



Students and society in the 2020s. Three future 'histories' of education and technology

Felicitas Macgilchrist, Heidrun Allert & Anne Bruch

To cite this article: Felicitas Macgilchrist, Heidrun Allert & Anne Bruch (2019): Students and society in the 2020s. Three future 'histories' of education and technology, Learning, Media and Technology, DOI: [10.1080/17439884.2019.1656235](https://doi.org/10.1080/17439884.2019.1656235)

To link to this article: <https://doi.org/10.1080/17439884.2019.1656235>



© 2019 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 26 Aug 2019.



Submit your article to this journal [↗](#)



Article views: 765



View related articles [↗](#)



View Crossmark data [↗](#)

Students and society in the 2020s. Three future 'histories' of education and technology

Felicitas Macgilchrist ^{a,b}, Heidrun Allert^c and Anne Bruch^a

^aMedia|Transformation, Georg Eckert Institute for International Textbook Research, Braunschweig, Germany;

^bInstitute for Education Science, Georg-August-University of Goettingen, Goettingen, Germany; ^cDepartment of Media Education/Educational Computer Sciences, Kiel University, Kiel, Germany

ABSTRACT

As social science fiction, this paper imagines three possible futures for education and technology. Among the most important technologies emerging today are data-aggregating technologies such as AI, affective computing, adaptive or predictive software, clouds and platforms. The paper is not, however, directed at specific technologies, but at indeterminate sociotechnical configurations. Set in 2040, it offers three 'histories' of the 2020s. Might students become (i) 'smooth users', improving themselves in the pursuit of frictionless efficiency within a post-democratic frame created by large corporations, (ii) 'digital nomads', seeking freedom, individualism and aesthetic joy as solopreneurs exploiting state regulations and algorithmic rules while stepping out of the state and deeply into the capitalist new economy, or (iii) participatory, democratic, ecological humans embedded in 'collective agency' that see institutions as spaces for exploring more equitable ways of living? The paper reflects on the future research and the political, educational and technological decisions which would make each of these three fictional future histories more or less likely.

ARTICLE HISTORY

Received 20 July 2019

Accepted 5 August 2019

KEYWORDS

Educational technology; subjectivation; speculative theory; social science fiction; digital education

Introduction

This paper speculates three different futures into the coming decade. Starting from current policy on 'education in a digital world', we identify three directions in which the 2020s could unfold. Our focus lies less on specific emerging technologies, and more on the socio-economic-material embedding of technologies in future educational practices. The paper explores how this embedding configures the contours of what is thought to be a desirable future student-subject: What priorities will they have? How might they organise their lives? What kinds of experience will they want to have. In short, who might they want to 'be'?

Current research imagines different kinds of student-subject that can, could or should be shaped by education and technology. One set of observers highlights the potential for learning analytics, artificial intelligence, adaptive learning, maker-centred learning and other interactive or data-driven technologies to increase equality of opportunity by fostering independent, flexible, reflective, team-working individuals who have developed grit, tenacity and a sense of self-empowerment (Clapp et al. 2017; Hamilton et al. 2019; Luckin et al. 2016; Shechtman et al. 2013).

CONTACT Felicitas Macgilchrist  macgilchrist@leibniz-gei.de  Georg Eckert Institute for International Textbook Research, Celler Str. 3, Braunschweig 38114, Germany

© 2019 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

Other observers critique these traits as encouraging young people to constantly monitor, evaluate and improve themselves, practices which reduce schooling to the preparation of young labour to be exploited by a capitalist economy (Means 2018; Peters 2013; Thompson and Cook 2016). Technology becomes, in this view, a tool for the constant surveillance/dataveillance of young people, hindering democratic decision-making, determining what counts as good schooling and distracting efforts from the structural transformations necessary to overcome entrenched socio-economic inequalities (Eynon and Huw 2018; Macgilchrist 2017a; Williamson 2018). Yet other observers foreground the need for students to gain radically critical and political perspectives on technology, citizenship and resistance today (Caines 2017; Emejulu and McGregor 2019), and for scholarship, pedagogy and technology design to prioritise students' potential to live in relations of care and community, intellectual privacy and safety (Bali 2017; Doxtator 2017; Reich and Ito 2017; Zeide 2017).

This paper draws on recent ethnographic and conceptual work that emphasises the constitutive indeterminacy of technology in education. This work foregrounds ambivalences, tensions, dialectical relationships and lines of flight. It shows how potentially transformative technologies are domesticated by everyday practices and entrenched hierarchies; and how reforms oriented to growing the economy and shaping pliable workers sow the seeds of their own destruction by creating spaces conducive to collective action (Au 2018; Selwyn et al. 2018; Sims 2017).

The transformative moments of practice can unfold in [at least] two different directions, they can be directed towards the re-enforcement of explicated rules, standards, and codified bodies of knowledge, or they can be geared towards the practical enactment of qualitatively new forms of interaction and experience that account for alternative knowledges, values, and aesthetic criteria. (Richter and Allert 2019)

The paper also draws on post-foundational theories of subjectivation which question the notion that individuals act autonomously with technological tools; instead we see individuals as subjectivated in social practices co-constitutively entangled with technology (Butler 1997; Richter and Allert 2017b). The social practices enacted with technology invariably exceed developers' expectations. Just one example is when self-optimising fitness-tracking apps, which use GPS data to mark progress, have been (mis)appropriated to create artwork using the GPS traces or to highlight the dangers of such data-tracking apps by revealing secret military locations.¹

For each of the following three scenarios, written as if it were 2040, the paper engages in a kind of social science fiction to speculate on how technology will have been used in schools, and what this means for how future student-subjects will have been addressed in the future past of the 2020s. Each section first sketches sociotechnical developments over the course of the 2020s, second, identifies the roots of these developments in educational policy decisions in Germany and Europe of the 2010s, and third, explores the effects of these socio-political-technical developments on students as the 2020s progressed.

Scenario 1: smooth users, competent subjects

<body id="2040" class="competencies-users-centralise-optimize-smoothen">

Artificial intelligence, learning analytics, predictive analytics, adaptive learning software, school management software, learning management systems (LMS), school clouds. No school was without these and other technologies branded as 'superintelligent' by the late 2020s. Tied into the aims of solving social problems and making the world a better place, Silicon Valley tech entrepreneurs and major edu-businesses successfully rebranded existing companies (which were no longer called 'textbook publishers', but instead 'global learning platforms') and founded new companies which produced software for learning, teaching and assessment. They developed platforms to integrate learning resources and track student data. Since they were seen as the only people with the ability to understand digital technologies, in particular data technologies, they were invited to take on central roles as advisors to national governments and local districts on educational futures.

The competences prioritised in Germany remained consistent over the years: From the first national strategy for ‘Education in a Digital World’ in 2016, the goal was to prepare students to become efficient, capable, self-sufficient users of available digital technologies (KMK 2016). Media literacy, including digital as well as information literacy, became an important feature in education and democratic participation, emphasising ‘the ability to understand, select, evaluate and use media as a leading purveyor and processor, if not producer, of information’ (UNESCO 2013, 29). Students were to ‘respond to’ the ‘challenges’ of the digital world, i.e., to become proficient users of hardware and software provided by others, and to react to changes being made to the world by other entities (politics, commercial actors). They were not encouraged to believe they could actively *shape* the digital world by understanding, programming, controlling, contextualising and critiquing digital technologies and processes. The German national strategy – and similar policy documents across Europe – emphasised the individual rather than the collective. In addition, seeing individuals as ‘having’, ‘developing’ and ‘exhibiting’ competences presupposed that competences were relatively static, decontextualised, autonomous abilities rather than situation-specific, relational performances, deeply embedded in power relations.

With this focus on individual abilities, a major report by technology advisers to governments in 2022 prioritised adaptive software and predictive education as the key measures to improve national educational systems: The goal throughout was to ‘optimise’ educational processes and help students to optimise themselves. Data science promised to enable educational technology to respond to learners’ needs and to their emotions (see Williamson 2018). Personalised learning pathways would motivate students and thus help to close the achievement gap. Affective computing and AI techniques would enhance learning by their ability to sense, interpret and interact with student’s feelings, moods and emotions (McStay 2018). Satisfied and fully immersed learners, capable of using the newest technologies, would be an asset to innovation in the workplace, and spur economic efficiency and GDP growth. Technology-enhanced assessment tools would improve formative, summative and predictive test procedures. Learning management systems (LMS) would make school management, administration, teaching and learning more efficient.

With this 2022 landmark report, schools and colleges integrated new technology providing learning opportunities for students to become efficient, autonomous, team-working and creative problem solvers. Students engaged in citizen science projects, they worked independently with AI-driven technologies, collaborated in international teams, and used 3D graphics and virtual reality/augmented reality (VR/AR) to experience new dimensions of the curriculum content that they were expected to learn.

Critical voices noted that the discussion about ‘new’ educational media in the 2020s had historical precursors, which can be traced back over one hundred years. When, for instance, educational films were gradually incorporated into primary and secondary schools in most European countries and the USA from the 1920s, progressive educationalists were convinced that films could fulfil their aspirations to extend educational opportunities for all and to help reform the traditional system of education based on more democratic values (Bruch 2018; Cuban 1986).

Topics from the 2020s such as equality, democracy, efficiency, skills, training, dynamic images and modernisation echo these debates of the 1920s (Kurig 2015). Educational policymakers and film entrepreneurs in the 20th century had asserted that films were not only an efficient means of education, but that they responded to the immediate needs for more skilled and trained workers. They based their claims on the theory of suggestibility and the supposed impact that images had on the minds of students (Binet 1900). They argued that films provided a more direct and immediate form of instruction over text-based methods or textbooks because they believed the mind learned through the accumulation and association of images. In this respect, they positioned themselves as modernisers, attempting to revitalise and to change pedagogical practices. However, though the proponents considered films to be pedagogic instruments which could help achieve the *established* educational goals of the time, they did not use them to *transform* educational goals, nor, for instance,

as an avant-garde medium that could construct novel ways of seeing using film techniques as montage or the aesthetics of expressionism.

Similarly, in the 2020s, despite the new technology, the goals of formal education remained static. By 2025 large-scale studies demonstrated unequivocally that the use of new technologies had not fulfilled the promise of ameliorating socio-economic inequalities. Students' self-efficacy decreased as they followed learning pathways determined by computational devices (Bali 2017). The response was to roll out more new technology. Learners became increasingly invested in optimising and improving the self (since they were seen to be individually responsible for developing their competences and for closing the achievement gap, see Ladson-Billings 2006). It became self-evident that being an agreeable, pleasant person who could independently solve problems, create novel ideas and find compromises without conflict, was the key to social and economic success.

There was little public discussion of how global corporations were encoding highly ideologically valanced norms and standards into the software and infrastructures underlying education, and thereby subtly shaping what is valued as 'good education' (Jarke and Breiter 2019). Nor was there widespread concern about the fundamental relations of 'rentier'-tenant' which began to dominate society through the overreliance on products from commercial entities. In this world of 'rentism' (Frase 2016), the elites are those individuals and organisations that extract profit from renting out patterns to which they own the intellectual property rights through, e.g., patents or copyright. The main source of profit is no longer control over physical entities (factories, hardware, cables, chips) but control over 'patterns' (algorithms, blueprints, software and other kinds of information that produce and reproduce our world): 'In order to maintain control over the economy, the rich increasingly need to control that information, and not just physical objects' (Frase 2016, 71).

By 2026, to meet the policy expectation that they assist students in becoming optimised technology users, and given the lack of publicly funded open source alternatives, educational institutions relied almost exclusively on intellectual property owned by commercial entities, from Microsoft and Google to commercial LMS and proprietary software for languages, STEM subjects, coding and robotics. Indeed, the centralising tendencies of platform capitalism led a small number of (transnational) corporations who built the fundamental technological infrastructures of education to become key players (Srnicsek 2017). These platforms had the power to aggregate and analyse user data, and to prefigure classroom practices – and thereby societal values and forms of subjectivation – through the software and content they made available. User interfaces circulated an aesthetic of smoothness and predictability that lulled users into agreeable, smoothed personae.

Throughout the 2020s, activists and scholars pointed out opportunities for citizens to shape the digital world, to critique the power differentials between technology corporations and citizens, and to protest against the expropriation of common public resources through platform services (Noble 2018; Stalder 2015, 277). However, these debates had little effect on mainstream educational practices. Ethnographic research demonstrated that despite the hopes funnelled into technologies as key to 'disrupting' entrenched socio-economic inequalities and widening participation, traditional hierarchies and exclusions re-emerged (Sims 2017). In response, and in a genuine attempt to rectify these inequalities, major public-private partnership efforts were made in 2027 to build newer, more transparent, more participatory technologies. However, since these efforts retained the focus on individualised competences and individualised participation, most funding was funnelled into building new schools with high-tech AI, robotics, etc. equipment rather than initiating major economic transformations; socio-economic equality was still not achieved (Duane 2018). The societal process of smoothing continued, fuelled by the aesthetics of the predictable, responsive, pleasurable interfaces of everyday life. At the same time, the 'post-democratic' move, in which technology companies began to make significant educational decisions outwith the purview of public, democratic contestation (Stalder 2015), continued to gain strength throughout the 2020s, with the former Google educational data scientist, Stephania Seerobbe, appointed the EU Commissioner of Education in 2029.

Scenario 2: digital nomads, exploiting digitalisation for individualism

<body id="2040" class="digital-nomads-individualism-new-economy">

From the mid-2010s, an increasing number of solopreneurs drew on the platforms provided by global, data-based, algorithmically-driven corporations and utilised data as a resource and value to start their own online business. As 'digital nomads', these solopreneurs started to use digital technologies to profit from geoarbitrage, i.e., they earned income from markets with hard currencies such as Germany, while living in countries with low living expenses such as Vietnam, Indonesia or Thailand. Global platforms like Amazon, AirBnB and Facebook provided the infrastructure which smoothed the process of starting up one's own business while travelling the world or setting up base on a tropical island. Through these platforms and the gig economy, becoming an entrepreneur no longer required large investments to build up a company or take responsibility for staff. In viral and expanding online networks, digital nomads referred to themselves as self-determined, free and independent as they deregistered their permanent residences, rejected standard employment and stopped paying tax.² The key to success and freedom was running an online business which was scalable and automatable. The individual was seen as the solution to any problem. World travelling families promoted autonomy, personal needs and unschooling, but the question of whether they wanted to go to school was left to the children themselves.

As important as the sophisticated use of digital technology and running an online business, was the development of an appropriate 'mindset'. Digital nomads discussed this mindset – on Instagram, Twitter, Facebook, YouTube, and other emerging social media platforms – as 'stepping out of the system' and questioning staid, boring belief systems passed on in society, schools and traditional models of work. Working nine to five in a location-bound job, investing oneself in the rat race, and converting time into wages was rejected by these expanding nomadic networks. A family-orientation as well as healthy lifestyles, personal development, meditation, and learning by doing took centre stage. Claims such as 'becoming the best self' and 'programming oneself' reveal that this lifestyle is about optimisation. Schools and universities were seen, either for pragmatic or for ideological reasons, as dispensable.

As the 2020s progressed, those students who were particularly fluent in using digital tools for collaborating, managing projects, meeting and training withdrew from nation-state systems and adopted digital nomadic lifestyles. They did not necessarily have programming skills or other IT knowledge; the skills a solopreneur did not have themselves could easily be outsourced within the network of solopreneurs or on worldwide freelancer platforms. Learning, training and transforming beliefs was highly valued as it opened up new options. Formal education was assumed to be superfluous. Doing was key.

Ironically, the rejection of formal education emerged as young people adapted and adopted precisely those key competences which formal education and digital education proponents had promoted in the 2010s: A key set of competences foregrounded in Germany's strategy for 'Education in a Digital World' circulated around the notions of selecting digital communication tools appropriate to the situation; collaborating via digital tools to combine information, data and resources; planning, designing, presenting and sharing content and (media) productions in diverse formats; identifying and formulating algorithmic structures; and recognising the economic relevance of digital technologies, especially for one's own business strategies (KMK 2016, 15f.). In ways that exceeded and inverted the expectations of teachers and policymakers, young people enacted these competences to liberate themselves from national/state education, from their potential role in strengthening the national economy, and from tax obligations.

A long-term digital ethnography of the dynamics of digital nomadism, conducted by one of this paper's authors from 2014 to 2029, revealed that 'stepping out of the [state] system' often resulted in stepping deeply into an economic system which culminates in an entrepreneurial-self, for whom entrepreneurial thinking and business models such as 'personal branding' take priority. Being 'authentic' became highly relevant for business. In order to reach a wide audience, one's own everyday life

was presented via Instagram postings and stories. This resulted in the blurring of private, public and economic spheres.

As a reason for becoming nomads, families and young people mentioned that they felt insecure at home because of rising rents, broken networks and little quality time for parenting. This echoes web development of the mid-1990, which was arguably entangled with the rise of what we call the new economy:

Individuals could no longer count on the support of their employers; they would instead have to become entrepreneurs, moving flexibly from place to place, sliding in and out of collaborative teams, building their knowledge bases and skill sets in a process of constant self-education. (Turner 2006, 6)

By the mid-2020s, increasing numbers of digital nomads were fulfilling this demand. They understood themselves as the technologically enabled elites who build online businesses and reject traditional forms of governance. They escaped the consequences of the new economy at 'home' while reinforcing it in their new lifestyles at the very same time.

Digital nomads were – and still are in 2040 – more likely to become good customers and heavy users of e-commerce services such as booking.com, Uber, AirBnB, accepting general terms and conditions, than to sign local tenancy agreements and labour contracts. Public fail-safe systems such as public unemployment insurance and national pension funds are mistrusted. Instead, individualism based on financial freedom and private assets is promoted. Their lifestyle is not about moving from state to state, but is a self-chosen status of being state-free, avoiding regulations and bookkeeping for one's own online business (Boamong and Eckhardt 2018) while at the very same time exploiting national regulations when implementing a business model.

Although learning is highly appreciated among digital nomads, public educational institutions are regarded as dispensable or even harmful. In a spate of YouTube videos in 2026, some digital nomads reflected on their unschooling practices. However, their justification of unschooling confirmed rather than rejected the norms and values of their contemporary national school systems, such as individualised learning, project-based learning, language skills, programming, teamwork and creativity. There are no references to concepts like emancipation, generation conflict or critical thinking. Nevertheless, nomad parents have tended to argue that they can provide a better education than school classrooms by assembling their own teaching material as well as by using online educational videos, MOOCs and DOCCS à la carte.

As early as 2019, a plethora of business models such as Amazon FBA, Private Labeling, and Facebook Marketing were taught through online courses on platforms such as Udemy, via podcasts and private academies such as AMZ Academy.³ Digital nomads learned and taught through these courses. While free webinars were open to many participants, 'Premium MasterClasses' and 'Inner-Circles' became the route to monetisation. They were open only to a small number of carefully selected participants. MasterClasses, for instance, were offered by those already successful online. Students were introduced to one specific business model and guided through the first phases of building up their online business via Skype, WhatsApp and Facebook groups. Often these models were blueprints which could be adapted and partly copied. Scalability and automatisations, key concepts in their business models, stood at the core of the coaching and training models of the 2020s.

For over a decade, the widely shared ideal remained Tim Ferriss' 4-hour workweek. Many digital nomads proclaimed their search for a holistic lifestyle. As they merged spirituality, meditation and health with finding one's self and optimising one's body they embraced technology such as advanced biotechnology, stem cell therapy and natural biohacking. Online non-public universities such as Mindvalley University complied with this idea and by 2023 offered curricula which addressed the desire to harmonise the use of digital (and bio)technology with an holistic lifestyle and spirituality: Online courses were categorised under the overarching label of 'transformational education' as 'career and influence', 'lifestyle and productivity', 'mind and spirit', 'health and fitness' or 'love and relationships'.⁴

Performing a business model on platforms such as Amazon, AirBnB, YouTube, and Instagram in the 2020s required skills in data analytics and using simple and sophisticated analytic tools. It entailed a thorough understanding of the underlying algorithms, as solopreneurs were dependent on their work becoming visible and ‘on top’ in algorithmically-sorted listings and feeds. And it required knowledge of the regulations of global corporations and local, national and transnational political bodies. They needed to know, for instance: Does Amazon allow one to give away free samples in exchange for customer reviews? Is AirBnB rental permitted in Berlin, Chiang Mai, Dahab or Medellin? Which state imposes low tax on online business? How does ranking well on Amazon differ from ranking well on AirBnB? How does the algorithm for Instagram’s feed work since its latest update last week and how to get my post seen? How to optimise my Amazon product description based on sales psychology and fitting into Amazon’s bullet points scheme – or where can I buy such a service? Which data to analyse for dynamic pricing for a flat on AirBnB? How to persuade a landlord in Medellin to let me sublet the flat? And so on.

Despite this development, universities did not realise that the platform economy posed a threat to publicly funded institutions. Throughout the 2020s, the digital was still framed as functional and unpolitical. In 2029 state universities and public schools were under intense pressure. Tax income was low, individualism widespread, and only children whose parents were not financially free and not interested in starting an online business, sent their children to school. Most of those parents delivered Amazon’s packages and cleaned AirBnB flats. Everyone wanted to flee from society. Problems had been identified, but no majorities to solve these problems could be formed. Those who wanted to bring about change, i.e., decentralising the web and promoting an economy for the common good, were laughed down by those believing in individualism.

Overall, by the end of the 2020s the expansion of now classic commercial platform technologies had promoted and supported individual entrepreneurial thinking as a means to become free. ‘I choose freedom’, the slogan of DNX (‘Digital Nomad’) community members and speakers at #dnxfestival in Lisbon in 2018, became the motto of the decade. The key competencies of understanding how data analytics and the underlying algorithms of commercial technologies could be used for one’s own business strategies, led solopreneurs to reject formal education and evade nation-state economic politics. Precisely the freedom and individualism of an increasing number of digital nomads had sedimented the (data)monopoly of corporate global platforms by 2029.

Scenario 3: collective agents, in institutions as spaces for exploring new forms of living

<body id=“2040” class=“collectivities-community-care-explore-political”>

By 2020, it had become clear that new solutions were required for the socio-economic inequalities, ecological damage and national political dependencies brought about by the global capitalist market economy. It was evident that the promised ‘trickle-down effect’ was no longer to be expected, and that classic economic theories had led to widening gaps between the very rich and the rest, with large percentages of the global population living below the poverty line. The planet had been stretched to breaking point, with toxins polluting the seas and the land, the climate under pressure, and natural resources insufficient to cope with global levels of consumption. The role of conflict minerals in technical devices was undeniable. National governments were unable to keep state secrets, not because of external hacking attacks, but because of their dependence on proprietary software supplied by corporations who could build in mechanisms for surveillance and sabotage by foreign governments or high bidding non-governmental actors. Public resistance to post-democratic governance through the lobbying, consultancy and technologies of a small number of for-profit technology corporations was rising. School children were striking for the future of the planet.

Given these challenges, educators, students and parents in Germany realised that three elements in the national frame for ‘Education in a Digital World’, that had previously been considered tokenistic

gestures, were of the highest priority: (i) using digital technology for social well-being and inclusion and to participate as citizens in society, (ii) taking the environmental effects of digital technologies into account in the daily lives and (iii) protecting personal data (KMK 2016, 15ff). These competences foreground a student-subject who cares and takes responsibility for the network of human and more-than-human relations in which they find themselves (Haraway 2007).

This spurred a radical rethinking of education. Educational policy, practice and institutions were fundamentally reorganised to realign ‘competences’ as a collective, embedded, embodied and political, rather than individual, practice. By the mid-2020s, a critical mass of informal initiatives, community organisations, collective actions and coordinated educational policy had coalesced to transform the priorities of educational technology. The EU emerged as a global leader in supporting and requiring ‘respectful design’ (Tunstall 2017). This impacted the software used in classrooms and in school management and administration. It affected the infrastructures and institutions of formal education. And it shaped the content taught to young people.

Since it was generally agreed that data privacy was a high priority – both for students as individuals and for the organisations in which they would later work – several measures shaped the design of educational software. First, in 2022 privacy by design became mandatory for all learning apps and school management software in the EU before they could be purchased with state funds and implemented in schools.

Second, companies stopped grumbling about this new legislation after a TEDTalk went viral in 2023 in which the CEO of an edtech start-up critiqued the edtech community for complaining that ensuring data privacy was difficult: This complaint is, she said, like a toy manufacturer saying, ‘It’s so hard not to put carcinogenic chemicals in these toys that we make. This is so hard! We’re so upset about these rules’ (see Macgilchrist 2019).

Third, pragmatic review systems for classroom tools became widespread by 2024, such as Common Sense Media’s K-12 Edtech Privacy Evaluation Platform. These platforms worked with educators, school districts and local communities to develop simple and usable resources to find concise and transparent evaluations of edtech privacy and security practices. The platforms assessed the most popular edtech apps to help teachers, parents and students make informed decisions about whether to use them or not.

Fourth, Ministries of Education across Europe drew on the experience of the German Federal Foreign Office, which had, after a bumpy start, transitioned its entire organisation to free and open source software in 2021. To save costs, but primarily on the grounds of security concerns, the Foreign Office had implemented a participatory process that involved all stakeholders and staff, explained the ethics and security of working with open software, and had run multiple practical workshops with staff to ensure a smooth transition.⁵ In a similar process, educational administrations across the EU transitioned in the mid-2020s to open source software.

This significantly shifted the priorities of edtech companies. Privacy by design become standard. Student data was owned by the schools and/or students, not the edtech company. Data privacy was no longer seen as a block on the edtech business but as a human right and thus an expected cost of business. Carefully crafted opt-out policies offered users fine-tuned control of how an app aggregated and analysed their data.

Similarly, open educational resources (OER) became more widespread. These ranged from uploaded worksheets through materials for working with collaborative open data projects such as OpenStreetMap or GovData to adaptive learning platforms with open algorithms such as the German Schulbuch-O-Mat biology project which launched in 2021 and had been successfully taken up in schools across the country by 2024. The key to the success of OER was public funding for development, quality control and to build communities of practice. Before these extended communities were established, OER activists had a solid tradition on the margins of mainstream educational practice. After the German OER Information Centre began to designate substantial resources in late 2022 to create and support multiple, specific, sustainable, active, diverse and inclusive OER communities, however, OER took off across Germany (but see Vică 2015 on the ideology of open).

OER also opened the doors to radically multiple perspectives on history, science and society. This had long been a stated goal of schooling but had rarely been implemented. As the extent of datafication in society became clear, algorithmic literacy became central, including obfuscation tactics, and consideration of the ethics, ecologies, economics and politics of algorithms, analytics, artificial intelligence and hardware (Brunton and Nissenbaum 2015). Data activists were invited to schools to foster students' data literacy, including their understanding of data sovereignty and how to build an ethical relationship with data. It became common practice for students to learn about the politics of design choices; about the ethical obligation to act if data is available (Prinsloo and Slade 2017); about which questions can be asked of data, and which insights generated through which types of data; about the statistical and algorithmic basis of data; and about how to choose where their data resides and who can access it, or how content can be decoupled from a software application; about how to collaboratively make use of data to advocate for social change (see Daly, Devitt, and Mann 2019; Gutiérrez 2018).

The ecological activism of the late 2010s, which gathered strength through the 2020s, also laid the groundwork for today's [2040] self-evident appreciation of the need to develop and work with 'convivial technologies', i.e., tools which are not designed with novelty and profitability in mind, but with a view to a more equitable, participatory, democratic, interrelated and ecological society oriented to degrowth (Vetter 2018). This activism, and the ensuing educational practices, connected to a widespread recognition that 'agency' is collective, spanning human and more-than-human entities, and transcending individualism (Bennett 2010).

As schools integrated laptops running Linux with their students rather than opting for iPads or Chromebooks, students learnt not only to be users of already available materials and software, but also how to (collaboratively) build, repair and adapt the software they were using. They learnt to understand the foundational principles of networks, such as protocols, client-server architecture and W3C standards, which empowered them to use networks for emancipatory purposes, and to develop democratic networks. Overall, this led students to reflect on the power hierarchies and norms engineered into different types of software, hardware, infrastructures and standards.

Since education is always a reflection and co-constitution of broader societal norms and values, this transformation of education was intimately entangled with broader societal shifts. Institutions became spaces for exploring new forms of living together. Solidary economies, e.g., community economies, doughnut economies, participatory economics, degrowth, etc. had begun to replace capitalist economic models as the mainstream way of understanding economies (Albert 2003; Gibson-Graham, Cameron, and Healy 2013; Raworth 2017). Strategies for achieving degrowth were, for instance, firmly on the agenda of the Inter-Institutional Agency for Liveable Futures (IIALF). The IIALF, founded in 2024, was the first of many institutions to involve young people in all key decision-making processes. It grew from projects oriented to platform cooperativism and citizen-centred data infrastructures in public governance, first implemented in early 2023 in the 'Roadmap Towards Technological Sovereignty' in Barcelona (Dencik et al. 2019, 875).

The appeal to 'community' within and outwith education had initiated conversation and disseminated a desire for multiple ways of being-in-common which accepted that there was no perfect community 'that lies outside of negotiation, struggle, uncertainty, ambivalence, disappointment' (Gibson-Graham 2006, 99). The activities of 'assemblies', with horizontal rather than vertical organisation, foregrounded collective responsibility and decision-making rather than individual leaders (Hardt and Negri 2017). Student-subjects were called into being who saw themselves as guardians, caretakers and stewards for the physical environment, and as collective innovators for diverse economies, fair politics and respectful technology design.

On the world wide web, democratic structures (as envisioned in the cyberspace metaphor of the 1990s but lost as corporations took over in the 2000s) were regained. After 2018 increasing numbers of projects were rolled out, building decentralised architectures and modular open-source technology. Tim Berners-Lee, the founder of the web, was one of the most prominent proponents of this emancipatory turn: 'It's time to reset the balance of power on the web and reignite its true potential',

his start-up ‘inrupt’ stated when it launched in late 2018.⁶ Striving against data monopolies, inequalities between the data-rich and the data-poor, and platform centralisation through global corporations, ‘Solid’ (‘social linked data’, of which inrupt is a part) ‘aims to radically change the way web applications work today, resulting in true data ownership as well as improved privacy’. After its launch, the platform took off, both for business and entrepreneurs as well as for social interactions. Similar platforms were developed in Europe, and heavily funded by the EU. By 2026, these decentralised and interoperable platforms had fulfilled their promise to ‘unlock the true promise of the web by decentralizing the power that’s currently centralized in the hands of a few’ (inrupt.com). This was marked in March 2026, when Facebook filed for bankruptcy; Google had already become obsolete a few years previously.

Berners-Lee’s vision was that learning to code should support this democratic, participatory vision. At its launch, he expected Solid to ‘resonate with the global community of developers, hackers, and Internet activists who bristle over corporate and government control of the web. “Developers have always had a certain amount of revolutionary spirit”, he observes’ (quoted in Brooker 2018). Others developed decentralised messaging, micro- and fotoblogging services based on existing and new protocols and W3C standards. This set the scene for the way we now – in 2040 – choose from different providers for microblogging and messaging, and can share with anyone, irrespective of which provider we each subscribe to (i.e., send from Telegram, receive in WhatsApp).

A side-effect of this was to reduce the ‘participation gap’ in which economic divides had marked different engagement with social media, with students from low-income families orienting more towards social media sites available on computers, while high-income students oriented more towards smartphone apps. It also impacted strongly on the environment, as transparency about the planetary resources required to run apps and build new technology was increasingly engineered into the technology by activist developers.

By the late 2020s care and solidarity, participatory research and development, had become the guiding norms and values in public institutions. Open to all based on transparent processes and criteria, raising the level of data literacy amongst learners, institutions nourished a valuable diversity of epistemic cultures, embraced generation conflicts and empowered learners to raise critical questions. The goal became to shape society collaboratively embracing the strife and conflict that this process requires.

Discussion

<body id=“2019” class=“today-discuss-reflect” add=“further research”>

As noted above, the key issue for this paper is not the technology in itself, but the sociotechnical configuration in which it is embedded: In this section, we reflect – writing in 2019 – on the socio-political-economic implications of each scenario. We foreground the political, pedagogical, technological and scholarly decisions that would have been taken to enable each scenario and identify further avenues for research to understand – and perhaps try to shape – the future of education and technology.

In the first scenario (smooth and competent users), recalling previous moments in the history of educational technology, students are encouraged by policymakers, schools and universities to use new technological tools efficiently to increase their productivity. Students are addressed as individuals who optimise themselves; they monitor, adjust and curate polished lives that fit a frictionless high-tech world. When technology is understood as a ‘tool’ to be used competently, post-democratic moves are strengthened in which governments invite technology corporations to advise them on their educational technology strategy. As promised, technology helps close the ‘achievement gap’, but observers are puzzled when socio-economic equality is still not achieved. With decision-makers foreground technical solutions, the few critical voices noting that addressing inequality takes more substantial (and conflictual) transformation are marginalised. Life is smoothed. Everyone is

agreeable, creative, productive and oriented to the self. Inequality is accepted. Democracy is emptied of conflict and struggle, becoming increasingly technocratic.

In the second scenario (digital nomads), individualism is pushed to the fore, as young people adopt and adapt corporate business models, drawing from their understanding of algorithmic data-aggregating commercial processes. Freedom and individualism frame digital nomad solopreneurs' sense of self. The good life they cultivate draws on images of tranquil desert islands. Having time and being able to slow down, stepping out of the rat race of traditional workplaces, and questioning the mindset passed on in their home societies, are important features of success. Formal education becomes increasingly irrelevant, at the same time as the income from taxes which funds public education decreases. Digital nomads respond to demands of the new economy by optimising themselves as entrepreneurial selves. They do not transform the logics of the new economy, but enforce them as they gain by exploiting the new economy's rules. Universities and schools failed to realise in time that the new economy and the Internet are entangled so neatly and that the digital is not a neutral tool, but inevitably political.

In the third scenario (collective agency), institutions are spaces for exploring and experimenting with new ways of living. The focus is on collective subjects, i.e., on actively participating in designing the kind of socio-ecological-technical future that the planet can sustain. This happens in community, through solidarity, collective organising and a recognition of our constitutive entanglement with the 'stuff' of this world. Public funding supports respectful technologies, assemblies and community-building. Control is decentralised through open source technologies. Coding skills are taught as a democratic practice. Public interest in convivial technology, associated with low ecological impact and degrowth, increases. Struggle and conflict are not evaded in this scenario; the hard work involved in making participatory, democratic decisions to make the world a safer and more just place is recognised.

These scenarios, we suggest, open up several lines of inquiry for scholarship today. Research is inevitably part of making these scenarios more or less likely. First, further research is needed on different forms of subjectivation which are unfolding in lines of flight away from formal institutions (Macgilchrist 2017b). Ethnographic studies of unschooling and worldschooling practices or the family lives of online solopreneurs would point in this direction. Findings might question the continued relevance of the fundamental concepts of 'modern' education such as autonomy and self-determination.

Second, further theoretically informed design research is required that explores how 'new' technologies (whatever is new at the time) can be designed differently, to support more just educational practices. This type of research considers 'design as critical engagement' (Richter and Allert 2017a), orients to 'respectful design' (Tunstall 2017) and/or aims to decolonise technology (Benfield n.d.). It takes up the provocations of concepts such as terraformation (Bryant 2014) which remind us that in materialdiscursive strategies to change oppressive social systems, education and technology are only ever partial aspects.

Third, the utopian elements in this fictional paper highlight a generative criticality, i.e., drawing on critical theories to design new meanings and new ways of living (Haraway 2000). Non-fictional studies, by identifying politicised collective actions that are already underway but under the mainstream radar, critique current injustices, but also offer alternatives. The scenarios in this paper suggest further research on data justice or on public funding efforts to take educational technology out of corporate control (Dencik et al. 2019; Gutiérrez 2018).

Concluding thoughts

This paper sketched three possible futures for education and society which outline emerging issues for the sociotechnical configuration in which we live today. In the first future configuration, young people fit themselves into a frictionless, smoothed, capitalist society. In the second, young people devise their own routes to freedom by rejecting the nation state and the commons. In the third,

collective action, experimental institutions and public funding shape a more ecological and equitable world.

While the materiality of technology is undeniably important, each future history means decisions have been taken about which technologies, institutions, funding lines, research, pedagogies, relations, designs, etc, to prioritise. These decisions are being made today. For the first (Orwellian) scenario to unfold, policy can continue as it is today; activists would have to step down. The second marks a slow 'brain drain' from formal institutions; it requires institutions to continue ignoring the growing interest in digital nomadism. The third demands more of the radical collective and public action which is already underway. Research, in turn, shapes these decisions by focussing critical attention on aspects of these potential future histories.

Notes

1. See, for instance, the GPS art on <https://gpsdoodles.com/>.
2. A major website connecting the 'digital nomad global movement' is <https://www.dnxhub.com>.
3. Podcasts are available on, for instance, <https://www.digitalenomadenpodcast.de>. For courses, see <https://www.udemy.com> and <https://amzacademy.org>.
4. Mindvalley courses are available at <https://www.mindvalley.com>.
5. From 2007 to 2011 the Federal Foreign Office (AA) was a model public institution implementing open source software but did not fully inform or train staff (Feilner 2011). The AA returned to proprietary software from 2011.
6. See, descriptions and quotes on inrupt (<https://www.inrupt.com>) and SOLID (<https://solid.mit.edu>).

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Felicitas Macgilchrist is Head of the 'Media|Transformation' Department at the Georg Eckert Institute of International Textbook Studies, and Professor of Media Research with a focus on Educational Media at the University of Goettingen. Her current research draws on ethnography, discourse studies and cultural theory to explore the politics and practices of educational technology.

Heidrun Allert is Full Professor and Head of the Department of Media Education/Educational Computer Sciences at the Christian-Albrechts-Universitaet zu Kiel. She is interested in critical software studies and mass collaboration. Since 2000, she has been involved in a number of national and international projects in the area of technology-enhanced learning and knowledge work.

Anne Bruch is Research Fellow at the Georg Eckert Institute of International Textbook Studies. She is Principal Investigator of 'Educational Film in the Interwar Period'. Her research focuses on the national and transnational debates about educational films as innovative media from the 1920s. From 2018–20 she holds a Research Fellowship on European educational and informational films at the European University Institute in Florence.

ORCID

Felicitas Macgilchrist  <http://orcid.org/0000-0002-2828-4127>

References

- Albert, Michael. 2003. *Parecon: Life after Capitalism*. London: Verso.
- Au, Wayne. 2018. *A Marxist Education: Learning to Change the World*. Chicago: Haymarket Books.
- Bali, Maha. 2017. "Against the 3A's of EdTech: AI, Analytics, and Adaptive Technologies in Education." November 29. Accessed December 20, 2017. <https://www.chronicle.com/blogs/profhacker/against-the-3as-of-edtech-ai-analytics-and-adaptive-technologies-in-education/64604>.
- Benfield, Dalida Maria. n.d. "Volume 3, Dossier 1: Decolonizing the Digital/Digital Decolonization." Accessed July 10, 2019. <https://globalstudies.trinity.duke.edu/projects/wko-digital-3>.

- Bennett, Jane. 2010. *Vibrant Matter: A Political Ecology of Things*. Durham: Duke University Press.
- Binet, Alfred. 1900. *La Suggestibilité*. Paris: Schleicher.
- Boampong, Schacha, and Timo Eckhardt. 2018. "Digitale Nomaden Podcast - Raus aus dem Hamsterrad. Rein in die Freiheit. DNP237: Steuerfrei und ohne Buchhaltung um die Welt - mit Christoph Heuermann von staatenlos.ch." Accessed September 30, 2018. <https://itunes.apple.com/de/podcast/der-digitale-nomaden-podcast/id1108912209>.
- Brooker, Katrina. 2018. "Exclusive: Tim Berners-Lee Tells Us His Radical New Plan to Upend the World Wide Web." September 29. Accessed September 30, 2018. <https://www.fastcompany.com/90243936/exclusive-tim-berners-lee-tells-us-his-radical-new-plan-to-upend-the-world-wide-web>.
- Bruch, Anne. 2018. "Educational Cinema in the Weimar Republic." *Educació i Història: revista d'història de l'educació* 31: 113–124.
- Brunton, Finn, and Helen Nissenbaum. 2015. *Obfuscation: A User's Guide for Privacy and Protest*. Cambridge, MA: MIT Press.
- Bryant, Levi R. 2014. *Onto-Cartography. An Ontology of Machines and Media*. Edinburgh: Edinburgh University Press.
- Butler, Judith. 1997. *Excitable Speech: A Politics of the Performative*. London: Routledge.
- Caines, Autumm. 2017. "#DigCiz. June 2017 is Here." May 22. Accessed September 10, 2017. <http://digciz.org/uncategorized/digciz-june-2017-is-here/>.
- Clapp, Edward P., Jessica Ross, Jennifer O. Ryan, and Shari Tishman. 2017. *Maker-centered Learning: Empowering Young People to Shape Their Worlds*. San Francisco, CA: Jossey-Bass.
- Cuban, Larry. 1986. *Teachers and Machines: The Classroom Use of Technology since 1920*. New York: Teachers College Press.
- Daly, Angela, Kate A. Devitt, and Monique Mann, eds. 2019. *Good Data*. Amsterdam: Institute of Network Cultures.
- Dencik, Lina, Arne Hintz, Joanna Redden, and Emiliano Treré. 2019. "Exploring Data Justice: Conceptions, Applications and Directions." *Information, Communication & Society* 22 (7): 873–881.
- Doxtator, Benjamin. 2017. "Maybe We're Not Afraid: On Edtech's Inability to Imagine the Future." March 26. Accessed April 28, 2017. <http://www.longvieweducation.org/maybe-not-afraid-edtechs-inability-imagine-future/>.
- Duane, Daniel. 2018. "Learning the Hard Way." *Wired*, 70–79.
- Emejulu, Akwugo, and Callum McGregor. 2019. "Towards a Radical Digital Citizenship in Digital Education." *Critical Studies in Education* 60 (1): 131–147.
- Eynon, Rebecca, and Davies Huw. 2018. "Is Digital Upskilling the Next Generation our 'Pipeline to Prosperity?'" *New Media and Society* 20 (11): 3961–3979.
- Feilner, Markus. 2011. "Das deutsche Außenministerium migriert von Linux auf Microsoft." *Linux Magazin*. <https://www.linuxmagazin.de/ausgaben/2011/05/auswaertiges-amt/2/>.
- Frase, Peter. 2016. *Four Futures. Life After Capitalism*. London: Verso.
- Gibson-Graham, J. K. 2006. *A Postcapitalist Politics*. Minneapolis: University of Minnesota Press.
- Gibson-Graham, J. K., Jenny Cameron, and Stephen Healy. 2013. *Take Back the Economy: An Ethical Guide for Transforming our Communities*. Minneapolis: University of Minnesota Press.
- Gutiérrez, Miren. 2018. *Data Activism and Social Change*. London: Palgrave.
- Hamilton, Ali, Donald Rubin, Michael Tarrant, and Mikkel Gleason. 2019. "Digital Storytelling as a Tool for Fostering Reflection." *Frontiers: The Interdisciplinary Journal of Study Abroad* 31 (1): 59–73.
- Haraway, Donna J. 2000. *How Like a Leaf: An Interview with Thyrza Nichols Goodeve*. London: Routledge.
- Haraway, Donna J. 2007. *When Species Meet*. Minneapolis: University of Minnesota Press.
- Hardt, Michael, and Antonio Negri. 2017. *Assembly*. Oxford: Oxford University Press.
- Jarke, Juliane, and Andreas Breiter. 2019. "Special Issue: Datafication of Education." *Learning, Media and Technology* 44 (1).
- KMK (Kultusministerkonferenz). 2016. Strategie Bildung in der digitalen Welt. Accessed June 10, 2019. https://www.kmk.org/fileadmin/Dateien/pdf/PresseUndAktuelles/2016/Bildung_digitale_Welt_Webversion.pdf.
- Kurig, Julia. 2015. *Bildung für die technische Moderne. Pädagogische Technikdiskurse zwischen den 1920er und 1950er Jahren in Deutschland*. Würzburg: Königshausen & Neumann.
- Ladson-Billings, Gloria. 2006. "From the Achievement Gap to the Education Debt: Understanding Achievement in U.S. Schools." *Educational Researcher* 35 (7): 3–12.
- Luckin, Rose, Wayne Holmes, Mark Griffiths, and Laurie B. Forcier. 2016. *Intelligence Unleashed. An Argument for AI in Education*.
- Macgilchrist, Felicitas. 2017a. "Backstaging the Teacher: On Learner-driven, School-driven and Data-driven Change in Educational Technology Discourse." *Culture-Society-Education* 12 (2): 83–103. <https://pressto.amu.edu.pl/index.php/kse/article/view/17900>.
- Macgilchrist, Felicitas. 2017b. "Die medialen Subjekte des 21. Jahrhunderts: Digitale Kompetenzen und/oder Critical Digital Citizenship." In *Digitalität und Selbst: Interdisziplinäre Perspektiven auf Subjektivierungs- und Bildungsprozesse*, edited by Heidrun Allert, Christoph Richter, and Michael Asmussen, 145–168. Bielefeld: Transcript.

- Macgilchrist, Felicitas. 2019. "Cruel Optimism: When the Digital Data Practices of Educational Technology Providers Inadvertently Hinder Educational Equity." *Learning, Media and Technology* 44 (1): 77–86.
- Mcstay, Andrew. 2018. *Emotional AI: The Rise of Empathic Media*. London: Sage.
- Means, Alexander J. 2018. "Platform Learning and On-demand Labor: Sociotechnical Projections on the Future of Education and Work." *Learning, Media and Technology* 43 (3): 326–338.
- Noble, Safiya Umoja. 2018. *Algorithms of Oppression: How Search Engines Reinforce Racism*. New York: NYU Press.
- Peters, Michael A. 2013. *Education, Science and Knowledge Capitalism: Creativity and the Promise of Openness*. New York: Peter Lang.
- Prinsloo, Paul, and Sharon Slade. 2017. "An Elephant in the Learning Analytics Room: The Obligation to Act." LAK '17 Proceedings of the Seventh International Learning Analytics & Knowledge Conference, ACM, New York, NY.
- Raworth, Kate. 2017. *Doughnut Economics: Seven Ways to Think Like a 21st Century Economist*. White River Junction, VT: Chelsea Green.
- Reich, Justin, and Mizuko Ito. 2017. *From Good Intentions to Real Outcomes: Equity by Design in Learning Technologies*. Irvine, CA: Digital Media and Learning Research Hub. https://clalliance.org/wp-content/uploads/2017/10/GIROreport_v3_complete.pdf.
- Richter, Christoph, and Heidrun Allert. 2017a. "Design as Critical Engagement in and for Education." *EDeR - Educational Design Research* 1 (1): 1–20.
- Richter, Christoph, and Heidrun Allert. 2017b. "Poetische Spielzüge als Bildungsoption in einer Kultur der Digitalität." In *Digitalität und Selbst - Interdisziplinäre Perspektiven auf Subjektivierungs- und Bildungsprozesse*, edited by H. Allert, M. Asmussen, and C. Richter, 237–262. Bielefeld: Transcript.
- Richter, Christoph, and Heidrun Allert. 2019. *Critical Incidents as a Participatory Research Approach for Transformative Cultural Practices*. Singapore: UNITWIN - Second Yearbook on Arts Education Research for Cultural Diversity and Sustainable Development.
- Selwyn, Neil, Selena Nemorin, Scott Bulfin, and Nicola F. Johnson. 2018. *Everyday Schooling in the Digital Age: High School, High Tech?* London: Routledge.
- Shechtman, N., A. H. DeBarger, C. Dornsife, S. Rosier, and L. Yarnall. 2013. *Promoting Grit, Tenacity and Perseverance: Critical Factors for Success in the 21st Century*. Washington: U.S. Department of Education, Office of Educational Technology & Society.
- Sims, Christo. 2017. *Disruptive Fixation: School Reform and the Pitfalls of Techno-Idealism*. Princeton, NJ: Princeton University Press.
- Srnicek, Nick. 2017. *Platform Capitalism*. London: Polity.
- Stalder, Felix. 2015. *Kultur der Digitalität*. Berlin: Suhrkamp.
- Thompson, Greg, and Ian Cook. 2016. "The Logic of Data-sense: Thinking through Learning Personalisation." *Discourse: Studies in the Cultural Politics of Education* 38 (5): 740–754.
- Tunstall, Dori. 2017. Respectful Design. <https://www2.ocadu.ca/feature/dean-dori-tunstall-on-respectful-design>.
- Turner, Fred. 2006. *From Counterculture to Cyberculture. Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*. Chicago: The University of Chicago Press.
- UNESCO. 2013. "UNESCO Global Media and Information Literacy Assessment Framework. Country Readiness and Competencies." Paris. <https://unesdoc.unesco.org/ark:/48223/pf0000224655>.
- Vetter, Andrea. 2018. "The Matrix of Convivial Technology – Assessing Technologies for Degrowth." *Journal of Cleaner Production* 197: 1778–1786. doi:10.1016/j.jclepro.2017.02.195.
- Vică, Constantin. 2015. "Open Data, Ideology of Liberation, and Open Government." In *Re-thinking the Political in Contemporary Society: Globalization, Consumerism, Economic Efficiency*, edited by Viorel Vizureanu, 163–182. Bucharest: Pro Universitaria.
- Williamson, Ben. 2018. *Big Data and Education*. London: Sage.
- Zeide, Elana. 2017. "The Structural Consequences of Big Data-Driven Education." *Big Data* 5 (2): 164–172.