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The 'Solution Stack' of a Neoliberal Inferno Apparatus: A Call for Teacher Conscience

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Abstract
Education technologies have a growing capacity to control and influence students and teachers. However, policy and industry goals with these technologies are evolving into ambitions that go beyond improving learning outcomes and facilitating teaching. Policy and industry see data-generating EdTech as the means to a larger socio-technical 'solution stack' that can serve the neoliberal project. This position paper looks at the complex 'apparatus' emerging through the use of data-intensive algorithmic systems, which are often imposed by policy and promoted through industry's marketing rhetoric. This apparatus is fuelled by data and claiming pedagogic authority in schools. It is linked to industry workforce demands and influence over how education should meet them. We describe this apparatus and define its properties through substantial desk research of public policies, white papers, presentations, and other relevant documentation. We argue that as schools are roped into serving this apparatus, the teaching profession is compromised. In it, teachers are steadily downgraded to 'line operators' of software and data collection. Based on Gert Biesta's 'gift of teaching' as a 'gift of truth giving' that defines teachers' role in the classroom, we call for their conscience to resist this apparatus, which can only harm learners and their futures.

Keywords EdTech · Teachers · Datafication · Neoliberalism · Data pipelines · Cradle-to-career · Critical pedagogy

Introduction

The beauty but also the biggest challenge of teachers is that theirs is one of the few professions left undefined. A staple exercise in many teacher credentialing programs is to develop one's teaching philosophy and go on to teach with this

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vision at the forefront of pedagogic decision-making. For example, Gert Biesta (2013: 8) holds the philosophy that 'education must always make place for that which cannot be foreseen as a possibility, that which transcends the realm of the possible'. Many teachers would feel as if the profession were a calling strictly for the multitude of gifts the job affords, such as, the gift of being part of the greater community, the gift of a lasting impact on one's life and imparting knowledge. It is these 'gifts' and varying definitions of education built from the soul of the practitioner that Biesta (2013) describes to be the gift of teaching. In a word, he positions the teacher as a truth giver.

However, a new truth is upon us as societies enter the second decade of the twenty-first century. From the gift of teaching, the teaching profession is transforming into a race for data collection, managing leader- and score-boards, juggling software applications (apps) and platforms, charging, and repairing devices. The digitisation of education, propelled through policy and the recent health pandemic, has opened doors for a rather intense focus on digitising everything in and about education. The teacher—the truth giver—seems more like a 'line operator' of apps and platforms in the classroom. The teacher is now tethered to dashboards watching which student is in the 'red box' (being in trouble) or in the 'green box' (doing well in class) as though on a 'command console'. The philosophy of pedagogy is mutating into data management and software products.

This philosophical transformation has been discussed considerably (Giroux and McLaren 1989; Cuban 2004). Education has been the permanent territory for political debates, blamed for failing and simultaneously used as the means to yield human capital (Means 2018). For decades, this shift away from the notion that public education should be the place where students find their voice and develop a sense of self has been gradually yielded to the goal of producing a docile workforce for a rapidly changing and hungry-for-growth marketplace.

Digital technologies are deeply integrated in schools through data-intensive systems such as student information learning management and intelligent systems. Amassing, eschewing, and generating substantial data, analytics, automation, and prediction, this advancing software is capable of identifying when students may be lacking motivation or predicting who is likely to be depressed or cheat (Hillman and Esquivel 2022). Quick response (QR) codes are used to track students' movements in school (Cox 2022). Platforms collect attitudes, thoughts, and feelings from children to profile them (Azevedo 2021; Hillman and Esquivel 2022).

How the collected data is used, processed, and how it influences pedagogic decisions, and teaching and learning is hard to tell. It is with these mediating properties that educational technologies (EdTech) are acquiring powerful capabilities for control and influence in education – and control over students and teachers (Selwyn et al. 2021).

This is not all there is about the capacity of these technologies in public education. Their greater scope is manifesting in a much larger orchestration. They begin to form part of something like a techno-solutionist 'stacking' or layering of complex functions once data becomes available and continuously generated. This stacking builds into an *apparatus*, an engine that becomes a powerful economic tool in a neoliberal political economy, which demands speed, efficiency,

and workers to power it. Data and EdTech systems present the opportunities both for utilising efficiency and linking economic needs for labour with education. In this paper, we describe this apparatus and how it fits the neoliberal project.

Before we continue, we wish to bring out two points of clarity. First, we address K-12 public education classrooms in the USA. Second, we refer to the economic force of neoliberalism. While we leave it to the experts to defend or reject it, here, leading discourse on neoliberal economics demonstrates the motivation behind the 'solution stack' we describe. We take on the neoliberalist view which posits that markets will always self-correct, and that politics (at least in the USA, the main setting of the paper) should adhere primarily to the values and the wellbeing of the market. However, as Nick Couldry argues:

> 'Neoliberalism proper' identifies something more than the spread of markets into new areas of life … it is the principle that market functioning is the privileged reference-point for organising how governments - indeed, all modes of social organisation – must operate … [which] overrides other political principles, whether of social welfare, non-market ('public') provision of goods, services or resources, or non-market modes of bureaucratic organisation. (Couldry 2010: 23)

As we demonstrate, 'the principle market functioning is the privileged reference-point for organising' (Couldry 2010: 23) education, too. Critical work has already looked at such mechanisms for organising higher education as a function of market wellbeing (Hall 2019; Peters et al. 2019). Hall argues that the higher education institution is 'repurposed' so that 'its activities, social relationships, cultures, supply chains and so on enable the production of commodities that can be exchanged' (Hall 2019: 45). Further still, he describes neoliberalism as an 'infection' of academic labour, cultivating a climate of competition that has become normalised among higher education.

We build on this as we focus on how a similar organisational structure is intended for the earlier years of K-12 education via data intensive algorithmic systems. With the digitisation of schools, data becomes the means to monitor, predict, and influence curriculum in ways that it aligns with industry needs in terms of workforce.

We posit that given similar critique of how higher education is transforming to mere servant of economic needs (Peters et al. 2019) and to neoliberal economy, schools are viewed as the means to power the market economy by producing cheap and adequately skilled labour. Adequately skilled labour will look after the wellbeing of the market. We argue against this logic that undermines the teaching profession and does not guarantee quality education or future economic opportunities. At any point, the market can metamorphose and change its needs, leaving behind those it has spent decades training.

First, we position our argument within critical pedagogy, as we adopt the engineering concept 'solution stack' (Fig. 1) or 'software stack'. It entails various subsystems or components that make up a functioning machine of sorts that is engineered to produce a specific output.

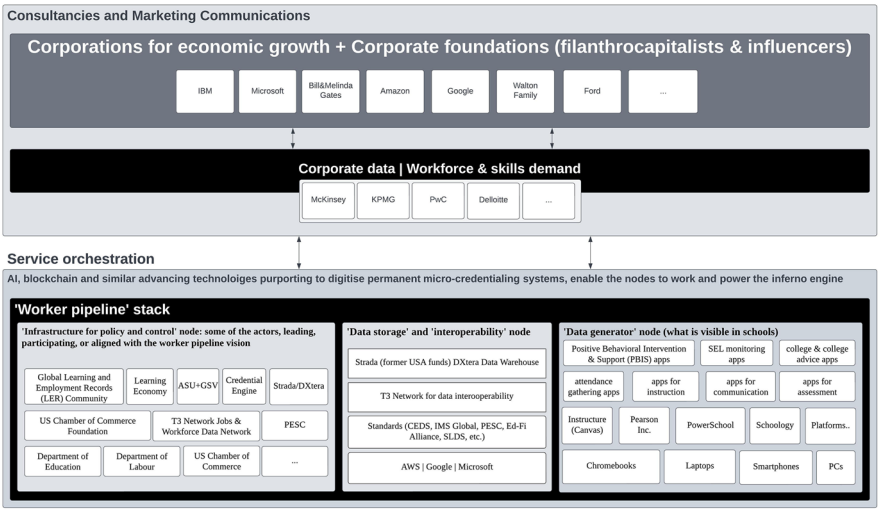

Fig. 1 A 'solution' stack combines technological (hardware, software, connectivity) and data nodes, with a political and economic layer shaping and simultaneously influenced by consultancy and media (Velislava Hillman)

We adopt this concept to visualise the layers of EdTech, policies, frameworks, strategies, and industry needs that rise up into what Pierre Bourdieu (1998) calls a 'neoliberal utopia'. Here, reality is embodied in 'a kind of infernal machine' (100) which transforms education into means of labour (re)production. It is important to note that much of the technologies and proposals come as philanthropic gifts fuelling what becomes known as *philanthrocapitalism* (Geismer 2022).

This trend of using private funds to stimulate productivity among public institutions assumes an image that educational institutions are incapable of operating efficiently and need both financial support and business expertise. Even more so, however, the budding partnership of public and private market dealings eliminates 'democratic accountability and transparency from the policy process' (Geismer 2022: 13).

As public institutions are being funded with private monies, policymakers become accustomed to the generosity of private donors, but also 'infantilised', in a sense disempowered, (Mazzucato and Collington 2023) and unqualified to maintain a critical and watchful eye of the philanthropic gifts influencing education. Even more so, politicians embrace these new gifts as they come with the promise that, should industry be allowed to influence public education, the educated individuals will find work and purpose back in industry.

Second, we choose Biesta's definition of education as a gift (Biesta 2013) to juxtapose what is entirely *un*-educational about the 'solution stack', which we describe as we expose evidence that has helped us to define each of its layers. Specifically, we analyse existing and publicly available literature, presentations, and proposals for innovating and changing education through digital innovations and analyse relevant policies.

Next, we trace these initiatives in the US to demonstrate EdTech's mass adoption and schools' growing dependence on the 'solution stack'. While we acknowledge the opportunities from digital technologies, we name the growing dependency of educational processes on data systems and highlight their inherent problems as they are built only upon promise rather than explicit evidence.

We call for proactive governance, in the best interest of children *before* harm occurs as a result of the infiltration of advancing algorithmic systems and their capabilities to serve a more neoliberal market project. Rooted in the philosophical work of Biesta (2013) and his notions of teaching as a gift, we also call on teachers to recommit to their roles and responsibilities that come with their profession with their critique and resistance of emerging classroom technologies for the preservation of public education's sovereignty, as for now many still possess the autonomy to control pedagogic execution (Cuban 2017).

To do so, we argue that within the functions of the presented 'solution stack' for which we claim is transforming education, the teaching profession is severely compromised by downgrading it to a mere 'line operator' of algorithmic systems. Failure to critique the 'solution stack' can lead to an impoverished education for children and the demise of teachers' profession.

The 'Solution Stack'

The 'solution stack' or software stack is an engineering concept and, at first sight, has nothing to do with teaching. Here, we speak to educators and in tandem describe software terms in relation to teaching. The reason is that software has become part of the teaching practice and the classroom to the extent that teachers unwittingly are its important component—but also its determinant. If teachers refuse to use any software in class, there will simply be a pile of unused hardware and software in a corner somewhere. In reality, policy mandates make sure that teachers use software for many reasons: to enable accountability measures (software collects data that shows how a school is doing), to justify the money spent on the software, and for the greater potential of advancing software (since users like teachers and students help software improve).

Within a neoliberal context, the drive for economic growth and maintenance of the market (a big condition of the philanthrocapitalist partnership) is also to ensure the right labour market fulfils industry's needs. And so, software becomes an important subsystem which can determine what labour is needed and what skills are being taught in school. The software therefore stacks around this objective as part of the larger 'solution stack'. All the layers of the 'solution stack' connect concentrically to create spheres of influence and steer education.

One layer is called *service orchestration* (Fig. 1). It has at least three 'nodes': *infrastructure for policy and control*, *data storage and interoperability*, and *data generator* nodes. Some of these components, such as the infrastructure for policy and control and data storage and interoperability nodes, power back-end processes. These are typically invisible to teachers and students. Here, data storage primarily signifies the education data concentration and accumulation.

The data storage node is not in a singular, centralised, domain, but siloed in various cloud providers [mostly on Microsoft, Google, and Amazon Web Services (Williamson 2022)]. To overcome the silos and ensure a more granular 'view' of how education and its stakeholders are doing, policies and solutions have been introduced to drive for common data standards and interoperability. Therefore, the data storage and data generation nodes increasingly begin to look like streamlined data pipelines [or, as others call it even more crudely: 'plumbing' (Learning Education Economy 2020: 7)].

The importance of this particular layer of the 'solution stack' is that it immediately draws attention to the power these pipelines can wield. Should such data pipelines allow for data interoperability (the systems share data with each other), this in turn would allow for advancing data manipulation, inferencing, and prediction. Since priority is the wellbeing of the market, such capabilities mean that prediction and inferencing can be made around what skills are needed to power the economy and influence education to focus on these niche skills.

A second layer—*media*, *consultancy*, *and communications*—represents the convoluted courting between consultancy firms, media, and corporations. In *The big con: how the consulting industry weakens our businesses*, *infantilizes our governments*, *and warps our economies*, Mazzucato and Collington (2023) argue that the biggest consultancy firms, such as PriceWaterhouseCoopers, McKinsey, and others, perform a confidence trick to carve their way into legitimating their expertise and capacity to advise governments on all matters from EdTech to climate issues.

Along the way, they obfuscate corporate responsibility, while consultancies' work manifests in policy, media coverage, and corporate decision-making. We trace some of the biggest consultancy firms' narratives on 'the future of education', the role of EdTech in it, and the future of work (Sanghvi and Westhoff 2022; Bryant et al. 2020) to policies driving the digitisation of education and streamlining cradle-to-career pipeline development as the means to aligning industry labour demand with education supply. Within this layer is media. It plays a powerful role as it legitimates the digitisation of education because it often blurs the lines between evidence and market discourse (Yu and Couldry 2020).

As such, the 'solution stack' is an onerous proposition for education because its goals are driven entirely by data with capitalist motivations. Like in an electric circuit, data-intensive systems have the capacity to close into a self-reinforcing loop: data enables predictive analytics; predictive analytics enables influence in curriculum; in a neoliberal political economy, the loop aims to satisfy market priorities and the wellbeing of the market.

There is nothing educational about this 'solution stack'. We see it as a euphemism for technocentric idealism, which posits that any complex social problems can be solved through technology (Papert 1987). In education, technocentrism is expressed by decision-makers' total faith in technology as the ultimate solution to any educational problem. As some scholars contend (Picciano and Spring 2013), the technocentric notion manifests neoliberalism, especially profound in the US, where education is commodified for the market of EdTech.

It is with this increase in commodity to which a disconnect arises as dependency on digital technologies grows (Hall 2019). Put otherwise, as EdTech inserts itself in education at any level, the teacher, as the pedagogical expert, loses autonomy to the newly settled digital pedagogue whose commitment and quality is unknown.

The 'Solution Stack' Promises to Fulfil Labour Market Needs

In computing, a 'solution stack' or software stack is a set of subsystems necessary to create a complete platform in ways that no additional software or components are required to support applications and functionalities. Here, we bring evidence to support our design of the planned 'solution stack' in public education because of its growing digital transformation. We analyse existing and publicly available literature, presentations, reports, consultations, and proposals for innovating and changing education through digital innovations. We review policies and strategies on how each layer is envisaged, while these have been detailed with greater focus elsewhere (Hillman and Bryant 2022).

Service Orchestration

Over the past decade, digital technologies in education have evolved in their offerings. Beginning as digital interfaces with varying functionalities has morphed into what we can compare to an iceberg. The interface on the top is what the user accesses and sees; a depth of complex operations and capabilities stack at the bottom is what the end-user never sees, knows how it works, or has any control over. The data capabilities and opportunities for exploitation remain invisible to the user.

However, they become a promising blueprint for extraction of granular information, for prediction, and for influencing decision-making. Many proponents in the market of data systems, standards, and interoperability solutions offer how such insight can be extracted and what that would mean for the future of education and the economy.

For instance, the so-called Internet of Education (IoE) network (Learning Economy Foundation 2020) is positioning itself as a uniform entity and while the IoE network's members remain obscure. Their goal is 'to design a pluggable Verifiable Credential (VC) and Verifiable Presentation (VP) protocol (VCP) in line with World Wide Web Consortium (W3C) international standards to enable interoperable and portable exchange, storage, and programmability of credentials' (IoE Network n.d.). Their intention is to create a general infrastructure through which education can be owned and operated under the principles of the neoliberal economy—drive efficiency through an interoperable programmable unified system.

Part of this IoE Network are Strada (and its project DXtera Institute), the Learning Economy Foundation, Credential Engine, and others, all meshed into the *infrastructure for policy and control* nodes (Fig. 1). Their goal unifies as they all envision a sort of coordinated initiative for stamping credentialing of students, making real-time supply-and-demand link between employer and job seeker but also between industry labour demand and education skills training and development.

Strada Education Network [formerly United Student Aid (USA) Funds (Fein 2017)] is a non-profit organisation seeking to develop pathways between education and employment. Their work revolves around research and philanthrocapitalism by

funding companies and seeking to influence policy and engineer the *service orchestration* layer (Fig. 1).

Their research focuses on student choice of education, experiences during education and training, and outcomes, 'including persistence, completion, employment, and socio-economic outcomes' (Strada Education Network n.d.).

However, there is no knowledge or enough understanding about how and at what granularity such data is generated, with whom it is shared, by what means it is collected, and what purpose it serves from there on. There also lacks substantial proof that the aims of Strada Education Network and the entire IoE network are ethically sound and benefit all students and are not simply experimental in nature.

Strada Education Network supports DXtera Institute and other similar initiatives all of which have similar motivations in education: to provide 'scalable solutions to remove digital integration barriers' and 'advance EdTech integration' (Strada Education Network 2017).

While both Strada and DXtera's initial efforts are to build a 'solution stack' around post-secondary and higher education, their interests expand to primary education (DXTera Institute n.d.b) [e.g., see DXtera's work at the European Union through its EdTech Alliances, input into the Broadband Commission Data for Learning Working Group, and its contract with the European Commission to establish a Community of Practice to support a new Digital Education Hub].

The AI EdSAFE Alliance, a DXtera Institute community offspring, is 'committed to establish a healthy ecosystem in the AIEd industry' (DXtera Institute n.d.a), attracting the commercial stakeholders to a common goal in finding means to access data for the development of AI in education. As one of the founders put it:

> one significant challenge in education technology is the lack of access to large scale, high quality, labelled datasets that authentically represent communities of people. Communities like learners, employees, job seekers, and even employers. This lack of data significantly limits the ability of the AI community to build and test effective models and tools. (Allen 2021)

Put simply, Allen's plea is for schools to release data so that industry can develop and train their AI products. In DXtera's words, only after data is accessed and effective models and tools are built can provision for 'overall improved and customised educational services to students' be made possible (DXtera Institute n.d.a).

The 'Multiple Stakeholders. One Vision' (Kim 2019) of another non-profit organisation called Postsecondary Electronic Standards Council (PESC) reflects similar ambitions. Its mission has been to establish and adopt 'trusted, free and open data standards across the education domain' for its community of data, software, technology service providers and vendors, educational institutions, professional, commercial, and non-profit organisations.

The goal is to provide 'approved standards [to] enable cost-effective connectivity between data systems, networks and applications'. Data pipelines, as it were, would allow 'necessary data to flow automatically and seamlessly from one network, system or application to another when and where needed…' (PESC n.d.). PESC's ambition mirrors DXtera Institute's.

Similar visions are expressed also from the U.S. Chamber of Commerce Foundation (USCCF) and a list of PESC members, who collectively 'look[s] to progress efforts as a member and participant in the Chamber Foundation's Job Data Exchange (JDX) and T3 Innovation Network' (Kim 2019).

All these non-profits and consortia aim for borderless access to data from education because data fulfils the need to align workforce needs and education 'outputs'. In an event back in 2016 the USCCF directly called for a 'business-led approach for supporting K-12 schools' (USCCF 2016).

The Every Student Succeeds Act requires 'measures of career readiness as part of school accountability systems', which 'provides a new opportunity to define what it means to be career ready and to better align what is taught in schools with workplace needs'. Here, 'the option to include measures of career readiness' invites more EdTech products that can assess and collect such data about 'career readiness' to enable the alignment between 'what is taught in schools and workplace needs'.

PESC is annually sponsored by Credentials Solutions, National Student Clearinghouse, Oracle, Parchment, Degree Data, and others. Its partners include Credential Engine, DXtera Institute, and the U.S. Department of Education's Common Education Data Standards (CEDS) initiative (2020).

To this web of entities designing the service orchestration layer are Lumina Foundation [a private, non-profit with hard-to-follow financial history (Navient n.d.)] in partnership with the USCCF to 'smooth data flow in the education sector' (Duncan and Tyszko 2017) with the promise of 'getting it right'. This means:

> better and more comprehensive learner records, improved and more transparent credentialing pathways, and better job opportunity data for learners who are also job seekers…a new partnership between the U.S. Chamber of Commerce Foundation and Lumina Foundation that will explore the new public-private data infrastructure of the future. (Duncan and Tyszko 2017)

As Tyszko, vice president of USCCF's Centre for Education and Workforce, proclaims:

> Interoperability and better data integration is important for students, education, and business alike. This project will not only help Lumina reach its national credentialing goal of having 60% of Americans with a high-quality postsecondary credential by 2025, but also will help the business community better locate the talent they need to grow and succeed in today's economy. (Duncan and Tyszko 2017)

The aim of the above is for data interoperability to create constant seamless data streams that will flow freely from schools. Subsequently, data can flow back from industry and the labour market. Moreover, as visualised in Fig. 2, employer, or industry representative, is envisioned to determine critical skills requirements.

Here, data plays a crucial role in 'communicating' what the employer decides is critical to pass on for curriculum adjustment, none of which considers student or teacher voices.

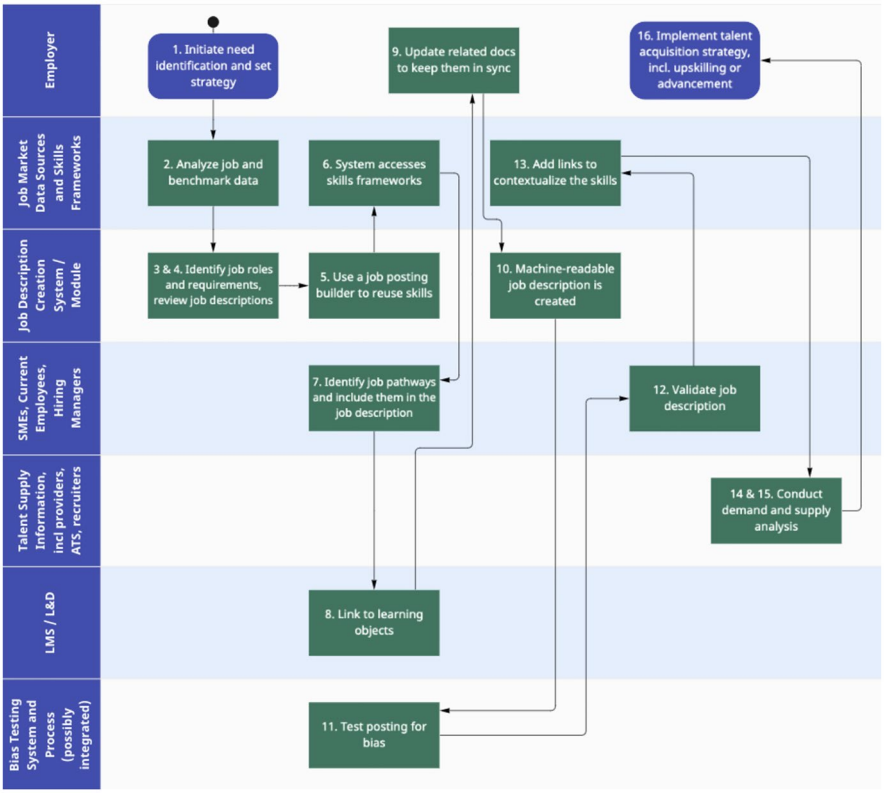

Fig. 2 U.S. Chamber of Commerce Foundation and T3 Innovation Network. (T3 jobs and workforce data network 2022)

In 2019, a white paper (American Workforce Policy Advisory Board 2019) was published about interoperable learning records by a working group that expressed the demand for the American Workforce. It highlighted the need to have interconnected and verifiable learner records to 'more efficiently match people with jobs that will benefit both workers and employers by reducing time to hire and creating a more efficient labour market' (American Workforce Policy Advisory Board 2019: 4).

The working group has representation from what we have outlined to be both the *corporation and worker pipeline* nodes. Organisations such as USCCF (2021) are described in this white paper as leveraging 'participants in the Talent Pipeline Management project that brings together employers, employer collaboratives, education providers, and Human Resource technology service providers' (American Workforce Policy Advisory Board 2019: 31).

In 2014, Tyszko himself made a call to action on behalf of the USCCF introducing the need for a demand-driven data system built upon supply chain principles. He dubs this approach 'talent pipeline management' (USCCF 2014: 9).

The argument made is that as the US faces a 'skills gap', it is 'a threat to American growth and competitiveness' and 'US employers are increasingly reporting problems finding qualified workers … particularly in manufacturing' (6). The solution pitched is lessons in supply chain management. For example,

> supply chain management calls for companies to make sophisticated 'make and buy' decisions. This starts by removing any unnecessary product or service features that may increase costs and reduce responsiveness without adding value to the customer. (USCCF 2014: 12)

USCCF's call to action eventually morphed into a five-part copyrighted 'Academy Curriculum' in 2021. This blueprint for the *service orchestration* node was funded by none other than Strada Education (USCCF 2014). The goal of turning education into a pipeline for workers is clear. Additionally, translating the quote within the context of education suggests a tragic fate for education.

The question remains whether by 'removing any unnecessary product or service features that may increase costs and reduce responsiveness without adding value to the customer' it is insinuated that curriculum can or should be narrowed by removing any subjects that a student may not need to cover should such subjects have no value to their future employer, the USCCF's primary customer.

Data Generator and Data Storage Nodes

Data collection in education continues to grow both as a political response (National Forum on Education Statistics 2021) and as a result of the increasing use of EdTech in the classroom. Historically, debates related to data collection and use have evolved from hopeful (Cunningham and Milam 2005) to worrisome (Hillman 2022). Hope that EdTech will improve education has manifested not only in hefty EdTech investments (Escueta and Holloway 2019) but also in continuous structural, pedagogical, and curriculum reorganisation.

The historical narrative that schools are failing (U.S. National Commission on Excellence in Education 1983) has been closely accompanied by the consistent emphasis on the role of data in developing accountability measures.

From this logic has followed another. The need for more data leads to the need for more technologies and accountability measures such as standardising assessments (Brady 2012) and standardising data collection [e.g., the Statewide Longitudinal Data Systems, which collects data from birth throughout the schooling of a child (Strauss 2018)].

It is this goal for data interoperability in education that has motivated the *infrastructure for policy and control* node and its growing membership of public and private entities to seek and/or offer solutions. Data interoperability can enable predictive analytics, profiling, and inferencing. Data interoperability sets fuels the 'solution stack' and promises to enable dynamic restructuring of education to fit labour needs or any other goals.

The Common Education Data Standard (CEDS n.d.) is a data interoperability template available for districts and states to adopt and implement (NFES n.d.). CEDS is a state-wide 'initiative … to streamline the understanding between and across P-20W' (National Forum on Education Statistics 2021). This is data across the early years, kindergarten, primary, postsecondary, and workforce institutions and sectors. CEDS's proposed 'common language' (National Forum on Education Statistics 2021: 7) for data interoperability has attracted an expanding network of third parties that adopt it.

The CEDS Data Warehouse 'has the capacity to support the full P-20W data pipeline' (CEDS 2020). It partners with learning agencies, public and private higher education institutions, the US DoE, the US Health and Human Services, and the US Department of Labour; education data standards organisations; and powerful members of the private sector (CEDS 2021: 3).

Some are directly related to education, others are not (InnovateEDU 2021). Supporters of the *infrastructure for policy and control* node are also the T3 Innovation Network (USCCF), Bill & Melinda Gates Foundation, Lumina Foundation, Microsoft, Google, Walmart, and other corporations or foundations whose unifying mission is:

> to enable the digital transformation of the talent marketplace by promoting data interoperability and harmonisation across diverse stakeholders, including: employers; education, training, and credentialing providers; government agencies; and technology partners so learners and workers can better pursue education and employment opportunities. (T3 Innovation Network n.d.)

Infrastructure for Policy and Control Nodes

Policies enable data collection and mandate a digital future for education. There is little choice for teachers to go completely non-tech in the classroom and neither is there for children. Policies also envision data utilisation, through interoperability, and cradle-to-career data collection. These fuel the *worker pipeline stack*.

The worker pipeline stack is an expanding network born out of the USCCF. The T3 Innovation Network explores 'the emerging technologies and standards in the talent marketplace to create more equitable and effective learning and career pathways' (T3 Innovation Network 2022a, b):

> This network has grown to more than 500 organisations working together to change the way we provide, access, and use educational and workforce data by using advanced technologies like AI, blockchain, and others to create an open and decentralised public-private data ecosystem. (US Chamber of Commerce Foundation 2022)

The T3 Innovation Network aims to 'harmonise data' in ways that allow both the talent pool and employers to be 'better aligned' (T3 Innovation Network 2022a, b) with the new economy. In other words, companies seeking particular talent can find help from the private sector and scour a catalogue of individuals that possess

the sought-after skills (Credential Engine 2021). While the figure below highlights Rosetta Lens as the metamodel, the network architects behind the model include companies such as Credential Engine a 501(c)(3) organisation, whose mission is 'to bring transparency to all credentials in the marketplace' through a.

> cloud-based Credential Registry, which is designed to house common, searchable, and comparable information about all credentials — from diplomas, badges, and certificates to licences, certifications and degrees of all types and levels. By using this Registry, students, credentialing bodies, employers, and more will have access to critical credentialing data needed to make decisions about both education and career. (Credential Engine 2018: 1)

Initiatives of data and worker pipeline development already exist in Career and Technical Education (CTE) (Hillman and Bryant 2022). The climate of policies and structures which foster data extraction for student tracking and profiling—or powering the *worker pipeline* stack—has enabled corporate influence in CTE. Both policy and industry have seen the opportunity to use data to align what is taught in school with labour market needs.

Federal agencies, including the Department of Labour (DoL) and the Department of Education (DoE), provide funding and other support for states to establish boards and agencies for the development of workforce plans and systems with focus on employment and economic outcomes (The Washington State Board for Community and Technical Colleges 2019).

Some policies have proposed to section states into industrial regions (State Training and Education Coordinating Board 2020). According to them, state workforce plans design and steer the local workforce development efforts including education.

Policies are also driving for more data collection—the *data generator* and *data storage* nodes (US Government Accountability Office 2016). The California's Cradle-to-Career Data System Act (CCCDSA) (2019) envisages 'state-wide data infrastructure that integrates data from various partner entities' (4) from K-12 data to college, student financial aid agencies, state labour agencies, and so on. The Act proposes identifying and tracking predictive indicators for the provision of appropriate interventions, identifying the impact of early education on student success, college access and completion, and so on.

CTE is not a one-size-fits-all program in public education. Once funding is obtained, county offices, school districts, and individual schools can then choose to use funds to best suit the vision, mission, needs, and demands of the student populations once approved by the school board.

There are two points worth noting here. First, the CCCDSA requires hours long professional re-training and development, which impinges on teachers' pedagogical imperative. Students lose out on the wider opportunities of teachers' pedagogic expertise which is now reduced and redirected toward working for data collection.

Second, students are being incentivised to participate in CTE programs through the use of award systems—tokens, badges, college credit, diploma seals—a focus on accumulation (consumption), rather than knowledge. As stated from the CCDSA Operational Tools Assessment Report, students will 'only experience the full benefit' of the new envisioned tools if 'districts improve data accuracy, align the tools

with their local district policies and priorities, develop clear implementation plans, and encourage students to use the tools by integrating them into instructional time or required college and career planning workshops' (Bracco et al. 2020: 17).

As Fig. 2 states: 'Employer determines critical skills requirement'. While this may seem like an opportunity to keep education relevant to the economic and technological demands of the day and promise graduates to acquire employable skills, education has and should offer more than that. In an economy where advancing technologies have turned precarious 'gig' and casual work into the norm (Means 2018), it is of little hope that watering down education to mere skill acquisition is the way to guarantee any future security or personal fulfilment.

Education becomes a knee-jerk reaction based on what a faceless industry demands today. However, education should be focusing on deeply humanistic goals of depicting the bigger picture of the current political and economic systems, of the environmental cost these systems continue to incur, and of the concentration of wealth and the deepening of disparities and inequalities.

And then, education should inspire critical thought and empower students to generate novel ideas and alternative solutions. In other words, schools should be places that foster innovation rather than a place in which innovation is imposed. Alas, the neoliberal political economy also has a big picture. It has carved its way deep into education through the apparatus we have described. Not only is public education yoked to serve purely economic values, but it is also an instrument of human control. As Alexander Means posits:

> [algorithmic education] not only embodies synergies with the security state where everyone is under surveillance at all times but is also a powerful educational and cultural apparatus to standardise and contain teaching and learning as a prescriptive endeavour to serve markets and human capital, as opposed to a deeply humanistic affair aimed at producing mass intellectuality and democratic solidarities. (Means 2018: 120)

In this 'algorithmic education', teachers should ask: what is their role and what impact are they impressing upon their students?

The Gift of Truth Giving: the Role of the Pedagogue in the Neoliberal Inferno Apparatus

In *Educational Assessment Evaluation and Accountability*, Biesta (2009) poses the fundamental question of the purpose of education and draws the attention away from the drive for measurement—datafication—to rethink what constitutes good education.

Biesta looks critically at the culture of 'performativity in education' which has risen prominently in public education, 'a culture in which means become ends in themselves so that targets and indicators of quality become mistaken for quality itself' (Biesta 2009: 35). Biesta distinguishes between *being taught by* and *learning from* and argues that learning from a teacher produces mere learning

experiences rather than the construction of authentic knowledge initiated by expertise and built upon someone's personal experiences.

These notions therefore influence a teacher's 'process of truth giving' sentiments because as Biesta (2009: 458) argues, learning 'is about how the individual relates to the truth, … rather than what the individual relates to' and how learning transcends from teacher to student. These arguments help us to assess the practice of pedagogy in the digitised classroom and call for teacher conscience and critical practice as teachers adopt and adapt to the neoliberal apparatus.

Teaching has slowly been redefined as a facilitating practice, while education has become amphibious in nature. Today, teachers live double lives operating in facilities that aim to afford learning experiences and opportunities for learning (Biesta 2007) while simultaneously churn a data operative for commercial imaginaries (Williamson 2015).

Consequently, attention shifts from what students *learn* to what students *do* or *perform* and how they 'construct' their own knowledge operationalising constructivism not just as learning theory but as a new form of pedagogy (Biesta 2013: 450). The focus diverts from the trained expert delivering instruction to the behaviours of the students and how they are constructing knowledge for themselves.

This diversion and the influx of corporations and philanthrocapitalism relishing over public education, the project for schools is made: run education like a business because 'government regulations are considered outdated barriers to educational innovation' (Brass and Lynch 2020: 14).

Propelled by big consultancy firms' narratives for the need to digitise education, philanthrocapitalism has been lubricated into education further still. Consultancies have an influential voice in support of digitising education. The foundations for the perceived need for digital innovation in education is strongly carved through the likes of McKinsey (Bryant et al. 2020), Ernst and Young (Ernst and Young 2022; Reynolds 2022), and other firms partnering with global supranational organisations like UNESCO and UNICEF (Fullan et al. 2020; UNICEF n.d.). Their discourse that education needs EdTech has justified policymakers' drive for massive investments into EdTech, while making little effort to scrutinise the businesses behind the products (Hillman 2022).

Moreover, the drive for EdTech is ingrained in the neoliberal idea for efficiency—in delivering education and, through data analytics, influencing education to satisfy market needs. As neoliberal politics root for economic growth and the wellbeing of the supermarket, education becomes the workroom for moulding human capital.

However, in the classrooms, this unfolds into a dreadful picture. EdTech products were initially introduced as tools that teachers could incorporate into their instruction in novel ways. Yet, teachers and students now depend on an excess of devices, platforms, and apps for the entire school day. Research contends how the integration of technology undermines teachers' role, robbing them of pedagogic autonomy (Kerssens and van Dijck 2022).

Many digital technologies, not solely those for education, claim to offer opportunities for access to education, content, and communities, for creativity, self-expression, and exploration. In parallel with these opportunities, however, the drive for educational

institutions' accountability, the accelerating computational capacities, and the rise of data capitalism rapidly overshadowed such opportunities by diminishing EdTech into mere data generating nodes that can feed a bigger machination.

This machination is the 'solution stack' that envisions the development of a cradle-to-career pathway for individuals, whereby industry labour demands can be aligned with the outputs of educational institutions.

This neoliberal reasoning has given way to how efficiency measures dictate policy (Berman 2022). And as efficiency measures drive policy, measuring educational outcomes becomes prioritised (Johnes et al. 2017). In what Biesta (2009) describes as the age of measurement, there is increased interest in measuring educational outcomes without giving much thought to the purpose of education, the philosophy of the profession, and learning as a whole.

Biesta (2013) argues that the actions of educators matter, and if teaching (rather than facilitating) is to be restored in education, we need to 'resist the depiction of the teacher as a disposable and dispensable 'resource' that students can learn from or not' (2013: 1). The more digital tools, services, subscriptions, and contracts are signed with third-party EdTech commerce, the less curriculum teachers themselves can create.

Teachers dedicate years of professional training to earn a licence and teach in good faith to serve communities as trusted experts of their craft. As software businesses enter education to fulfil the apparatus, they only temporarily fulfil the purpose of caring for the wellbeing of the supermarket, not the student.

Conclusion

Education is, as Biesta has defined, a gift given to societies that should not be taken for granted. As philanthrocapitalism takes hold in education and EdTech and data extraction fuels the apparatus of neoliberal ambitions, we ask: Are the world's children now being defined not by community values, cultures, and principles but by business priorities and algorithms?

Teachers are given tremendous responsibility for not only educating children but also being trusted to do so. Today, their care for students stretches beyond the classroom in unimaginable ways. Care extends from the tangible (e.g., improving learning outcomes) to the intangible (e.g., keeping them motivated, teaching them to be kind, empathetic, etc.).

Students globally now compete with peers as they are tracked and categorised, while the teacher operates and analyses them from behind a computer screen. With each mouse click, teachers are being distanced farther away from the students—their profession being redefined by the invisible machinations of the apparatus.

When teachers draft their pedagogical philosophies, the narratives come from the belief in education and belief in their role. The trained teacher is a combined factor of a line of teachers coming before her which creates a living and breathing blueprint for teaching that constantly expands in depth and breadth because a strong 'philosophy of education must always make place for that which cannot be foreseen as a possibility, that which transcends the realm of the possible' (Biesta 2013: 8).

Alarmingly today, the teacher is reassigned to be an involuntary co-partner of the inferno apparatus by collecting data and manoeuvring around apps and platforms; robbed of time to make sense, question, or resist the apparatus. Meanwhile, AI and algorithmic systems advance as students and teachers train them unwittingly through their own use. The invisible new student in the class is the AI that is thrust in the hands of students and teachers.

As it stands today, teaching cannot control, understand, or outdo the inferno apparatus. However, they should resist the new role of line operator, facilitator of algorithms, and pusher of data. Teacher conscience and expertise must re-define both education and the use of technology as tools in their classrooms and initiate robust strategies to protect the sanctity of education—of all that is of value which cannot be measured.

Building upon the notions of transcendence (Biesta 2013) to receive the gift of teaching, learning must transcend from expert to student. As it stands now, teaching does not and cannot transcend the power of the 'solution stack'. Teachers must aim to redefine education to be a gift given from them to the community for the greater good of society. With EdTech's centrality, educators are merely a second thought when developing materials for the classroom, rather than the masters of their craft.

Full integration of the described stack of the new digital ecosystem in public education leaves no alternatives or exit for neither teachers nor students. The teacher is now viewing the classroom primarily through a screen and platform dashboards.

Toggling from app to app, downloading, uploading, editing, and analysing, digital tools risk reducing the profession to nothing more than a glorified IT professional for which, in reality, a trained educator knows no better. And while teachers fight for relevance, children and young people can be a greater collateral damage.

Children's voices drown under the pressure of moving from red to green box on a dashboard; the child becomes numbers with a bottomless backpack of credentials which constantly slip in irrelevance because technologies change and, with that, industry's demands. Teachers have a responsibility in resisting the apparatus and protecting children's best interests. This paper is in defence of their profession and summons them to action.

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