adolescent's evolving capacities and rights to freedom of expression, access to information, and privacy. The UN Convention on the Rights of the Child, particularly a new General Comment on children's rights in the digital environment, offers a helpful framework for ensuring that digital transformations support adolescents' well-being and promote their best interests. (69)

There is a consensus that today's adolescents and their caregivers require a combination of digital and civic literacy and skills to prepare them for a digitally connected society and to manage risks inherent to life online. (13,18) Digital skills and citizenship programmes should therefore be designed to enable all adolescents, especially those from disadvantaged populations, to leverage digital transformations to support their well-being and contribute to wider society. (70)

Stronger national and international regulatory frameworks are required to guarantee the quality of digital tools and online information available to adolescents. Governments should tightly regulate digital marketing of unhealthy products and work closely with technology companies to protect adolescents from online content and use of digital devices which could be detrimental to their health and well-being. Policymakers and regulators should create national, regional, and global governance frameworks and safeguards to provide adolescents with adequate personal and data protection in the digital environment whilst maximising opportunities to use data to improve public health and well-being.

Organisations driving and governing digital transformations must recognise adolescents from all backgrounds as change agents, innovators, and rights-holders with vital roles to play in shaping the digital world. Policymakers and industry should therefore foster meaningful, equitable, and long-term dialogues and partnerships with adolescents and adolescent-led organisations representing diverse groups so that future transformations are responsive and accountable to their needs and views.

Finally, whilst digital transformations present many opportunities for improving adolescent well-being, they are not always a panacea. Policymakers must ensure that investments in digitalisation and digital tools are complementary to, and do not displace, broader efforts to strengthen systems that can offer a range of high-tech, low-tech, and no-tech adolescent-friendly education and services. (49)

8. Conclusion

Equipped with a smartphone and internet access, a new world is available to many adolescents, full of opportunities for communication, learning, self-expression, and civic participation. At the same time, in online environments, an adolescent can be exposed to risks of commercial exploitation and multiple forms of mental and physical harm. Digital technologies in themselves are neither helpful nor harmful to adolescent well-being; they are tools that can either support or undermine well-being depending on how they are designed, used, and governed.

How an adolescent navigates the opportunities and risks of digital transformations depends on a wide range of factors including their level of digital literacy, individual characteristics and the wider social, economic and political environment in which they are situated. Further research is needed to increase our collective understanding of the opportunities and threats that digital transformations pose to adolescents' well-being, particularly the most vulnerable and disadvantaged adolescents, and adolescents living in LMICs.

Too many adolescents remain disconnected and completely excluded from digital environments. This undermines their rights and ability to reap the benefits that digital transformations have to offer. Governments and the private sector need to close the digital divide and get all adolescents online. Simultaneously, they must create digital tools and online environments that are fit for adolescents.

As more adolescents come online and digital transformations increasingly influence their lives, the case for stronger global and national governance of digital environments, technologies, and data will continue to grow. While it will never be possible to shield

adolescents from all forms of digital harm, adolescent well-being can be protected and promoted through a combination of measures including tighter regulation of digital technologies, practices, and content; investment in digital literacy and skills; and taking a rights-based approach to digital transformations. Adolescents, in all their diversity, must be enfranchised and supported to shape digital transformations so their well-being and other goals are fulfilled, now and in the future.

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