

## Cracks in the sidewalk. Looking behind the seamless surfaces of digital schooling

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### Abstract

*As the significance of digital devices and study materials in classrooms grows, traditional classroom spaces are re-negotiated and constructed in novel ways. From a methodological point of view we must now answer the question of how to do classroom research when the school moves out of the classroom. Through the development of two methodological approaches, the article searches for possibilities for research methods that are able to navigate the borderlands between school, home, public and market spaces where the digitalization of education currently unfolds. The first methodological experiment involves tracing the entanglements of upper secondary school students' mobile phone use by creating a closed wi-fi network inside the school and enabling the students to share their phone screens with researchers; the second following the Covid-19 distance school days of upper secondary school students with portable video cameras. By mapping the entanglements of digitally connected classrooms, we can gain insight into the marketisation of public education and the growing influence of global digital platforms seeking to strengthen their foothold in schools. The article proposes approaching digitally connected classrooms as assemblages and developing methodologies that see technologies as practices. Through examples taken from our methodological experiments, we look behind the seamless surfaces of technology and the flashpoints that emerge. This leads us into the human and non-human co-operation required in digitally connected classrooms.*

### 1. Introduction

As the theme of this book suggests, we are increasingly encouraged to see ourselves as embedded and interconnected. The idea of loosening school boundaries and expanding educational spaces is simultaneously something that describes the intertwined and entangled character of existence, and a discourse that produces specific effects, changing how we answer questions about what education is and where it takes place. Digital technologies play a central role in expanding the fields of education, by for example shifting the discussion from teaching spaces (located in schools) to learning spaces (located in non-traditional teaching spaces, outside schools and potentially anywhere) (Gourlay 2021a).

As the boundaries between being on-line and off-line have lost their meaning and an internet-mediated existence has settled into a pervasive norm of 2020s life, the distinctions between school and non-school related technology use have become difficult to make. In order to clarify the situation, Bulfin, Johnson, Nemorin and Selwyn (2016) suggest differentiating between school as a location and school as a purpose for technology use. In practice this means that many things we do with technologies in school have little to do with school itself but belong to the private domain – and on the other hand, many things that take place outside the school may still clearly be directed towards school tasks and learning. While this distinction is helpful and interesting, we must also ask how far we can extend distinctions like this and how long will they hold. Discourses of digitally connected classrooms have celebrated the possibilities new technologies may bring in eradicating the boundaries between school spaces and others. As Gourlay (2021b, 60) points out, “the digital is frequently discussed in terms which suggest a ‘breaking free’ from the constraints of physical spaces and temporal frames, particularly when discussing mobile digital devices.” However, the seamless ideals

of digital and interconnected education also mask the flashpoints bubbling under the surface, emerging in the tensions between classroom practices and mobile technologies or public education and platform capitalism.

The aim of this article is to look at two methodologies with a potential for mapping these emerging educational spaces and the flashpoints therein without turning a blind eye to the re-negotiations and breakdowns that are present. Taking inspiration from Gallagher (2019) and Alirezabeigi, Masschelein & Decuyper (2020a), we propose the need for methodologies that are able to bring out the ‘cracks in the sidewalk’ behind the smooth façade of digitally connected classrooms. This is no easy task, as digital technologies work through interfaces that hide material and social relations behind them. As a result, technologies fade into the background by design, making it easy to lose sight of human-technology relations in the analysis (Gallagher 2019). We suggest approaching digitally connected classrooms as assemblages (Deleuze & Guattari, 1987) and developing methodologies that see technologies as practices. This means exploring how they entangle with other actors and societal relations. Through examples taken from our methodological experiments, we hope to demonstrate how this has enabled us to peer behind the seamless surfaces of some technologies – into the human and non-human co-operation required to keep them running smoothly, and flashpoints that emerge when this co-operation fails.

## 2. “Taking leave from the surface” – the need for sociomaterial approaches

Our starting point is the idea that in order to understand the interconnectedness and complexity of ed-tech and schools, we need methodologies that can go beyond the surface of technologies and map them as assemblages. There are a number of ways we can be stuck on the “surface”. Gallagher (2019) points to how the material aspects of technology can easily be ignored in the analysis. Alirezabeigi et al (2020a) warn against seeing technologies as functioning too perfectly and propose a focus on breakdowns and disjunctions as a potential site of research. Decuyper (2019) argues that technologies should not be seen as static entities but instead as practices that are constantly being enacted in different ways. It is these enactments and practices that we should focus on, not what the technologies theoretically or ideally are.

For us, approaching digitally connected classrooms as assemblages (Deleuze & Guattari, 1987; Paakkari, 2020; Thompson et al., 2021; Paananen & Grieshaber, 2022; Piattoeva & Saari, 2020) has meant exploring them relationally and investigating how contextuality changes what a technology does in a given situation. For example, an enquiry into the role of mobile devices in classrooms leads us to the connections between devices, classrooms, digital labour and platform capitalism (Paakkari & Rautio 2018; Paakkari 2020). Looking at the surface of mobile devices in classrooms and following their connections to gain a view of digital labour and platform capitalism value production reminds us of what Marx (1887) writes in the chapter on The Buying and Selling of Labour-Power in *Capital*.

”Accompanied by Mr. Moneybags and by the possessor of labour-power, we therefore take leave for a time of this noisy sphere, where everything takes place on the surface and in view of all men, and follow them into the hidden abode of production, on whose threshold there stares us in the face ”No admittance except on business.” Here we shall see, not only how capital produces, but how capital is produced.” (Marx, *Capital I*, p. 123)

The enduring power of Marx’s analysis comes from the way it shows how capitalism functions by hiding the central tenets of its operation. While talking about the “so-called original accumulation” it shows that the starting point of capitalist production, the “voluntary” buying and selling of labour-power, can only take place once the so-called original accumulation has dispossessed the working

class from their means of production and recreated them as workers who have the liberty and necessity of selling their labour-power on the market. They may be free but are also forced to enter the market since they no longer have any other means of subsistence. Similarly in the above excerpt, Marx suggests that the realities of production cannot be seen from the surface where things seemingly operate through a fair exchange between “Mr. Moneybags” and the “possessor of the labour-power”. Only by looking beneath the smooth surface can we understand the frictions and negotiations determining the exact conditions of this fair exchange.

Taking inspiration from Marx, we ask what remains unseen under the surface of digitally connected classrooms. Methodologically, we need to pay attention to the human and non-human details that make these connections work. As Gallagher (2019) and Gourlay (2021b) suggest, we should turn our attention to the materialities behind the digital. So far, there has not been enough emphasis on critical in-depth and up-close analysis of educational technologies (Decuyper, 2019). In order to fully understand digitally connected classrooms, we must pay close attention firstly to how the technologies operate, and secondly to how they are entangled with their environments. We believe our approaches show promise in both regards.

Next we turn our attention to the study of breakdowns and frictions as potential tools for understanding what happens under the surface. Two important inspirations for our approach have been Gallagher’s (2019) article on expanding the scope of media analysis in childhood studies, and Alirezabeigi’s et al (2020a) article on the possibility of using breakdowns as keys to analysis of digital schooling.

### **3. Breakdowns and hidden materialities**

Ethnographic focus has traditionally been foremostly on human actors. The ethnographic eye has focused on life in school, with the school as a somewhat static frame for human activity that animates surrounding matter and is at the centre of the research. As Alirezabeigi et al (2020a) write, ethnography has often perpetuated the division between active humans and passive objects. In the case of digitally connected classrooms, we are forced to reconsider how technologies participate in the defining of education and what we consider as school. This makes the case for a sociomaterial school ethnography that asks how school is constantly being made through relations and associations between human and non-human. One of the challenges here lies in how well technologies project the illusion of smooth and seamless functionality, shielding us from their gritty operations and technical choices. Much of ed-tech research has centred on user perspective. This can partly be due to long-standing human-centric traditions and difficulties in building non-human perspectives, but is also symptomatic of how well technologies operate (Gallagher 2019). The aim of interface designers is to make the devices seem self-evident and hide the machinic calculations supporting its activities. In this sense, the research preference of user perspective is evidence to how well the algorithms operate and how successful they are in decontextualizing technology. To borrow Gallagher’s (2019, p. 6) expression, exclusive focus on the *use* of technology can lead to findings that “merely confirm the effectiveness of designs that have been deliberately engineered to capture human attention and thereby capture surplus value.”

In approaching ed-tech and classrooms through a sociomaterial approach, we encounter tech-school events as assemblages. In this article we are especially inspired by Alirezabeigi’s et al. approach of investigating digital doings through breakdowns (2020a). While the inspiration for a breakdown-centred approach comes from a long ANT tradition of focusing on the unusual and the failing, such as Latour’s (1996) study of the Aramis transportation project or Vaughan’s (1996) study on the explosion of the Challenger space shuttle, Alirezabeigi et al. show its usefulness in a digitally

connected classroom. The starting point of their investigation is that schools are not only organized around human actors. The idea of “breakdowns” is used as a heuristic device for noticing the in-depth relations between human and non-human actors in a technology-mediated school environment. The authors argue that when the typical constellation of actors breaks down in one way or another, it has the potential of revealing something from the order that usually stays hidden. In relation to ed-tech this can also be a powerful way of disturbing their tendency of fading into the background. Gallagher (2019) argues that this tendency is also reflected on the level of research which still concentrates on technology use, largely ignoring a more comprehensive investigation on the social and material aspects of technologies. To Gallagher, this is only an illustration of the efficacy of the machinic interface which operates exactly as designed, hiding the inner workings and agentic connections of the devices from users and researchers alike.

Alirezabeigi et al (2020a) identify four breakdowns in classroom technology use. Breakdowns are chosen as a way of introducing moments of disagreement and negotiation into the seamless passage of technology-mediated classroom life. The first breakdown deals with a cyberbullying incident that leads to the teachers collecting all student smartphones in a basket. The authors see this as bringing to light the importance of the rhythmic interplay between classroom teaching and the personal stuff that students regularly check on their phones. The second breakdown is caused by a terrorist attack that disrupts the world surrounding the school and shows how the world leaks into the school through the devices. The third breakdown is a timetable breakdown caused by the students being suddenly called into the auditorium. The final breakdown is caused by construction work that mistakenly cuts the school’s internet cable and causes a significant loss of connectivity. This leads to the classes being relocated all over the building in search of a Wi-Fi signal. The authors show how this actually reveals the interconnection between classrooms and digitality. Internet is not only an addition to schooling but a vital and necessary component.

The usefulness of breakdowns as a methodological tool is in the way they point to something that is not immediately obvious or visible in the situation. When the habitual ways of living are interrupted we can gain a look at the processes that sustained them and kept the parts of the assemblages together. Taking this as inspiration, we will now turn to our own research in search of similar possibilities.

#### **4. Two cases of mobile schooling**

We will now turn to our two recent investigations on mobile schooling. The first is a research on upper secondary school students’ mobile phone use during school days that was carried out in 2015-2017, the second an investigation into Covid-19 distance school and video conference teaching in upper secondary school carried out in 2021. We refer to these as two cases of *mobile schooling*: in the first case, we investigated how mobile devices question educational spatialities, bringing new actors and power relations into classrooms (Paakkari, 2020; Valasmo, Paakkari & Sahlström 2022; Paakkari & Rautio, 2019). In the second, it is the school that moves as traditional teaching space is being re-negotiated by video conferencing technologies that reconfigure classroom participation (Valasmo, Paakkari & Sahlström, in process).

We use the idea of mobility in mobile schooling as a reminder of the need to stay methodically flexible. Digital technologies challenge school spatialities in interesting ways and can be no more presumed to stay the same in the future than so far. Methodologies must be ready to shift and move along with their research participants. Digital media research must be able to follow the actors into their lifeworlds. This requires inventiveness and the willingness to re-negotiate research designs. Pink et al. (2016) encourage experimentation as a fundamental part of digital ethnography. Neil Selwyn et al. (2017) also remind of the constant need for renewal. Technologies change and are contextualised

in new ways. With digital ethnographies we are constantly faced with the possibility of once innovative and insightful methodologies losing their ability to engage with emerging digital contexts (Selwyn et al., 2017).

#### **4.1. Mobile phone ethnography**

In 2015-2017 we were part of a research project that inquired into the changing reading and writing practices of Finnish upper secondary school students. It was soon evident that in order to thoroughly investigate students' reading and writing, we would need to better understand the texts they produced and encountered on their mobile devices. Through several iterations we constructed a research apparatus that allowed students to share their mobile phone screens with researchers. It consisted of students and their phones; video cameras in the classroom; laptops in the corridor; Wi-Fi modems; a mirroring application; and researchers using the laptops. Participating students had phones with either Android or iOS operating system. They either used their own phones or could borrow a device from the project. With Android phones, we used a screen casting application Mirror Beta<sup>1</sup>, developed by a company called ClockworkMod. On iOS (iPhones) we used the Airplay screen casting feature that was built into the operating system. A Wi-Fi modem was used to create an encrypted network into the school for the student and the researcher to connect into. Once both were in the same network, students could project their screen content onto the researcher's computer which then recorded it as a screen capture video. While one researcher was outside the classroom using a laptop, another was in the classroom following the student with a video camera. These two recordings were then combined into a single video feed showing the student with the phone screen image popping up on the screen whenever the phone was in use.

Because of the level of required technical complexity, our research assemblage included more technological parts than customary in ethnographic research. In its eventual form the data was constructed of a classroom video camera recording overlaid with a feed showing the phone screen of an individual student. The technology-heavy setup meant that data production required the careful co-operation of video cameras, microphone transmitters, microphone headpieces, microphone connecting cables, batteries, memory cards, mobile phones, screen mirroring applications, laptops, power adapters, extension cords, Wi-Fi modems, video editing software and portable hard drives. The technological complexity and the fact that researching mobile devices deals with intensely personal data also meant that we had to carefully consider the ethical implications of the research. We paid close attention to the fact that participants always knew when they were sharing content with us and after the recordings we went through the data with them in order to make sure they were ready to share the data we intended to use. The participants appeared to be well aware of the recordings which could be seen in the way they joked about the presence of the researchers in their school life. (Valasmo, Paakkari & Sahlström 2022). While this may have had a potential effect on how the phones were used we were able to produce a significant amount of data of phone use in varying school contexts.

What this approach afforded us was a look beneath the surface of mobile device use. The data guided us towards the flashpoints of digitally connected classrooms, showing the devices as parts of assemblages, relationally entangled. This enabled us to start reaching beyond the affects of seamlessness and uninterrupted surface. With regards to mobile devices and social media, what emerged were relations of production in platform capitalism (Srnicsek, 2017) and digital labour (Fuchs, 2014; Fuchs & Sevignani, 2013). Looking at mobile technologies in school through the

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<sup>1</sup> The name of the app has since changed. In December 2018 it was available on Google Play store under the name of Screen Recording and Mirror <https://play.google.com/store/apps/details?id=com.koushikdutta.mirror&hl=en>

practices they are enacted in gave us a chance to analyze emerging student-technology associations instead of seeing them as ready-made entities. Practices are not pre-given but shaped by the relations between actors who enact them, as Decuyper (2019) writes. One example of an analysis this approach afforded was an event where a student is browsing the photo-blog application Tumblr while sitting in the back row of an upper secondary school psychology lesson. While the lesson is situated in a traditional classroom setting and takes place during a cloudy winter morning, the media content the student is browsing shows images of sunny beaches and memes questioning the disciplinary practices of school. (Paakkari & Rautio, 2019). It also produces sexuality and desire in a markedly different way compared to the framing of puberty as the body's preparation for reproduction which is what the psychology lesson deals with. At the same time, many of the images are explicit invitations to consumption and overlaid with brand names and advertisements. Reading this together with Deleuze & Guattari's concepts of de- and re-territorialization (Deleuze & Guattari, 2003) highlighted the way in which capitalism works through the production and re-orientation of desires. This gave us a chance to analyse how mobile technologies bring the economic and power relations of platform capitalism inside the classroom, and how these become entangled in the school, becoming parts of the assemblages of digital schooling (Paakkari & Rautio 2019). During the research, we could examine how students engaged in digital labour throughout the school day and how the classroom was reconfigured as a place where one could simultaneously participate in classroom interaction and produce, curate and circulate content on global social media platforms (Paakkari, Rautio & Valasmo, 2019). We could also see that digital labour was not always easy and straightforward and how there were meticulous rules governing content production and how, as content producers, students had to cater to the assumed needs of their audiences (Ståhl & Kaihovirta 2019).

Seeing mobile devices entangled in classroom activity enabled us to understand that while it was *possible* to do these things while being present in the classroom, there was indeed a price to pay in that participating in the classroom interaction was often tricky with students missing the key moments in which to enact their participation (Sahlström, Tanner & Valasmo, 2019). Participation is enacted in the interplay between students bodies and screens, as an assemblage (see also Mehto, Riikonen, Kangas & Seitamaa-Hakkarainen, 2020). Only seeing a single part of this assemblage would not enable us to understand the full complexity of what is going on. While the technologies of digital schooling foster the illusion of seamlessness, looking beneath the surface shows the flashpoint of the work that is required for holding the assemblages together. The assemblage of a digital classroom requires the constant effort of students who tie the different elements together (Valasmo, Paakkari & Sahlström, 2022; Sahlström et al., 2019). Without this work the elements are in danger of separating, leading the assemblage to dissolve and fall apart. This can be seen in Sahlström et al. (2019) which looks at how fragile the assemblage of classroom interaction actually is in relation to mobile technologies. While students using social media are seemingly participating in the classroom interaction, they are in fact constantly a few moments too late to successfully participate in the context of teacher-led plenary teaching: for example, they raise hands moments too late for the teacher to notice and never get a chance to speak. This shows how the practices of the participation are constituted in the assemblage – in the teacher-led plenary teaching this means that the teacher asks questions and the students must be able to answer them within a given timeframe. In the context of the social media application their participation is perfectly successful. However it does not match with the participation criteria of plenary teaching.

The approach helps us to see how students hold together the assemblages of boundless classroom. Seeing the different rhythms of classroom and mobile interaction gives the possibility of seeing the work the students engage in to tie these different rhythms together. It shows how students produce the boundless classroom through practices, by tying the different rhythms together. In Valasmo et al. (2022) we engage in a detailed analysis of how a student manages the parallel streams of social media

content and classroom teaching and works to maintain participation in both during a lesson. The presence of the social media application is made possible through the constant efforts of the user and the programmed flexibility of the device-application entanglement. Tsing (2015) emphasizes the polyphonic rhythmicity of an assemblage: it is the intertwining and coming together of autonomous rhythms that intertwine. Tsing takes an example from a factory that serves multiple supply lines and is constantly switching between different products and clients.

“The factory’s job was to match industrial coordination to the complex rhythms of supply chains [...] The farther we stray into the peripheries of capitalist production, the more coordination between polyphonic assemblages and industrial processes becomes central to making a profit.” (Tsing 2015, 24).

Studying mobile devices with this research approach helped us see the coordination required to hold the elements together and notice the flashpoints that emerge as the assemblages of digital schooling rub against (Piattoeva & Saari, 2020) the practices of plenary teaching.

## 4.2. Distance school ethnography

In 2021 we participated in a project that looked at the practices of Covid-19 distance schooling and the experiences of upper secondary school students and teachers. At the time of the fieldwork, the school already had significant experience of various distance school practices and the teaching had somewhat settled around video conferencing tools like *Zoom* and other educational platforms such as *Itslearning*, *SpeedCrunch* and *GeoGebra*. This time we constructed a research apparatus around portable GoPro video cameras for the students, eye-tracking glasses for the teacher, and computer screen recordings for all. The resulting video footage allowed us a ‘student viewpoint’ of a typical distance school lesson. The students were sitting in their homes, some in living rooms and some in their own spaces, typically at a desk. In front of them were books, notebooks, pens, laptops and mobile phones.

Our aim was to create a system that would give us a chance to see to the background of virtual classroom activity. This would enable us to understand its complexities, the disagreements and negotiations sustaining it. In this sense, the data proved fruitful in at least two ways. Firstly, what the view at the students’ rooms afforded us was insight into the material surroundings of distance schooling. As Gourlay (2021b) points out, the discussion around Covid-19 online education has often perpetuated the ideas of free-floating human subjects that are freed from material constraints, even these subjects must still make spaces between laundry and cardboard boxes at their homes in order to enable the digital interaction. The description of digital practices as “messy assemblages of human and nonhuman actors, unfolding in the nitty-gritty material and spatial circumstances of the homes” (Gourlay 2021b, 62-63) seems entirely fitting. Distance school practices brought students’ homes – and by extension their parents’ social, cultural and financial capital – in to view in a new and perhaps more immediate manner. Instead of a publicly funded school classroom, the students now assembled virtually from their homes where some sat in lavish surroundings in the midst of well-cared design furniture and others sat in their modest rooms in ascetic surroundings.

Secondly, the outside of the computers provided by the portable video cameras gave us a possibility to examine the workings of Zoom algorithms. In Valasmo, Paakkari & Sahlström (in process) we conduct an in-depth investigation into how the Zoom video conferencing software reshapes the interaction and participation patterns in a distance classroom. The starting point is seemingly simple: students say that they would have liked more interaction during lessons and all lessons blended into each other, seeming the same; teachers spoke of how difficult it felt to engage with the students online and how easy it was to end up having a monologue. A closer analysis led us to analyze the role of the software in constructing and maintaining the interaction patterns. This brought out several surprising

conclusions. It seemed that the gestures and interactions that have been culturally understood as participation in a classroom no longer produced the intended effect of participation in distance teaching. The traditionally predictable lines of visibility in a classroom suddenly became unpredictable online: while Zoom allowed many user thumbnails on the computer screen simultaneously, most of the teaching was carried out with the teacher sharing their screen with students which meant that typically only four student thumbnails were visible on the teacher's screen. In other words, instead of seeing the whole class, the teacher typically only saw four students. To further complicate this, the way the software allocated visibility seemed unpredictable for the students. While most students had their video on, this did not guarantee being seen by the teacher since the software seemed to allocate visibility on the basis of microphone activity. In practice this meant that a student who never spoke and kept their video off during the whole lesson, could end up as one of the four students shown on the teacher's screen if they had their microphone on and it became activated from a random sound (such as keyboard noise). Meanwhile, other students had their camera on and performed traditional participation gestures, such as nodding in reaction to the teaching, but did not become visible on the computer screen and therefore remained completely unseen by the teacher.

Sociomaterial critiques on the prioritization of user experience and human agency mention the lack of interest in materialities surrounding digital technologies (Decuyper 2019; Gallagher 2019; Gourlay 2021b; Alirezabeigi et al. 2020a; 2020b; Hohti, Paakkari & Stenberg 2019). In Gallagher's analysis, a sociomaterial approach leads him to a "geology of media" that connects the bodies of the children mining for cobalt in the Republic of Congo to the users of the mobile devices in the global North. In the case of the distance school, we were left to ponder how video conferencing technologies encounter and reproduce bodies. The fundamental disconnect/re-configuration was situated in where on-site classroom participation is produced through bodily gestures such as posture shifts, gaze directions and raising hands, the video conferencing software constructed participation primarily as an acoustic phenomenon, ie. through the activation of the microphone. Things that activated the microphone became registered as participation, consequently affording the student on-screen time. However, the traditional markers of participation went unnoticed which led to the bizarre situation of students visibly actively participating to the lesson in their homes but the software ignoring this and giving the screen space to black screens with the video turned off. The teacher was left ruing the lack of participation and the students bemoaned the difficulty of getting through to the teacher. A sociomaterial analysis showed how this was actually the result of choices made in the software development and the technical capabilities of the laptop microphones and cameras. The distance lesson seemed to operate in a diametrically opposed way to a classroom with regards to participation: we saw an emergence of a flashpoint where those who wanted to participate (demonstrated their participation corporally) were denied, and the ones who wanted to remain hidden (kept their cameras off) were shown.

## **5. Discussion**

A sterile and undifferentiated conception of interconnectedness can serve as an ideological smokescreen hiding the negotiations and disagreements between the supposedly interconnected parties. With regards to ed-tech and digitally connected classrooms, what often remains hidden are the power relations between different actors and the ways in which digital technologies are never immaterial but always supported by human and non-human materialities. Investigating the assemblages of digital education may help us to steer clear of techno-utopist fantasies in which human capabilities are endlessly and frictionlessly enhanced through technological innovations. In the above, we have wanted to search for methodologies that would enable us to peer into the "hidden abode" of production and labour. This has helped us to question the technological promises of a shiny surfaces.

In this we align with Gauthier's (2014, 194) idea of a "necessity to introduce queer objects into the field".

Looking at the material aspects of schooling may also lead us to ask: what is the classroom and does it have a unique function? An on-going debate between traditional classroom teaching versus spatially unlimited lifelong learning posits the prior distinctly into the past and the latter onto the future (Gourlay 2021b). In this discourse, education becomes an increasingly individual affair that is not limited by spatialities or temporalities. These discourses are evidently very much driven by ed-tech visions of the future (Selwyn et al. 2020; Williamson 2019). At the same time, research seems to suggest that many students in the affluent and highly educated West are more exhausted and experience higher levels of stress than before (Löfsted et al. 2019). Perhaps the theorists who suggested that expanding the sphere of knowledge work would become exhausting were right? (Berardi 2009)

As we have seen, digitally connected classrooms are not immaterial or free from power relations. Technologies drag power relations and ideologies with them and flashpoints emerge where these rub against each other. As Tsing (2015, p. 23) writes: "assemblages cannot hide from capital and the state; they are sites for watching how political economy works. If capitalism has no teleology, we need to see what comes together." While technologies create new connections and expand classrooms outside their traditional environments, they also create new hierarchies. Algorithms are a central tool in defining how technologies connect with and reassemble surrounding activity. In Kitchin's (2017) definition, algorithms comprise not only the codes but their uses in social settings. Algorithms have their own curriculums in the sense that they contain expectations and valuations about what is considered important. In other words, algorithms are also ways of shifting influence on curriculum from the public sector to private technology developers. The challenge in this is that it is very difficult to see inside an algorithm. Users often have very little insight into how the algorithms governing machinic activity make decisions and are constructed. Algorithms are designed to stay imperceptible, quietly operating on the background. Often they only manifest themselves when something goes wrong and technology does not operate as intended, as some cases discussed above showed. While it is important to research algorithms on a technical level, social scientists and educators can make important contributions by seeing algorithms as assemblages and focusing on technology as a practice.

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