

Digital degrowth: toward radically sustainable education technology

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Abstract: This paper outlines how ideas of ‘degrowth’ might be used to reimagine sustainable forms of education technology. In essence, degrowth calls for a proactive renewal of technology use around goals of voluntary simplicity and slowing down, community-based coproduction and sharing, alongside conscious minimalization of resource consumption. As such, the paper considers how core degrowth principles of conviviality, commoning, autonomy and care have been used to develop various forms of ‘radically sustainable computing’. Applying these ideas to education contexts, the paper then suggests four ways in which degrowth principles might frame future thinking around education technology in terms of: (i) curtailing current manipulative forms of education technology, (ii) bolstering existing convivial forms of education technology; (iii) stimulating the development of new convivial education technologies; and (iv) developing digital technologies to achieve the eventual de-schooling of society. All told, it is argued that mobilisation of these ideas might support a much-needed reorientation of digital technology in education along low-impact, equitable lines.

Keywords: degrowth, sustainability, digital, education, Illich

Digital degrowth: toward radically sustainable education technology

INTRODUCTION

This paper starts from the simple premise that education technology needs to be reimagined along radically different lines – i.e. toward forms of digital technology use that are more humane and sustainable, that strive to be genuinely nourishing, generative and empowering for all, as well as avoiding harmful impacts on the planet's environment and ecosystems. Hopefully, most readers will see these ambitions as an obvious response to the ongoing 'polycrisis' of the 2020s (Tooze 2021), and the imperative to reset societal activity in light of ongoing climate crisis, geopolitical instabilities, global pandemics, rising social inequalities and more. Nevertheless, these challenges have been rarely acknowledged to date in mainstream discussions of education technology. As such, it is perhaps best to start this paper with a brief justification for why education technology requires a radical rethink, before then going on to consider what forms such rethinking might take.

REFRAMING ED-TECH AS A PROBLEM RATHER THAN SOLUTION

At first glance, education might seem an obvious area where digital technology can make a positive contribution to sustainable development. In contrast, the fast growing critically-minded literatures around education and technology present a strong counter-arguments that the increasingly intensive (if not excessive) application of digital technology in education over the past twenty years has proven to be harmful in a number of ways. For example, there has been a succession of articles in this journal drawing attention to the ways in which digital technologies widen (rather than reduce) educational inequalities, both in terms of opportunities to access education and the outcomes that accrue. Alongside this, digital education has proven to extend and entrench the privatization of public education, corporate control over key educational processes, and the exacerbation of oppressive conditions of individualisation, standardisation and surveillance. As we progress into the 2020s, it makes little sense continuing to suggest that the ever-more intense digitization of education somehow offers a path to universal improvements, flourishings and progression toward 'better' forms of education.

Nevertheless, this message has yet to filter down to mainstream thinking around education. Indeed, growing numbers of policymakers, industrialists and education professionals continue to promote the imminent "digital transformation of education" (OECD 2021, p.5) as a key element of sustainable development in the 2020s and beyond. This is especially evident through the UN Sustainable Development Goal (SDG) 4 and the framing Incheon Declaration's assertion that: "information and communication technologies must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision" (UNESCO 2015, p.iv). While other SDGs push for 'responsible consumption and production' (SDG 12) and 'tak[ing] urgent action to combat climate change and its impacts' (SDG 13), the increased use of digital

technologies looms large in the education-focused SDG 4: “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”. The SDG 4 targets confidently foreground digital technology as a key area of skill development, as well as a means of equitable delivery, and system-wide planning and monitoring. These ideas have been subsequently bolstered by claims that the continued digitization of education can contribute to environmental sustainability, not least the alignment of digital education with ‘green-tech’ principles – where increased use of digital technologies might contribute to the reduction of carbon emissions associated with campus-based education (e.g. Caird & Roy 2019). As such, tech firm Huawei (2018, p.6) reckoned SDG 4 to have some of the highest levels of correspondence with digital technology across *all* seventeen SDG goals, concluding that “this is where digital technology has the highest potential to accelerate country performance” in terms of progress toward SDG 4 criteria. All told, SDG 4 continues to boost the idea of digital technology as a potentially powerful enabler of sustainable education during the 2020s.

There are many reasons to doubt – if not completely discount – these arguments that digital education developments are somehow able to address the complex social, economic and political nature of sustainability problems in the ways that are promised (see Selwyn 2023 for a full rebuttal). Perhaps most pressing, are the ways in which a continued emphasis on intensive forms of digital education is likely to *exacerbate* growing ecological and environmental harms associated with the production, consumption and disposal of digital technology. As such, any enthusiasms for the increased use of digital technologies in education have to reckon with the materiality of this technology, and its deleterious consequences for the planet. As Brevini (2021) has demonstrated in detail, arguments for the continued development of AI, augmented reality, and other emerging digital technologies feeds directly into environmental problems arising from the depletion of scarce resources in manufacturing, usage and disposal processes, alongside the excessive amounts of energy used to support data processing and storage, *and* the exacerbation of waste and pollution issues. These issues are therefore beginning to enter conversations around education and technology (e.g. Gallagher 2019, Burbules *et al.* 2020, Facer & Selwyn 2021, Macgilchrist 2021, Selwyn 2021), including a few papers in this journal (e.g. Macgilchrist *et al.* 2020, Selwyn *et al.* 2020, Macgilchrist *et al.* 2021), all making powerful arguments that the continued excessive application of digital technology in education makes little sense in term of environmental sustainability.

All told, there are many reasons to contend that it is both unsustainable *and* undesirable to be looking to simply continue with the forms of digital technology that currently prevail in education. This is not to deny that digital technologies offer a convenient and efficient means of supporting the needs and imperatives of educational institutions – i.e. to monitor, manipulate and control the business of education provision. Yet, this is to contend that digital technology cannot be blithely presumed to be a straight-forwardly enriching presence in education – especially in terms of social justice, public good and environmental harm. While there are many people keen to promote (and profit from) the continued digitisation of education throughout the 2020s and beyond, the forms of digital technology *already* in existence suggest that this will result primarily in further disadvantaging the already

disadvantaged, enhancing corporate control of public education, alongside hastening environment collapse. We can (and should) aim to do better.

RADICALLY RETHINKING ED-TECH – WHERE TO START?

This prognosis provides the impetus for the present paper, and its overarching argument for a radical rethinking of education technology. So, how might we develop forms of EdTech provision that fulfil communally-defined goods and social justices? Moreover, how can we anticipate these different forms of EdTech in an era when our engagements with digital technologies are increasingly constrained by the effects of climate change, environmental instability, and the precarity of natural resources and manufactured infrastructure? While these questions are not going to be easily addressed (let alone in one short article), it is high time that the education technology community begins to take stock of what is required – starting with a few fundamental reassessments of how we understand digital technology.

First, is the need to embrace the challenge of enacting technological change as a communal opportunity rather than individual obligation. This requires us to reject the prevailing framing (at least in Western societies) of digital technology as a matter of individual consumption. This mindset unhelpfully positions any risks that might result from altered patterns of engagement with digital technologies as a matter of self-responsibilisation. When conceived in this manner, enacting technology change can understandably appear to be a daunting prospect. Instead, approaching the implementation of digital technology in education as a collective, shared endeavour opens up the possibility of radically rethinking education technology in terms of a social movement with collective benefits *and* shared jeopardy.

Second, is the need to acknowledge that reassessing our relationships with digital technology along refined, restrained lines is a defiantly progressive – rather than meekly regressive – development. This requires developing critical consciousness of how contemporary societies are set up to facilitate and normalise the over-consumption of digital technology, as well as the ways in which new technologies are designed to engender endless engagement. Indeed, digital technology as a sociotechnical system is set up to push people into thinking that they need more technology, and that *not* having more technology is a retrograde step. This logic can be seen, for example, in the current promotion of digital ways of working as a ready means to reduce carbon emissions. Such discussions are designed to make us feel compelled to engage in the ordinary harms of excessive technology consumption and, it follows, provide IT industry producers and providers with legitimate markets to sell even more technology to (see Agnew 2020).

Third, is the need to acknowledge that reducing the consumption of digital technology is something that needs to be initiated within local communities rather than left to government, states or industry. As Liegey and Nelson (2020, p.14) point out, these dominant macro-level actors have no vested interest in initiating sustainable, fair and enriching change. Instead, various 'bottom-up' strategies and tactics are required to collectively change the conditions of technology in education. Following Erik Olin Wright (2010), these actions can be seen as (i) interstitial (i.e. building alternatives in the cracks of existing systems), (ii) symbiotic (i.e. working

within systems to reform them them), and (iii) ruptural (i.e. disrupting and fighting against dominant systems).

Fourth, then, is the need to begin to forcibly talk about ways of doing education technology differently. This is where ideas of degrowth come to the fore. Of course, there are many *other* ideas and philosophies of alternate technology approaches that might also be appropriated (many of which overlap with some of the core tenets of degrowth). These include cognate approaches that also foreground values of kindness, care, solidarity and communality – not least feminist approaches to technology (Atenas *et al.* 2022), and recent calls for ‘digital plurality’ (Siddarth *et al.* 2021). Education technology also needs to pay attention to recent efforts to foreground the needs, interests and experiences of otherwise marginalised groups – such as design justice and agonistic computing (Costanza-Chock 2020, Crooks & Currie 2021). In addition, are discussions around decolonising education technology (Adam 2019). For the remainder of this paper, however, we will concentrate on one specific area of thinking that aligns with many of these values while promoting a radical commitment to sharing, slowing-down, and self-determination – the idea of ‘degrowth’. We now concentrate on the central premise of this paper: *what is degrowth, and what might a degrowth oriented education technology look like?*

DEGROWTH - CORE PRINCIPLES AND PHILOSOPHY

Talk of ‘degrowth’ has grown rapidly over the past fifteen years or so, both as an activist pursuit and area of academic discussion. The underpinning premise of degrowth is a rejection of ongoing economic growth as the dominant basis for societal progress and/or human welfare (Latouche 2009, Hickel 2021). Rather than endorse the ever-increasing production of goods and services, degrowth pursues an ‘equitable downscaling’ of economic production and consumption (Sekulova *et al.* 2013). In this sense, degrowth can be seen as promoting an overtly post-capitalist agenda - seeking to develop alternatives to market forces as the primary organising force in our societies. In this sense, degrowth is not a straightforward proposal to use less of what we already have, or a call for the collective take-over of existing resources and techniques. Instead, degrowth calls for a radical rethinking of how communities choose to do things, as well as the resources they draw upon in order to do these things. Central to this approach are values such as simplicity, slowing-down, and a foregrounding of local approaches toward coproduction and sharing. At the same time is an emphasis on communities working together to experiment and refine grassroots practices that are appropriate to their local contexts and circumstances. In these ways, then, degrowth raises ideas such as ‘voluntary simplicity’, a conscious minimalization of resource consumption, and “purposely slow[ing] things down in order to minimise harm to humans and earth systems” (Kallis *et al.* 2020, p.viii).

At this early point in our discussion, it is important not to misread ‘degrowth’ as implying a retrogressive “return to a primitive past” (Liegey and Nelson 2020, p.49) or a form of “forced deprivation” (Kallis *et al.* 2020, p.18). Instead, degrowth strives for the progressive reorientation of everyday life in ways that are empowering, sustainable and pleasurable for much greater numbers of people and communities than is possible under market conditions. As such, degrowth agitates for the

adoption of new practices, relations and institutions that work toward progressive social change and values of ecological integrity and social justice. As Liegey and Nelson (2020, p.36) put it, “degrowth invites you to rethink your values and relations with respect to socio-cultural impacts ... in short to re-evaluate your use of everything”.

While approaches to degrowth vary, a few core components should be borne in mind for our subsequent discussions of education technology. First, is the idea of the commons, and the associated principle of ‘commoning’. In brief, this involves the management of shared resources that are open to all members of a community. The process of commoning is familiar from shared access and governance of natural resources such as parklands, forests, rivers, fisheries and other open spaces, as well as shared musical repertoires, folklore and other cultural knowledges. These are all instances where people come together to create, manage and share resources – with all members of a community collaboratively working out norms and rules of use, and other ways that these shared resources might be best governed and regulated. In this sense, the commons is not a ‘free-for-all’, but an arrangement of mutually agreed-upon rules, boundaries, sanctions, and social norms. Key here, are practices of regular communication, negotiation and experimenting. In this sense, commoning offers a means of mutual benefit and co-governance “which are significantly more equal, transparent, democratic and sustainable than those driven by the logic of the market” (Liegey and Nelson 2020, p.ix).

A second core component of degrowth is the idea of conviviality, drawing heavily on the work of Ivan Illich. This proposes a radically different relationship between people and the ‘tools’ that they encounter. Crucially, Illich’s notion of ‘tool’ encompassed everything from basic objects and artefacts through to more complex machines and technical resources, institutions and infrastructures (everything from a screwdriver through to a nationwide transportation system). Under industrial capitalism, Illich contended that these tools work in ways that is usually exploitative and disempowering – reducing a person to the status of operator, user or consumer, and deliberately impairing their freedom of thought and creative action. Illich referred to these as ‘manipulative tools’. In contrast, the idea of ‘convivial tools’ are those that are “understandable, manageable and controllable by their users” (Kallis *et al.* 2015, p.8). These are tools that can be used in self-determined ways, that are not prefigured and controlled by others, and not reliant on a small body of specialists with proprietary technical expertise and resources. Crucially, these are tools that exist (as much as is possible) outside of corporate and government control, and instead are resources that people can use together – sharing skills, expertise and experience, and collaboratively working out the best ways these tools might be used. In this sense, convivial tools are open to experimentation and reconfiguration, with people given a leading role in shaping the life-cycles of the tools that they use.

A third associated feature is ‘autonomy’. Much of the previous description of convivial tools relates to the idea of autonomous values and practices – where people are able to satisfy their own needs, rather than arbitrary ‘needs’ imposed by others. Illich refers to this as ‘vernacular subsistence’ - for example, tools that can operate outside of external infrastructures (such as a centralised energy system), or tools that can be easily maintained and repaired. Crucially, this is not an individualistic notion of autonomy, but an ethical valuing of individual autonomy that

derives from personal interdependence with others. In this sense, degrowth imagines groups of autonomous people working together to satisfy their own needs, while also providing each other with mutual support, assistance and solidarity. This leads onto a fourth set of underpinning principles of care and caring. The idea of care takes a few different forms in degrowth thinking, not least the idea of groups of people taking *care of resources* – as Helfrich and Bollier (2015, p.75) observe, “a resource becomes a commons when it is taken care of by a community or network”. At the same time is the idea of providing *care for others* – working to sustain a sense of community solidarity and lessening the vulnerability of others. All told, the idea of degrowth foregrounds ideas of mutual concern for others, mutual respect and a general emphasis on the enrichment of human relations.

RETHINKING DIGITAL TECHNOLOGY FROM A DEGROWTH PERSPECTIVE

So, how might these principles of degrowth translate into practical reimaginings of digital technology? What forms of digital technology have formed within the wider degrowth movement? At this point, it needs to be stressed that there is not a clear, unified degrowth stance on technology – as Kerschner *et al.* (2018, p.1619) conclude, “the role of technology on the path towards a ‘degrowth society’ is far from clear”. While some advocates enthusiastically promote the notion of ‘degrowth technology’ acting as an agent of change toward a degrowth society, others see large technostructures such as digital technology as inexorably linked with economic growth, social inequality and ecological breakdown. Discussions around degrowth are therefore infused with a ‘love-hate relationship’ with the question of digital technology (Kerschner *et al.* 2018). As such, degrowth is perhaps best seen as raising a set of choices and challenges – rather than providing easy answers – about what role digital technologies might play in our future societies.

First, degrowth discussions around technology highlight the need to initially identify sets of technology that are irredeemable in any degrowth society – i.e. technologies that need to be rejected outright because they are “destructive no matter who owns them” (Illich 1973, p.26). These might include genetically modified organisms, nuclear power, nanotechnologies, alongside digital developments such as cryptocurrency, non-fungible tokens and other ‘Web3’ developments that are entwined with efforts to stimulate economic growth while also incurring environmentally-reckless levels of energy consumption. At the same time, degrowth advocates are also resistant toward any attempts to establish what might be termed ‘green’ and ‘sustainable’ technologies – the popular hope of mass technologies becoming carbon-neutral and contributing to ‘sustainable growth’. From a degrowth perspective, these technologies remain entrenched in capitalist rationales of market expansion and continued economic growth – as evident in talk of ‘eco-efficiency and ‘green-consumerism’. These proposed technical fixes to climate crisis do little to address issues of social justice, rejection of market forces, and other core concerns that the degrowth agenda sets out to address.

Yet, this is not to say that degrowth is an inherently anti-technology movement. In contrast, degrowth thinking abounds with ideas about how technologies *can* be adopted and adapted in ways that lead to expanded freedom, creativity, autonomy and happiness. These enthusiasms are most obviously illustrated in the

quintessential degrowth technology of the bicycle – a ‘convivial’ tool that is accessible to a large number of people, offers a freedom of movement, consists of materials that are durable, and is easily maintained, repaired, adapted, shared and re-used (Kerschner *et al.* 2018). In this sense, the bicycle embodies principles of what is often termed ‘appropriate’ technology – i.e. technology that is broadly affordable and durable, as well as developed, produced and maintained with local supply chains and local materials (or, at least, materials that do not have to be imported globally). These are technologies that are repairable and adaptable without the help of external experts. Perhaps most importantly, these are technologies that are “relatively non-violent” (Schumpter 1980) in the sense that they significantly reduce negative social and ecological effects in comparison to ‘gigantic’ technology alternatives such as mass car transportation or air travel.

Whereas the bicycle is a prominent example of a popular tool that fits a degrowth agenda, these qualities are perhaps less obviously applicable to digital technologies. Indeed, discussions about digital degrowth tend to take on inevitably more pragmatic and compromised tones. Unlike bicycle parts, it is not possible for most communities to locally manufacture silicon chips, train AI models, or engage in many of the large-scale production processes that underpin digital technologies. In this sense, while most existing digital devices and systems are clearly ‘manipulative technologies’ which from a degrowth perspective need to be subjected to limits, some degrowth advocates are keen to explore the “latent technological possibilities” of digital technologies that might inform degrowth transitions (March 2018, p.1695). This pragmatic position therefore remains open to the possibilities of imagining the appropriation of digital technologies “to enable alternative urban transitions not dictated by the pursuit of economic growth but of socio-environmental justice” (March 2018, p.1695). As such, it is fair to say that digital technology has an ‘ambiguous’ presence in degrowth thinking. Indeed, in Illich’s later years as a frustrated PC user, he encouraged people to cultivate what he termed a ‘technological asceticism’ when it came to computing technology – i.e. a critical distancing that allows one to reflect on the extent to which one is engaged in a responsible use of digital technology, and when limits need to be applied (Samerski 2018).

PRACTICAL EFFORTS TO DEVELOP DEGROWTH FORMS OF DIGITAL TECHNOLOGY

This emphasis on restrained and responsible use of digital technologies is reflected in the ways in which degrowth principles have been picked up recently within computer science, software development and digital activist communities. Indeed, the past ten years or so has seen the sporadic flourishing of online discussions and loose collectives that might be described as sharing an interest in ‘radically sustainable computing’ (Heikkilä 2021), and working out ways of decoupling computing from the growth-focused imperatives of capitalist society. These include the idea of ‘Collapse Informatics’ (Tomlinson *et al.* 2013) which stresses principles of preparedness, and building durable computing systems in the abundant present that might later prove fit for possible futures of scarcity. Allied to this, is the idea of ‘Computing Within Limits’ which stresses principles of restraint and constraint, and looks toward generative forms of computing that fit within increasing real-world ecological limits – what Pargman & Wallsten (2017) term ‘coping with finiteness’.

These discussions are complemented by the idea of 'Permacomputing' (Heikkilä 2021), which seeks to extend permaculture approaches into digital domains, thereby encouraging principles of re-use, repair, maintenance, non-waste, dramatic decreases in the use of artificial energy, and an interdependent and co-operative relationship with natural systems.

All these emerging lines of thinking are now being applied in various different ways. For example, the idea of 'salvage computing' focuses on modes of hardware production that make use of already available resources – foregrounding the reuse and repair of existing devices, and the principle of 'waste as a resource'. In its purest form, salvage computing calls for an immediate halt to the production of new electronic devices and, instead, getting the most out of what has already been produced. Any future production of new resources (if ever deemed necessary) much be based around principles of planned longevity rather than planned obsolescence. This focus on longevity is complemented by the idea of 'designing for disassembly' – i.e. ensuring that all elements of newly produced digital hardware can be disassembled for repair, and all components reclaimed at the end of any device's working-life. This re-use and repair can be bolstered by open-source designs for devices that can be constructed from 'scavenge-friendly electronic parts' – i.e. discarded parts preserved in landfills that can be assembled with low-tech tools. As Templin (2021, n.p) reasons, such design practices engender "a more concrete, quantifiable approach to ecologically sound making and to consumption".

These approaches chime with concurrent discussions around 'frugal computing'. This is the idea of treating computing resources as precious and finite - only to be used when absolutely necessary and in the most efficient ways possible. The vision here is to continuously seek to develop new generations of devices with progressively extended life-spans *and* decreased energy demands. At some point it is envisaged that "the world will have computing resources that last forever and hardly use any energy" (Vanderbauwhede 2021, n.p). These principles of frugality also apply to software development and the idea of minimalist forms of programming. In contrast to the current trend for wastefully programmed 'bloatware', frugal forms of computing seek a revival of programming cultures from the 1970s and 1980s when limitations in memory capacity and processing speeds forced programmers to be as restrained and parsimonious as possible in their work. This has seen calls within programming and software development communities for 'low-level programming' and what Compudanzas (2022) describes as 'writing code closer to the machine'.

As yet, most of these ideas and agendas have only been practically realised in small-scale experiments, case-studies and 'proof of concepts'. As such, these discussions - and the principles that underpin them - should be seen primarily as provocations – challenges to think otherwise, to imagine alternate forms of interstitial computing, and to stimulate people and communities to begin to act on these ideas. In many ways, the 'convivial' potential of these proposals resides within the "networks of actors, rationales, and narratives" that are animated through the act of working out what these alternate forms of computing might entail (March 2018, p.1702). Thus, as Hug March (2018, p.1703) reasons, any sense of 'digital degrowth' is "not just a question of 'what technologies' but 'who produces, manages and controls them', 'to whom' they benefit and 'what' are the objective they serve".

SO WHAT MIGHT DIGITAL DEGROWTH MEAN FOR EDUCATION?

These emerging possibilities of digital degrowth offer a useful catalyst for now beginning to reconsider what the use of digital technology in education might be like. What might it mean to imagine technology resources that are ecologically-kind, accessible to large numbers of people regardless of their circumstances, and that offer autonomous forms of engagement that meet personal needs, rather than the need of managers and institutions? More fundamentally, how can discussions around education technology pay more attention to the limits and scales within which digital technology needs to be kept in ongoing times of environmental collapse? Indeed, all the discussions just outlined highlight an important shift in emphasis— i.e. a concern with how much technology is required, as opposed to how much technology is possible. This sense of ‘only what is required’ relates back to fundamental concerns with social justice, ecological harms, and the pursuit of a deliberate decoupling of digital technology practices from the exploitative and extractive circuits of digital capitalism. These are all major shifts in thinking for the education technology community to take on.

At this point, it is important to stress that any discussion of digital degrowth should be imbued with an understanding that there is no one approved or mandated sense of how technology ‘must be done’. Instead, degrowth prioritises consensual and democratic approaches to experimenting, negotiating and deciding on what forms of digital technology might be appropriate for local communities and local contexts. In this sense, Samerski (2018) calls for ‘reflective’, ‘sober’ and ‘cautious’ applications of degrowth principles to any area of digital technology use. This implies regularly re-evaluating on a collective basis what might be needed, and the limits to what people might require. In this exploratory spirit, then, we can consider a few areas of technology-related deliberation that might now begin to be developed with regards to education technology:

i) Which current forms of manipulative technology need to be expunged from education altogether?

First, degrowth challenges us to ask what forms of education technology are beyond redemption – i.e. current digital technologies that are obviously ‘manipulative’ in nature, not amenable to limits, and deserving of immediate scaling-back and ultimate rejection. In terms of environmental sustainability, for example, many dominant education practices are predicted upon presumptions of ‘abundant’ tech use – uploading everything to the cloud, requiring one-to-one device access in the classroom, expecting classes to be live-streamed, devices to be replaced every few years, and an ‘always-on’ mode of technology access and use. As already hinted at, these ways of using technology are likely to be unsustainable for various reasons. The production of laptops and tablets are reliant on the extraction of non-renewable minerals and rare metals, involve manufacturing processes that incur massive energy expenditure. The continuous use of hundreds of these technologies within a single school depends on energy-hungry and water-draining storage centres required to support software and online services. The eventual disposal of e-waste is

another major environmental burden. Moreover, this cycle of extraction, manufacturing and disposal is reliant on exploited labour in some of the world's poorest countries.

Similarly, schools and universities are currently replete with software and systems that primarily serve the institutional needs relating to administration, bureaucracy and management of mass education provision. These range from institutional 'management systems' and business intelligence systems, through to performance analytics and surveillance technologies such as online examination proctoring systems. All of these technologies convey little (if any) sense of increased autonomy, creativity, care or similar concerns for the individuals who fall under their gaze. Instead, these technologies are focused on issues of institutional efficiencies and effectiveness, and ultimately reinforce correspondences between education and economic growth.

Rejecting these technologies suggests a necessary shift in mindset, where education does not feel compelled to be led by 'gigantic' developments in corporate software development. This can be described along the lines of 'withdrawal' or 'releasement' from manipulative forms of education technology (Heikkurinen 2018) – i.e. feeling confident to continue with non-digital practices and offline processes that already work, rather than apply technology to them. This might also involve an increased willingness to actively and publicly resist forms of education technology that are not considered appropriate – engaging in protest and other forms of resistant activities to 'occupy' and disrupt mainstream public debates and politicking around education technology (Liegey and Nelson 2020). For example, the past few years have seen burgeoning protest movements by students, educators and parents against personalised learning systems, online proctoring and AI-driven tutoring. Conversely, even in official arenas, we have also seen the EU regulatory framework on AI designate the use of such technology in education as a 'high risk' that needs to be "subject to strict obligations" (European Commission 2021). Such sentiments now need to be extended into other forms of community oversight, scrutiny and dissent. For example, there will be an increased need during the 2020s to push back against greenwashing of consumer digital technologies - i.e. rejecting industry attempts to push 'green' forms of mass digital technology use that are ostensibly 'cleaner' and more resource efficient in terms of their production and/or use, yet ultimately are market-based solutions that look to extend economic growth.

ii) Which current forms of convivial technology might be retained and sustained in education?

Conversely, degrowth also challenges us to consider current forms of education technology that might be considered as 'convivial' in nature, and therefore deserving of retention. Such technologies and practices might fulfil a number of briefs. First, is the encouragement of the re-use, repair and recycling of digital resources within education settings and local communities. This can include obvious steps toward low-impact technology use in schools, universities and other educational institutions – such as significantly reducing the disposal of computers, screens, and other hardware. A few forward-thinking schools, libraries and other community settings already run repair cafes, device sharing libraries and other ways to "practically

enhance sustainability by reusing materials and equipment” (Liegey and Nelson 2020, p.121). These examples can be extended to involve the establishment of support networks that draw on the collective expertise and skills within a local community. In this manner, education settings and local communities can work to provide technical support and advice on a voluntary, collective, communal and open basis.

Second, is the retention of already existing forms of education technology that support creative, collaborative and caring ways in which individuals can self-direct their learning activities. This might see the revisiting of what was referred to during the 2010s as ‘personalised learning networks’ and open ‘knowledge networks’ – i.e. diverse informal networks that are developed organically by individuals and educators to support informal exchanges of information and interactions between communities of learners. All told, there are various examples from the past twenty years or so of provisional, experimental uses of education technology that offer access to the commons of collaborative learning and mutual care, and shaped by collective values of equity and community (rather than individual gain). Third, is a general emphasis on simple technologies that can be easily produced, maintained, augmented and repurposed on a local basis. This relates to the degrowth ethos of ‘voluntary simplicity’ (Liegey and Nelson 2020, p.12) and technology that is “slower by design” (Kallis et al. 2020, p.ix). Such a spirit has persisted throughout the recent history of educational computing – especially in terms of the renewed interest throughout the 2010s for mini-computers such as the Raspberry Pi and MicroBit, and the rise in ‘Maker technology’ and other forms of ‘tinkering’. Similarly, Macgilchrist (2021) raises the idea of encouraging the ‘hospicing [of] old technologies’ – especially pre-digital educational tools and technologies that might well still prove fit for purpose.

All of this suggests a revitalisation of ‘bottom-up’ technological cultures and mindsets in education – making technology use an experimentally-spirited process of local groups playing around with different small ideas, which might work together to support convivial forms of education. Rather than the top-down imposition of mass-scale systems and infrastructures, this suggests that technology use in any school or local setting is guided through collective democratic processes – shared stewardship of the technology resources and practices that a community decides is appropriate for supporting their educational goals. This situates digital technology use in any education setting within a broader network of care, solidarity and support – both in terms of technical support, but also in terms of emotional support relating to learning and teaching with technology. In this manner, education technology can be framed as a shared problem *and* a shared pleasure.

iii) What new EdTech innovations might be pursued in the future?

In the medium-term is the more speculative challenge of developing new education technology innovations that help further the cause of degrowth. As some degrowth commentators are keen to point out, degrowth is not anti-innovation (Haucke 2018) – rather, degrowth requires technological innovation that helps reduce dependency on large-scale manipulative tools. As Liegey and Nelson (2020, p.xi) put it, a degrowth

agenda “means inventing, developing and sharing the most simple, local, easy-to-implement and easy-to-use tools or technologies to satisfy our basic needs”.

Some of these innovations might be relatively mundane in appearance, yet foster principles of conviviality, commoning and care. Take, for example, the challenge of rethinking the current dependence of many educational institutions on online tuition. Rather than giving up on online tuition altogether it might make sense to pursue alternate ways to support more convivial forms of these technologies. For example, there are various past models of online learning commons from the 2000s and 2010s that might be revitalised and developed along overt degrowth lines. This might include ‘knowledge exchanges’ and ‘tutor exchanges’ – platforms where people offer tutoring in areas of their own expertise in return for tutoring in other areas that they wish to become more knowledgeable in. Applying the ‘open platform cooperative’ model to education might involve groups of local educators working together to run collective platforms that offering online tuition and tutoring services on a fair-work basis (Papadimitropoulos 2021). Alternately, there are various possibilities for supporting the development of more convivial uses of data in education. This might involve the development of democratic forms of data stewardship and data sharing – shifting focus away from creating economic ‘value’ from education data to values of public good, social solidarity and self-determination of how data is used within a local community (Micheli *et al.* 2020). In practical terms, efforts might be made to enact these principles through the establishment of ‘data cooperatives’ by education organisations, or public bodies establishing ‘public data trusts’ – collating education data to better inform community decision-making and promote the idea of ‘data as a public infrastructure’. There are many such examples of convivial technology that might be appropriated in education.

More radically still, we might consider experimental alternative digital technologies along the lines of ‘radically sustainable computing’. Reimagined along these lines, education technology might make use of Wi-Fi ‘mesh’ networks that support alternate forms of networking that do not require corporate datacentres, satellites and cabling, or solar-powered websites that can be hosted across networks of solar-powered micro-computers set up to capture sunlight in different locations around the world (Decker *et al.* 2020). Other examples include ‘Collapse O/S’ – a self-contained operating systems that can run on ‘improvised’ salvage-based computing device, or even the idea of ‘self-obviating systems’ – software and systems that are designed to become steadily more peripheral to the social and cultural systems in which they are embedded. Similarly, Macgilchrist (2021) raises the possibilities arising from alternative technologies such as mud batteries or mycelium-grown materials

As reasoned earlier, These examples, and the principles that underpin them, are provocations to think otherwise about the digital in an era of scarce resourcing and climate breakdown. As Bill Tomlinson (n.d) puts it, such movements seek “to bring about new kinds of computing systems that might allow us as a civilization to more effectively engage with these sets of issues”. Rearranging education technology around degrowth principles might see renewed emphasis on any such innovation. The key principle running throughout all such ideas is one of self-determination - what Gualter Barbas Babtista (2020, p.201) describes as “questioning technology by commonly owning it”. By developing these alternate forms of digital technology, different groups and communities are actively testing the boundaries of what aspects

of the dominant digital culture might be redeemable, and which aspects of dominant digital culture require rejecting.

iv) How should education ultimately be organised?

Finally, is the more existential challenge of deciding what forms of education organisation we want to see these degrowth approaches to digital technologies support and sustain. This relates to the fact that any degrowth transition of education technology needs to be part of much wider degrowth transitions across society. In this sense, it could be reasoned that some of the most 'manipulative tools' of contemporary society are education institutions such as mass schooling and higher education. Indeed, Illich saw schools and universities as tools that function to 'stupefy' rather than encourage people to learn in ways determined by their personal intentions and needs. Schools reinforce the notion that knowledge is a scarce commodity that needs to be competed for through the consumption of packaged curricula designed to support continued economic growth and meet the needs of the economy. In short, Illich (1971, p.8) contended that individuals in education institutions are discouraged "from taking control of their own learning", and also from engaging with other potential opportunities for learning within their immediate communities.

In all these ways, then, it might make little sense for degrowth approaches to education technology to work to support the long-term existence of our currently massified systems of compulsory and tertiary education. As Samerski (2018) reasons, degrowth is not a straight-forward matter of diverting resources from an undeserving area of society such as car manufacturing to a more deserving area such as an education system – indeed, doing so would result merely in a "change in growth patterns, but would not lead to degrowth". Following this logic, it might be concluded that a degrowth agenda might best support the repurposing of digital technology as a means of digital deschooling. For many proponents of degrowth, the long-term implication of degrowth involves looking beyond education systems that have become yoked to goals of standardisation, efficiency and employability, and have therefore irredeemably crossed the point where "the ends for which they were originally designed change. Institutions become a threat to society itself" (Deriu 2015, p.79).

Seen along these lines, then, digital technologies might instead be most fruitfully used to support alternate forms of engagement with teaching and learning that are genuinely accessible and beneficial to all, based around goals of what Illich (1971, p.53) described as 'facilitating activity' rather than 'organizing production'. This therefore fits well with the agendas pursued by advocates of 'open education' and 'critical digital pedagogy' – using digital technologies to support "the creation of networks, as opposed to institutions, that are temporary, autonomous, and non-hierarchical, and facilitate a variety of diverse models of learning and community interaction" (Todd 2012, p.78).

CONCLUDING THOUGHTS

In contrast to mainstream discussions around education technology, this has *not* been a conventional, comfortable paper that presumes the continued expansion of digital technology use in education. Instead, we have outlined a challenging set of emerging discussions around the question of how future forms of digital technology in education might be rethought along low-impact, equitable lines. Again, it is important to stress that these are arguments that join a growing literature that: (i) anticipates a radically different future shaped by ongoing effects of climate collapse, geopolitical instability, global pandemics, growing financial and social inequalities; and (ii) therefore agitates for developing “ways of rethinking rather than rejecting EdTech” (Macgilchrist 2021, p.2).

As such, degrowth should be seen as a different – rather than better – set of ideas for beginning to engage with the possible futures of education and technology. As this paper has shown, discussions around degrowth do this through applying the values and politics of social justice, environmental sustainability, and the post-capitalist decoupling of digital technology from economic growth – all ideas that are not usually foregrounded in discussions of education and technology. That said, there are some reasons to be cautious in fully subscribing to such thinking. For example, as Ben Williamson (2017) reminds us, ideas such as digitally-driven deschooling have been readily coopted over the past twenty years by decidedly non-progressive Silicon Valley actors promoting the high-tech ‘disruption’ of public education provision and mass schooling driven by hyper-individualized, privatized and exclusionary forms of ‘cyber-libertarianism’ (see Dahlberg 2017). Elsewhere, it is argued by some left-leaning critical commentators that degrowth is simply too fantastical a position to adopt - little more an unrealistic abdication of engaging in more immediate, messy struggles over class welfare, the rise of populist nationalism, neo-fascism and other current socio-political crises. As David Griscom (2022, n.p.) reasons: “degrowth isn't realism, it's a pessimistic belief that we can't build a post-capitalist society without global sacrifice and suffering”.

These misgivings notwithstanding, the key point of any anticipatory exercise such as the discussions begun in this paper is that we begin to engage seriously with what sorts of future existence we would prefer to have, and what current actions and attitudes are required to get us there (Amsler and Facer 2017). In this sense, ideas around degrowth clearly have merit as a useful means for “pre-figuring the type of world that [we] want to produce and inhabit” (Kallis *et al.* 2015, p.9). Thus, while it might seem confronting, anticipating a radical shift in the nature of education technology along degrowth lines seems an obvious step to be pursuing during the remainder of the 2020s and beyond. Indeed, from a long-term perspective, it makes sense to see education technology as part of wider historical ebbs and flows where trends in education come and go. History suggests that there is little reason to expect the hyper-expansive forms of education technology that we have witnessed for the past twenty years to somehow continue indefinitely. Instead, degrowth could be seen as a prompt for the education technology community to address “the obvious axiom that nothing can grow indefinitely” (Kallis *et al.* 2020, p.11). Of course, as stressed throughout this paper, these pressures are not *unique* to education. The degrowth of digital technology needs to be addressed across all areas of society. Yet, education is an ideal domain within which to initiate these debates - a high-profile and community-grounded area of digital technology use which might well inspire similar efforts in other areas of society.

Of course, initiating a degrowth transition in education technology would be a major undertaking. Discussions around degrowth can be criticised for remaining vague on the specific supporting roles that states, governments, and commercial actors might play as part of these transitions. Degrowth literature remains sketchy on the practicalities of establishing decentralized, self-governed structures, and there is a tendency to idealise notions of 'community' and 'local' while underplaying the exclusionary and oppressive dynamics that can often pervade community-based and cooperative efforts. It is also important to acknowledge that the excessive unsustainable forms of 'always on' technology engagement that degrowth seeks to counter are predominantly the preserve of global North contexts. As such, these are primarily transitions that need to be pursued within education technology communities in the global North. If degrowth principles are to be applied to education technology then much more thought needs to be given to the political sensitivities and political strategies required to realise these ambitions.

Yet, despite these gaps, continuing to embed ideas of degrowth into education technology discussions is a welcome initial step towards tackling these challenges. As such, the ideas sketched out in this paper should be seen as an invitation for ongoing dialogue rather than presenting a definite agenda or manifesto for immediate change and upheaval. Indeed, it is likely that any practical transition will involve a diversification of modes of education technology – introducing localised, cooperative modes of production, consumption and caring that might complement, renew or perhaps challenge existing forms of large-scale manipulative education technology that currently dominates. Any impetus will need to be led by bottom-up public mobilisation. This will initially require individuals, groups and communities to self-organise into grassroots networks – with alliances being built amongst those who do not have a vested interest in the continuation of 'EdTech' as it currently stands. As Kallis *et al.* (2020, p.58) puts it, "the goal [of degrowth] is not to replace one monoculture with another. It is to create conditions that support the development of more vibrant realms of possibility with different rhythms, purposes and scales".

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