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Whose interest is educational technology serving? Who is included and who is excluded?

¿A qué interés sirve la tecnología? ¿quién está incluido y quién excluido?

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ABSTRACT:

This article gives an account of what is happening nowadays in the intersection of education and technology. It aims to offer an overview that starts not in the present but in the past so that we become aware of how more often than not we are trapped in political rhetoric and capitalistic discourses. Headings in newspapers from 1963 read, "Crowded schools. Overworked teachers. In today's education turmoil, can your child obtain the personalized teaching that every child, average or advanced, need?" and for that problem the solution proposed was technological, hence, little has changed in relation to the crowded schools and overworked teachers. I then scrutinise the present through the invasion of platforms and the accompanying Silicon Valley discourse about universal solutions to education concluding that the situation does not look very different than at the beginning of the 20th century. The future is illustrated using my own research giving an account of my sociological oriented approach to educational research in the field. Critical realism and realist social theory are described briefly and proposed as a theoretical framework to think about these issues in a less deterministic way, giving its due importance to the local. It offers a theory-driven approach to a methodology that thinks about how to capture the daily entanglements of students with open and participatory digital tools in the context of their studies looking at uncovering the invisible thus hidden structures that operate as constraints for students' agency in their digital practice.

KEYWORDS: digital practice, technological determinism, critical realism, realist social theory, educational technology.

RESUMEN:

Este artículo da cuenta de lo que está ocurriendo hoy en día en la intersección de la educación y la tecnología. Tiene como objetivo ofrecer una visión general que comienza no en el presente sino en el pasado para que seamos conscientes de cómo con frecuencia estamos atrapados en la retórica política y en los discursos capitalistas. En los titulares de los periódicos se lee desde 1963: "Escuelas abarrotadas. Maestros desbordados de trabajo. En la confusión de la educación de hoy, ¿puede su hijo obtener la enseñanza personalizada que todo niño, estándar o avanzado, necesita?" y, para ese problema, la solución propuesta fue tecnológica, por lo que poco ha cambiado en relación con las escuelas abarrotadas y los profesores desbordados. Escudriño a continuación el presente a través de la invasión de las plataformas y el discurso de acompañamiento de Silicon Valley sobre soluciones universales a la educación, concluyendo que la situación no parece muy diferente a la de principios del siglo XX. El futuro está ilustrado con mis propias investigaciones que dan cuenta de mi enfoque sociológico a la investigación educativa en este campo. Se describen brevemente el realismo crítico y la teoría social realista y se proponen como marco teórico para pensar sobre estos temas de una manera menos determinista, dando su debida importancia a lo local. Ofrece un enfoque teórico de una metodología que contempla cómo capturar los enredos diarios de los estudiantes con herramientas digitales abiertas y participativas en el contexto de sus estudios buscando desvelar las estructuras invisibles y, por tanto, ocultas que funcionan como restricciones para la agencia de los estudiantes en su práctica digital.

PALABRAS CLAVE: práctica digital, determinismo tecnológico, realismo crítico, teoría social realista, tecnología educativa.

NOTAS DE AUTOR

- * Caroline Kühn Hildebrandt is an associate lecturer at the Institute for Education. She teaches different subjects across the university. She is a fellow of the Higher Education Academy and an active member of the Society for Research in Higher Education and the Association for Learning and Technology. Her research interest lies in the intersection of education and technology with an interest in social change. Student's agency in open digital spaces is a particular interest of hers. Her research is informed by social theory.

Whose interest is educational technology serving? Who is included and who is not? Which is the problem to which technology claims to be a solution? These are the questions that inspire this article, they come from a place of struggle while crafting the intellectual puzzle of my dissertation. I have been thinking deeply how often research in educational technology fails to capture the daily struggles that students face when trying to make sense of such a complex social structure as the Web, ubiquitous yet not always a welcoming space to interact with. If we look at the proceedings of the 2017 European Distance Education Network (EDEN) conference, we can see how much is devoted to problems of scale but little to the voice of students and were, in that scale, are their needs and struggles included. One of the keynotes, Georgi Dimitrov, who set up the European Institute of Innovation and Technology, did acknowledge in his speech the need for more work at the micro level around the present and messy reality of students' daily entanglements with digital technologies if we aim at generating any sort of change in the field of educational technology in higher education.

I will answer these questions going back in history and thinking about, for example, how did Edison think his discovery would transform education. I will look at similar issues more in the present and think about where are we standing today, how revolutionized is education and who are the beneficiaries of such 'revolution', if any? We refer to the past in order to situate ourselves in the present and guide our journey into the future, as Audrey Watters reminds us in her brilliant account of 'the history of the future of education (2015)', where she wonders about how we have envisioned the future in the past. Through history, we will be able to acknowledge that technology and its combination with education is nothing new. Despite hundreds of years of history, the plea for revolution and disruption has not yet been fulfilled and it is my guess we might be better off if we think not in terms of revolution but in terms of humble change.

Technology is, we cannot forget, a product of the human mind, it is not a magical thing that comes from a mysterious place and suddenly takes over human practice bringing some sort of supernatural changes with it. Instead, technology, in whatever shape or form is an intellectual artefact envisioned and created by humans through practice and for practice. As Karl Popper (1978) would say, a product of the World Three. Following Popper's theory, there are three worlds, World One is the world of living and not living things, objects and organisms, World Two is that of psychological processes where we make sense of our experiences giving meaning to them and World Three is the one where the products of those processes reside, it could be a book, a sculpture, a theorem, a physics law and so on. This world is where intellectual artefacts are created, not in isolation of the rest but in interaction with it. By saying this I want to stress the fact that technology is part of us, it is socially constructed and weaved into our social tapestry in different ways, it carries the moral precepts of its designers and it entails a history of human doings, interacting and thinking. I believe that educators and learners need to regain ownership over technology and look at ways in which it can be integrated with endeavours of co-design and co-production and not only for matters of efficiency, mass production and/or maximizing profit. Technology can do both, harm and immense good. The example of the gas cameras for killing Jews 'more efficiently' and the life-saving discovery of penicillin illustrates this paradox. Both are technologies. Both are created by humans. Both carry a set of values and moral beliefs. Both respond to completely different agendas and are underpinned by different political discourses, they were put to completely different uses thus they generated two completely different sub-universes, one of mass destruction and one of mass construction.

If our aim is to co-produce knowledge and co-design spaces of resistance as bell hooks and Paulo Freire would encourage us to do, I am wondering what type of questions need to be asked in the field of educational technology so that the notion of social science research that is developed through this agenda is more democratic and emancipatory (Selwyn & Facer, 2013) hence oriented towards social change. In this spirit a more critical study of educational technology can be embraced in the hope to identify spaces of resistance and find ways to make those spaces opportunities to enact change, so that different values, that of students

and teachers are weaved together into the social fabric of society hoping in that way to foster a more inclusive learning experience that encourages resistance instead of blind compliance.

WHAT CAN HISTORY TELL US ABOUT EDUCATIONAL TECHNOLOGY?

Almost a hundred years ago, Thomas Edison predicted a revolution would happen in education due to the obsolescence of the book in schools. He was involved in the technological invention of the motion picture, as Audrey Watters (2015) tells us in her brilliant account of the history of the future of education. Citing Thomas Edison from Cuban's book, *Teachers and Machines*, we can see how the obsession to revolutionise and disrupt education was present in his writing, "I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks" (Cuban 1986, p. 9). At that time, he complained about the inefficiency of schoolbooks and said,

I should say that on the average we get about two per cent efficiency out of schoolbooks as they are written today. The education of the future, as I see it, will be conducted through the medium of the motion picture... where it should be possible to obtain one hundred per cent efficiency.

Half a century later, Skinner, the famous Harvard psychologist believed that, "(...) teaching machines are destined to revolutionise our educational system and that in a few years they will supplant largely, if not entirely, the use of teachers" (Skinner, 1968, p. 1). For Edison and Skinner, it seemed clear that technology and education was a combination that would 'inevitably' bring a revolution to society. But, is that the revolution we really needed? Do we need to get rid of teachers? Why would we want to have a learning experience that includes the new technology but excludes humans? We can infer from these quotes some of the moral values that are embedded in the technologies at stake or at least in the use they are going to have in education. If I read these quotes through the ideas of Hamilton & Friesen (2013) who think about technology from a more philosophical perspective, I ask myself which discursive knowledge is the motion picture mobilising, and Skinner's teaching machines? For sure the discursive knowledge of the learning practice is one that should not have teachers in it and it ought to be a hundred per cent efficient. What pedagogical principles can we see embedded in the use of motion picture and teaching machines in education? Which are the values of those technologies in relation to the position the teacher occupies? Why is the important matter to supplant teachers instead of enhancing their practice through the new medium? Why is the motion picture a tool for efficiency and not for enrichment, why is the technology not envisioned as a new medium that allows the teacher to explore new ways to teach? Efficiency and automation, so it seems, have obsessed thinkers already a century ago.

There are many other illustrative examples but for the sake of space, this one suffices to show that questions around efficiency, automation in education, and technology are nothing new. The idea of technologies threatening to disrupt education seems to be part of the picture already in 1922 but the promise of radical change and disruption has not yet been fulfilled (I recommend Watter's article with many illustrative examples about the history of the future of education). If we scrutinise the ideas of Edison and Skinner and we think who benefited from these new technologies, who was included and who excluded in the technical design of the motion picture and any other teaching machine, it can be inferred that teachers are clearly not the beneficiaries from these technologies, on the contrary, they are completely excluded from the picture but also, being threatened to lose their jobs. No wonder many teachers were/are reluctant and fiercely opposed the adoption of technology in their teaching practice. Wouldn't you be so too?

DOES THE PRESENT LOOK DIFFERENT?

In present times the debates are not so much around motion picture and its 'revolutionary' effects in education but around the 'power' of platforms as some sort of innovative learning machines that will completely transform education bringing a revolution from Silicon Valley to the rest of the world. So we are told. I am sceptic when I hear such statements about universal technological solutions for education with statements that discount the local experience, the value of context and the particularities of each student and how all of those elements shape the learning experience. A platform is a technological system that can be programmed thus customized by people from outside, e.g. users. I am not against platforms as technologies that can be used in education, platforms can be useful technical frameworks, but how they are designed, what comes into that framework, who makes that choice is a completely other story and that is the story we need to write, the story we need to craft with care and criticality. As Watters argues (2012), the programmatic aspect of platforms is where the attention needs to be. I coincide with her, the open Web is my favourite education platform, but little of the open web is left for education, instead, there are a plethora of closed commercial platforms that offer as Edison did a hundred years ago, to revolutionise and disrupt education through universal solutions making the learning experience efficient yet personalised at the same time. This sounds rather paradoxical to me! And more paradoxical when we think about how little can students do in that endeavour of personalisation. These educational platforms, e.g. Blackboard, are hermetic spaces where students have no access to design any transformation. They kill from the beginning the very idea of student's agency and identity in digital spaces, such an important matter to stimulate in a society that is digitally mediated and technologically driven not only for matters of education but more and more for all matters of daily life.

The use that has been given to the different technologies, be it the motion picture, Skinner's learning machines or the different Silicon Valley platforms, touch on the idea of technological determinism that many scholars have elaborated upon (Coleman, 2008; Hamilton, 2008; Hamilton & Friesen, 2013; Selwyn, 2010; Selwyn & Facer, 2013). That is, associating, hence defining technology in relation to the practical processes we attach to them, in so doing we ignore that technologies are the outcomes of concrete development processes whereby its functions are delineated in relation to social practices, we ought not forget they are man-made. This makes us overlook the discursive and interpretive process out of which technical things emerge (Hamilton & Friesen, 2013). In this way the complex ecology where technology is designed and envisioned is invisible, bringing with it the danger to define technology relative to the practical purposes that users assign to them. In this same line of thoughts, Selwyn & Facer (2013) encourages us to work, not from our privileged position and experience with digital technologies, maybe the case of Edison, and definitely from the Silicon Valley Divas, but connected with a more politically aware and sociologically grounded narrative of change that understands educational technology as an,

intense site of negotiation and struggle between (...) different actors. These are struggles that take place across a number of fronts, from the allocation of resources to the design of curriculum, from maximizing the profit and political gain to attempts to mitigate patterns of exclusion (Selwyn & Facer, 2013, p. 5).

Definitely, not the place where Skinner was coming from. It is this negotiation and struggle that needs deeper exploration and for doing so Selwyn & Facer (2013) suggest approaching this analysis with criticality instead of blind enthusiasm fueled with utopian rhetoric. Among the points they stress is the need to opening up the black boxes of educational technology, which in their words entail two things, to bring to the fore the negotiation and struggle of technological practices, which in my view, is what is avoided in the current agenda of educational technology, and to critique the logic of the inevitability of sociotechnical change, that is, we need to question the idea that the progress driven by technological innovation follows an inevitable course but also the assumption that new technologies have inevitable internal logics of development no

matter the circumstances (Selwyn & Facer, 2013, p. 9). I believe this sense of overall inevitability block teachers from acting as there is the illusion that whatever they do, inevitably, nothing will change thus they are disempowered from the very beginning.

Counterarguing this idea of a neutral technology that drives inevitable change, Bijker and Law (1992, p. 3, as cited in Selwyn & Facer, 2013) put forward an understanding of educational technology that relies more on the social, that is, technologies are socially constructed, shaped and negotiated among different actors and interests, as Wiener (1980) would say, technologies have internal politics, they are the outcome of competing agendas. Technologies have implicit in their design and implementation a particular type of order, they allow some behaviours and impede others (Matthewmann, 2011). As said before and in line with Selwyn & Facer (2013), technologies carry with them a set of values, “(...) power is centralized, hierarchies are embedded, allocation is uneven, and there are structural constraints between social classes” (p. 10), or between hierarchies, I may add. Implied in this assumption is the idea that individuals and institutions need to adapt to technological change if they want to stay in the loop of development. Once more the drive is to adapt instead of resist, stasis but not genesis.

All of this becomes evident when we think about particular learning management systems (LMS) – platforms– that are part of most of Higher Education Institutions techno-material systems, or may I dare to say as Foucault would have suggested, ‘the apparatus’. These spaces, also called virtual learning environments (VLE) are mostly commercial platforms that are a perfect example of the uneven distribution of power which brings with it an uneven distribution of agency, being the student left with little to contribute in that space. I wonder what is the working definition of education for the designers of those LMS? Which are the features embedded in the VLE that are reflected in society? Who decides about these platforms? Whose money is invested in it? What are they privileging and financing? Whose interest does the VLE represent? For sure not students’ interests, nor an attempt to personalize student’s experience as has been promised for so long. A big part of what HE is interested in is to be able to gain access to student’s data, data relevant to matters of engagement or at least what they call ‘engagement’. Engagement is key to spot who is potentially dropping out, so it can be cached on time, like the fish that wants to escape the bowl. As Jesse Stommel (2017) tells us in his article, ‘If bell hooks made an LMS’, “Because the learning management system is a red herring, a symptom of a much larger beast that has its teeth on education: the rude quantification of learning, the reduction of teaching to widgets and students to data points”. Stommel concludes that bell hooks would not have created a VLE, to begin with as she might have said that such places are not for us to build. In general, all those management systems as they stand are, as Sean Morris (2017) says, closed systems which students must adapt to, and in order to adapt, they have to give up their agency. He goes even further saying, “They become their data, and while they may find ways to feed certain data into the system, they have no power to resist their own reduction to numbers, patterns, and statistics”. One can see how the VLE plays an important part in the administrative apparatus of the university. The VLE being itself an apparatus which as Foucault suggested is located in a power relation, and as such it appears at the intersection of power relations and relations of knowledge (Agamben, 2009). The actual intersection leaning to one side, namely to the side of the university who articulates their educational vision through the techno material systems they have in place.

These issues and others have been addressed in recent calls for special issues in academic journals that are related to educational technology. One of them is already published and the title is quite eloquent to the point I am making, *More than tools? Making sense of the ongoing digitization of higher education* (Castañeda & Selwyn, 2018). The special issue responds to the overarching question of how might we develop critical perspectives and alternative visions of technology in higher education? The editors argue that in the case of ‘learning management systems’ or ‘learning analytics’ there is a strategic association between learning and technology that masks the political, economic and cultural aspects of the system, the technology making us think that what is privileged is the learning. But as the authors argue, it is well known that the main function of LMS is to support management rather than learning. Once more, Foucault’s ideas of the apparatus are

relevant in that he argued the nature of the apparatus is strategic which implies a certain manipulation of structures either so as to develop them in one direction or block them (Agamben, 2009), the latter being the dominant direction of the VLE.

WHO OUGHT TO BENEFIT FROM DIGITAL TECHNOLOGIES IN THE FUTURE?

Looking at one century of history in educational technology is scary! It seems to me that if we want the future to be more human/learning centered there is a need to walk away from issues of efficiency and management and walk towards humanising the research agenda giving due importance to investigating the messy and always chaotic present of student's daily entanglements with digital technology. One way to do this is thinking about education and technology with a sociological lens, as it has been suggested by different scholars mentioned along this article. This view does give us a different stance to look at the current state of affairs and recognizes the danger of ignoring all that has been exposed above. In this section I would like to offer less of the current public and scholarly debates which I did in the previous section and share my personal experience as a researcher interested in exploring social reality from a critical realist perspective informed by Realist Social theory in the work of Margaret Archer (Archer, 1995, 2000, 2003). This perspective I consider, as Castañeda & Selwyn (2018) suggest, offers an alternative way of looking at the use of technology in educational settings. The idea of adopting a critical view is not to dismiss educational technology but to find different angles to think about it. Inspired by Foucault's thought that everything is not bad but dangerous, I have embraced the ethical-political choice to identify which is the main danger when overlooking what is happening in students' academic (open/closed) digital practices and why so many of them are not-engaging with digital tools, let alone with open and participatory tools when it comes to study. I have written elsewhere (Kühn, 2014, 2017) about my alternative approach to the alienating VLE as a learning space. My approach is inspired by the not so old idea of personal learning environments (Attwell, 2007; Castañeda & Adell, 2013; Porlán et al., 2016) as a self-crafted open learning space that could potentially provide students with the opportunity to engage in an experience of critical pedagogy as conceived in the work of Freire and hooks, that is, an education that engages students politically. I have thought carefully about the benefits that designing an open learning space would provide to students in many respects, in particular as a space to enact and exercise agency. But agency not as an empty signifier, instead, as a verb that is to be conjugated with political teeth as hooks (1994) would suggest us to do. But this is not a simple endeavour as it is often portrayed in educational research, it will demand effort, resources, time and lots of (inside and outside) struggle, so much needed for deep learning and its concomitant transformation to happen. My evidence (Kühn, 2017) shows that some students are not ready yet to embrace this endeavour seamlessly, naturally and effortlessly as people would like to believe. Students are all but not natives in this matter of reflexively engaging with open and participatory (Hergarty, 2015) facilitating an even greater global sharefest of resources and knowledge created by educators (Brake, 2013) digital tools in academic spaces, some of them feel anxious and unprepared to embrace such intellectual adventure because they fear the risk that is inherent in any adventure. I believe truly that students and teachers ought to embrace risk and uncertainty, namely, the adventure of becoming if what we aim to do is to offer opportunities for transformation. Hooks is inspiring in this matter, "For me, the place of radical openness is a margin, a profound edge. Locating oneself there is difficult yet necessary. It is not a 'safe' place. One is always at risk. One needs a community of resistance" (1989, p. 19).

Critical Realism (CR) is a part of that community of resistance, a space to think differently and deeply about social phenomena. A space that embraces the unpredictability of the social world accepting reality as messy and complex thus emergent, open and chaotic, becoming, processual, and often relational. Reality is seen as complex and multi-layered (Oliver, 2011), it is conceptualised as a causal network of interacting forces. I believe that future research in educational technology inspired by CR (Bhaskar, 2008) provides an alternative approach to look at deeper levels of social reality, to transcend the obvious, that what lies

at a superficial level and dig deeper into a level that transcends the senses. This deeper level of reality is determinant if we want to think about educational technology as a site of negotiation between agency and structure embedded in a cultural milieu that carries its own history. Critical realism is not an empirical programme; it is not a methodology; it is not a theory. It is rather a meta-theoretical position in sociology (Archer, 1995; Bhaskar, 1989) that is, a reflexive philosophical stance interested in providing a philosophical informed account of science and social science which will enlighten empirical investigations. The main interest on CR is on the impact and causal powers or generative mechanisms of social and cultural structures despite the fact they are invisible (Archer et al., 2016).

I have chosen CR as a broad ontological and philosophical framing that supports my argument that digital practices and their concomitant capabilities (understood in the work of Amartya Sen (Martins, 2006; Sen, 1995)) are not given but contingent, they are always in the making and constantly negotiated (Cronin, 2017) use, and reuse of open educational resources (OER. Within that metatheory, I propose to use realist social theory (Archer, 1995) to explore the interplay of structure, culture and agency in the context of (open/closed) digital practices embedded within the institutional culture of higher education. The framework allows to see beyond the obvious, that what cannot be observed empirically but nevertheless exists and has the ability to cause, to make things happen in the world (Danermark et al., 2002). At the same time, but more specifically, realist social theory allows to explore the long-standing debate on culture, structure, agency and ensuing practices in a way that it does not obscure the ontic difference between culture, structure, and agency, making it possible to explore the interplay of them. In so doing it permits both, exploring how digital reflexive engagements in formal and informal contexts are shaped by that interplay but also to define reflexive engagement (Donati, 2013) in the context of (open/closed) digital practices. Realist Social theory offers conceptual tools to define action as a distinct entity endowed with different causal powers, operating across time and space in the social world (Herepath, 2014).

Archer (1995), argues for an understanding of human experience in the world as partly free, autonomous, and enabled by structural circumstances, but at the same time, constrained and refrained by them, recognising an ongoing tension that mirrors the way in which students themselves experience most aspects of their digital practice. Realist Social theory recognises the interdependence of both, structures and agents within a particular culture, but not in a deterministic way. Case (2013) elaborates upon this referring to Marx: “Men make their own history, but they do not make it as they please; they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past”. Archer’s approach highlights that human experience, hence student’s experience, derives “from what we are as people and how we tacitly understand our social context” (1995, p. 29). To summarise, this framework offers me the advantage to conceive students not as completely subjugated or determined by social structures nevertheless affected by them, but with the capacity (exercised or not) through their causal powers, to have the autonomy and ability to potentially act and generate social change that will have an impact in their lives. This is what I advocate for throughout my work as a researcher, emancipation and freedom through the exploration and exposure of the real but hidden generative mechanisms in student’s (open/closed) digital practices so that they become aware of what is constraining and/or enabling their practices and device, together with teachers, strategies to overcome them, and in so doing they will strengthen their agency and become vehicles of change in their own practice.

The future looks bright to me, there is hope, there is interesting and relevant work to do both, exploring the messy present of students’ daily entanglement with open digital tools and rethinking, in the context of open digital practices, what is reflexive engagement, what is the nature of such form of engagement and how it offers possibilities for change. Reflexive engagement thought as a proactive way to engaging in (open) digital practices whereby agency is exercised critically and from a political perspective. I am elaborating these ideas more in-depth through the exploration of why and how students engage with (open/closed) digital tools in

formal and informal contexts. I hope that the potential solutions that are proposed by the end of my study will benefit students allowing them to become agents of social change through improving their own practice.

I am not alone in this endeavour; the scholarly community is also worried about the future of educational technology and the dominant narrative of a 'universal technological solutionism' as the ones coming out of the Silicon Valley bubble. This preoccupation has been shared by Michael Gallagher has defined it in an open call for a special issue of *Learning, Media and Technology*. Our community is worried and concerned, and it seems to me, there is traction and drive and there is a huge desire to change these deterministic narratives of universal educational systems driven, most of the times, by commercial partners with little interest in students' emancipation and flourishing. The call led, not to one special issue, but two! One will address the issues foregrounding local pedagogical knowledge and practices of learning with technologies developing critical perspectives and will advance nuanced accounts of the tensions, compromises, idiosyncrasies, and obfuscations through which digital media is shaping (and being shaped by) local practices of teaching and learning across the globe. The other issue instead will explore how these local practices are orchestrated within communities of practice, which offer rich insights about digital technologies often overlooked by broad accounts of educational technology. The intention is to advance an understanding of technology-in-use, by surfacing specific groups, communities and practitioners that have come together around particular technologies, software and online spaces. Both special issues are attempts to foreground learning practices, pedagogies, communities, and systems largely unaccounted for in contemporary accounts of digital education.

My work will contribute to our community of enquiry as described above and I am confident that it will afford new ways to exploring how students engage/not engage with (open) digital practices, scrutinising the messy present use of technology on the ground so that new questions can arise that challenge the so old efficiency obsession already present in Edison's and Skinner's predictions of educational disruption through some revolutionary teaching machines. New questions shall surface that instead of asking how the educational system can be more efficient asks how the work of teachers can be enriched through the use of technology when needed, and how can the social structures and institutional culture that are possibly constraining student's agency in digital spaces be addressed so that social change is possible.

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