6 How platformisation affects pedagogical autonomy in primary schools*

Niels Kerssens and José van Dijck

Introduction

The 'platformisation' of education – the transformation of educational content, activities and processes to become part of a (corporate) platform ecosystem, including its economies, infrastructures and technical architectures (Kerssens & Van Dijck, 2021) – is increasingly dependent on 'cloudification': the conversion and migration of data and application programs to corporate servers in order to make use of cloud computing. Together, these intertwined processes are a major cause of concern for the pedagogical autonomy of schools and teachers. First, technology giants like Google (Alphabet), Apple, Facebook (Meta), Amazon and Microsoft (GAFAM) – Big Tech – are rapidly expanding their platform services into the education technology (edtech) market (Outsell, 2017) and increasingly seizing control over the shaping and organisation of online learning environments in schools around the globe. Second, through the increased interweaving of a diverse set of cloud-based educational applications to be used in everyday classroom practices – tracking systems, learning apps and learning analytics – control over pedagogical decision-making shifts from teachers to platform algorithms and dashboard interfaces (Kerssens & van Dijck, 2021; Zeide, 2020).

We want to illustrate the platformisation of education by looking at a specific example from the Netherlands. The COOL learning environment – advertised by its Dutch owner Cloudwise (2021b) as 'one place for all your apps, managing your classroom and organizing schoolwork' – epitomises these two important global trends and concerns in the platformisation of education. COOL facilitates platform-based learning in the cloud for primary schools by offering teachers and pupils a central portal for single-sign-on access to all types of web-based digital learning apps, platforms and materials. It also includes a link to Gynzy, an adaptive learning platform developed by a Dutch start-up oriented towards an international market that, bundled with COOL, is offered as a package deal to schools. Digital learning environments (DLEs)

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like COOL facilitate the integration of national primary online education into global corporate cloud infrastructures by acting as intermediaries between (national) edtech markets and (global) tech companies like Google, Amazon, Microsoft, or Apple. COOL is developed and deployed on the Google Cloud Platform and provides a seamless connection with Google hardware and educational software – such as Chromebooks and Google Workspace for Education (GWfE) (including Google Classroom) – by employing Google's cloud services for identity management, single sign-on and device management, whilst facilitating easy access to Google's cloud services for data storage. Google Classroom integration enables assignments to be digitally provided, submitted and checked via COOL. And with COOL's Chrome-based monitoring tool, teachers can track in real time, from their own device, what students are doing on their Chromebooks. In short, COOL presents itself as a pivotal platform adhering infrastructural cloud services of Big Tech to all kinds of educational web applications for classroom use. Tech companies' efforts to equip classrooms with integrated packages for automating and aligning processes of digital infrastructure with those of learning and teaching, offer schools a one-stop shop for all layers of the platform stack – a package deal that is commonly motivated by arguments of efficiency and user convenience (Van Dijck, 2020).

The COOL example illustrates how educational institutions understand transformations to online learning first and foremost as technical and instrumental concerns, rather than as complex issues affecting the pedagogical autonomy of schools and teachers. To critically attend to these issues, this chapter approaches pedagogical autonomy as a dimension of the institutional autonomy of primary schools and the professional autonomy of teachers. We employ the term *institutional pedagogical autonomy* to refer to the degree of freedom schools have to design and organise the online learning environment according to their own insight and educational vision, independent of edtech market actors. We use *professional pedagogical autonomy* to refer to the degree of freedom teachers have to perform pedagogical practices and take pedagogical decisions in daily classroom teaching practice, independent of digital education platforms (Kerssens & Van Dijck, 2022).

This chapter is structured around three research questions triggered by the COOL example: How does the integration of K–12 online education into global big tech cloud infrastructures affect schools' institutional pedagogical autonomy?[1] How does the integration of digital learning platforms (DLPs) in classroom teaching and learning affect teachers' professional pedagogical autonomy? And what is needed to safeguard the institutional pedagogical autonomy of schools and the professional pedagogical autonomy of teachers within a platformised and cloudified educational landscape? To address the research questions, we use the critical lens of platform studies to highlight *political-economic* and *social-technical* levels of analysis. We first discuss how the integration of digital school systems into global cloud infrastructures operated by Big Tech companies may challenge the institutional pedagogical

autonomy of public schools. We argue that Google, Amazon and Microsoft, can wield unprecedented powers through their walled gardens of intraoperability. This political economic strategy, or 'infrastructuralisation' (Plantin, Lagoze, Edwards, & Sandvig, 2018), points to the reign of Big Tech's digital governance beyond the sector of education. Next, we underscore the importance of sociotechnical analyses of educational practices and discuss how the implementation of DLPs in classrooms contests the professional pedagogical autonomy of teachers. The social-technical and political-economic levels are inextricably intertwined: political-economic implications are cemented in social-technical affordances. It is exactly this dual approach of platform studies that renders this interdisciplinary perspective relevant to research on the platformisation and cloudification of education and its implications for the key public value of autonomy. We address the third question by briefly discussing recommendations for the future governance of edtech to serve the institutional pedagogical autonomy of schools and the professional pedagogical autonomy of teachers.

Glocal infrastructures: how platformisation affects schools' autonomy

Our hypothesis contending that the integration of local public online education into Big Tech's global cloud infrastructures affects schools' institutional pedagogical autonomy is based on research in the Netherlands. Public values fundamental to Dutch primary education, including pedagogical autonomy, are at risk as platformisation – 'the penetration of infrastructures, economic processes, and governmental frameworks of platforms in different economic sectors and spheres of life' (Poell, Nieborg and Van Dijck 2019, pp. 5–6) – not only challenges the belief that education is a public good but also affects the public values in which education is rooted (van Dijck, Poell, & Waal, 2018). In our work on the platformisation of Dutch primary schools (Kerssens & van Dijck, 2021), we demonstrate how a push for intraoperability – 'the strategy to connect platforms that are controlled and exploited by one central actor so this actor can funnel data flows, generated across the ecosystem, into proprietary assets' (p. 3) – undermines a logic of interoperability – 'the way in which services and databases are able to 'talk' to one another and share data across domains and platforms through the programming interface' (Bechmann 2013, p. 55). With intraoperability emerging as the leading logic of building platformised infrastructures for online learning, organisational and educational power is redistributed to benefit platforms rather than schools. There are a number of convincing research articles demonstrating the incorporation of public education into 'walled gardens' of intraoperability. (Williamson et al., 2022) present a convincing case for 'Amazonification' of education. In both cases, the role of one specific Big Tech company in the shaping of K–16 education's digital cloud infrastructure is highlighted. The quickly expanding role of Google and Amazon in educational infrastructures is not restricted to those

two companies, as Microsoft and Apple, too, have substantial stakes in the edtech market. Moreover, such expansion is not restricted to the edtech markets in the Netherlands or the United States, but we can witness the ubiquitous infiltration of Big Tech's hardware, cloud infrastructure and software around the globe, into practically every sector of society (Van Dijck et al., 2018).

These global online facilities increasingly penetrate local school systems, resulting in global-local, or 'glocal', infrastructures for classroom teaching and learning. Besides dominating the market for cloud services, data storage and analytics services, Amazon has major stakes in the market for voice-enabling devices, such as Alexa and other third-party plug-ins, to seamlessly integrate educational apps within its services. Through the seamless interweaving of cloud infrastructure, application programming interfaces (APIs) and platform integrations, 'Amazon is steadily becoming a dominant market player and a new kind of governing organisation in the education sector' (Williamson et al., 2022, p. 234). Very large online platforms (VLOPs, in legal parlance), owned and operated by Amazon and other tech companies, have become not only technical infrastructures on which many rely for their online activities, but they have turned into essential social and economic infrastructures akin to utilities such as electricity and water on which organisations necessarily rely for their survival (Plantin et al., 2018). If the 'stack' platforms can be visualised as a tree, the root layer of hardware and technical infrastructure such as data centres and cables or satellites carries the socio-economic infrastructure of very large online platforms that form the trunk of the tree; a layer of sectoral software built on top of those infrastructural layers complement the tree with its branches. Whoever owns and operates the infrastructural layers at the bottom and in the trunk of the 'platformisation tree' controls the architecture of the global platform ecosystem and hence provide the blueprint for the layers (van Dijck, 2020).

Obviously, Amazon's infrastructural expansion into the education sector is not an isolated case. In recent years, there have been investigative journalism reports and academic research articles explaining the 'Googlification' of primary education, both in socialtechnical and in political-economic terms (Krutka, Smits, & Wilhelm, 2021; Lindh & Nolin, 2016; Singer, 2017). For instance, Google's marketing strategy to sell hardware (Google Chrome laptops) preloaded with Google's basic software (Chrome, Search, Scholar, etc.) is a well-known lock-in mechanism. The seamless connection, via a single sign-on ID function (Google ID), to all other services within GWfE is a vendor lock-in strategy. Connection to other data-rich services inside or outside the GWfE environment, such as Google Analytics, guarantees Google a steady stream of aggregated data input, which can be used to personalise online advertising, also outside the school's online environment. Moreover, Google can offer individual schools good deals on its cloud services, providing server storage space with very attractive conditions while emphasising security and efficiency.

Tech companies' deployment of sociotechnical strategies, such as APIs, the seamless integration of cloud services and ID login services, cannot be considered separately from tech corporations' political-economic strategy to collaborate with local start-ups and education businesses through various forms of partnerships. The past few years have seen a big increase in the number of partnerships between (global) tech companies and (local) schools that often lack sufficient financial means and professional expertise to invest in an independent digital infrastructure. Within the Dutch context, the political-economic partnership of the national edtech company Cloudwise with Google illustrates how the formation of glocal infrastructures affects schools' institutional autonomy.

Cloudwise provides the COOL learning platform to about 2,000 schools in primary and secondary education in the Netherlands, Spain, Finland, the United Kingdom, Canada and the United States (Cloudwise, 2021a). In the Netherlands, Cloudwise controls about a third of the market for DLEs, in which COOL competes with other learning platforms such as MOO (Heutink ICT), ZuluConnect (De Rolf Groep) and Prowise GO (Prowise) (Kerssens and Van Dijck, 2021). Cloudwise, with its COOL platform, is an example of how Dutch start-ups helped connect local school systems to global corporate ecosystems; as happened in other sectors, stand-alone software products were gradually offered as cloud-based services (software-as-a-service, or SaaS). During the first two decades of the 21st century, a large and diverse edtech landscape emerged in the Netherlands, featuring DLPs and learning management and support systems developed by for-profit yet local educational publishers and edtech startups (Kerssens & Van Dijck, 2021). Cloudwise was one of a handful of commercial companies supplying information communication technology (ICT) to schools that started to offer integrated, all-in-one systems for cloud-based learning, testing and monitoring as well as for administration and communication among teachers, students and parents. These systems also functioned as centralised portals to access all types of web-based resources. Many of these Dutch providers committed to the principles of openness and market diversity by signing a collective agreement to keep technical standards interoperable (Basispoort) and by developing a public online ID sign-in system for students called ECK-iD.[2]

At the same time, commercial ICT suppliers like Cloudwise started offering cloud services for data storage, identity management and device management to schools, whilst facilitating access to cloud-based educational software services for learning and collaboration (e.g., GWfE, including Google Classroom). To provide these services, national SaaS-businesses had to turn to Big Tech infrastructural suppliers like Google, Microsoft or Apple and engage in partnerships to be able to bring seamless connectivity to schools. Through these partnerships, companies such as Cloudwise were able to offer schools and school systems the ability to outsource all their technological needs, rendering them dependent on Google. Of course, the seamless integration of these services works best on Chrome laptops, which are preloaded with

Google's software – not just educational software but also more general platforms like video, browser and login services. In contrast to local start-ups like Cloudwise, Google refused to sign the collective standardisation agreement Basispoort, which included the ECK-iD; instead, it promoted its own identification service through the Google Account – mandatory for login into COOL – to give students access to the core educational services of the Google Workspace environment (where Google acts as data processor) and additional consumer services such as Search and YouTube (where Google acts as data controller) (Nas & Terra, 2021). The use of the Google account gives Google significant control over the collection and processing of data within its closed and proprietary ecosystem of 'intraoperable' Google services (incl. the Chrome browser); in addition to the company's refusal to sign agreements that guarantee standards of interoperability, this 'underscores [its] vested interests in data monetization' (Kerssens & Van Dijck, 2020, p. 8).

What does this mean for legal protection of students' data privacy? Of course, operating in the Netherlands, Google must comply with the European privacy regulation that includes clear rules about data minimisation and binding collected (meta)data to prespecified goals and uses. In 2021, several Dutch educational associations carried out a Data Protection Impact Assessment (DPIA) of GWfE to investigate whether Google's data flows comply with the European privacy regulation (SIVON, 2021). Results indicated that Google's processing of data did not comply with the General Data Protection Regulation and involved significant privacy risks that contest the very legal foundations of the European privacy regulation.

Through the lens of its sociotechnical system (the seamless integration of Google's platform services) and the political-economic lens of its imposed governance (Google forcing its ID service onto the Dutch edtech provider Cloudwise), we are able to understand how Google deploys these local intermediaries to plug their global monetisation strategies directly into school systems. At stake, however, is not just privacy as an important public value for students but, implicitly, also a school's institutional autonomy – in this case, the freedom to refuse a corporate ID login service that allows a company access to students' online activities. As Lindh and Nolin (2016) argue,

> By making an implicit demarcation between the two concepts (your) 'data' and (collected) 'information' Google can disguise the presence of a business model for online marketing and, at the same time, simulate the practices and ethics of a free public service institution.
>
> (p. 644)

Since Cloudwise constitutes one of Google's glocal intermediaries, it actively contributes to the Googlisation of primary education and thus undermines schools' institutional pedagogical autonomy, in particular their self-governance, in securing privacy in the arrangement of their online learning environments.

While Cloudwise contracted with Google to become a 'Google for Education Premier Partner,' other providers of DLEs have engaged in similar partnerships to become official 'Apple Solution Experts' or 'Microsoft Authorized Education Partners.'[3] Like car dealers who have committed to selling and servicing specific brands, these local edtech providers and the schools they supply are increasingly integrated into the service line of one or multiple of the Big Tech companies. Beyond these local dealerships, Google also partners directly with schools through its Google Reference School Programme, granting special privileges, such as free training, in exchange for implementing the company's hardware and software in their online environments (Bouma & van der Klift, 2019). Once schools have invested in an (proprietary) ecosystem, it is costly to switch to another system. For instance, for schools that have invested in the Google line of services, choosing another cloud provider may come at substantial extra expense or cause technical friction. Yet, such dependency on one provider compromises a school's institutional autonomy, restricting its free choice in platform services that are allowed to be connected to the rest of the proprietary stack. So while schools may prefer to use an alternative (public) identification login service, they may be stuck with what Google provides because it is too complex or too costly to switch. Rather than investing in modularity and interoperability, the alliance between local edtech providers and global tech companies as glocal infrastructures causes vendor lock-ins, which undermine public efforts to secure common standards and leads to the further privatisation and commercialisation of education.

Most importantly, the social-technical design of dominant cloud services and their strategic political-economic strategies promoted as partnerships shift the onus of organisational power over teaching and learning from schools to tech providers, thus eroding schools' institutional pedagogical autonomy. The Googlisation of education in the Netherlands, much like Williamson et al.'s (2022) example of Amazonification in K–16 education in the United States, shows how platformisation through cloudification (and the infrastructuralisation that comes with it) poses a risk to public education and the values in which it is rooted. Through built-in affordances and integrated software packages, hence limiting the choices of schools and teachers, the public values of education may be seriously affected.

One such public value is the pedagogical autonomy of schools to design and arrange their own learning environments: schools should be in charge of organising (student-generated) data flows as part of their digital learning spaces; they should be able to decide individually and collectively what tools to use for what purposes and on what conditions. Schools should have the autonomy to refuse data-driven tools that do not comply with their standards around data protection or privacy. The increasing impact Big Tech companies have on the selection and implementation of online tools in a school's learning environment puts this autonomy at risk. Instead of promoting interoperability – the ability of systems to work with other systems – and diversity in resources,

they push schools towards intra-operability – using services of one and the same vendor – under the guise of user convenience, system security and seamless connectivity.

As said, Big Tech's power is not restricted to one sector or to one nation. Platformisation explains these companies' global grip on education by transporting their social-technical logic and political-economic strategies to the heart of public institutions in numerous countries. Amazon's and Google's substantial investment in the edtech market is not surprising given their crucial stakes in the ability to enforce connections between several layers of the stack – consumer hardware, infrastructural services for hosting, storage, identification and authentication and analytics, general-purpose software (e.g., search engines, app stores, cloud services) and educational software – hence securing power over data flows as well as algorithmic control. These companies' socio-technical logic and political-economic strategies increasingly penetrate state-funded institutional structures, pushing them further down the road from platformisation and cloudification towards infrastructuralisation – de facto rendering public spaces into private-corporate walled gardens. Big Tech's growing impact on the European education landscape, where the overwhelming majority of schools are state funded and organised in independent institutions, should lead to critical reflection on corporations impact on educational governance.

Digital classrooms: how platformisation reshapes teacher autonomy

In addressing the second research question, we again draw attention to how the social-technical level of this inquiry reinforces the political-economic perspective: How does the integration of DLPs in classroom teaching and learning affect teachers' professional pedagogical autonomy? DLPs are designed for educators and students whose teaching and learning are increasingly mediated by data analytics and interfaces. Scrutinising the social-technical level is essential for understanding the significant challenges DLPs present for teaching and learning at the classroom level – for instance, to make sense of fundamental changes to the profession of teaching given how platform mechanisms (van Dijck et al., 2018) and platform pedagogies (Sefton-Green, 2021; Perrotta, Williamson, Gulson, & Witzenberger, 2020) reformat teacher roles and erode teacher authority (Kumar et al., 2019; Zeide, 2020).

In the Dutch school system, the use of adaptive learning platforms is becoming a key part of many schools' curricula, integrating with daily classroom practices of teachers and students. These platforms use learning analytics to adapt to a student's behaviour and competency (Bulger, 2016; Dishon, 2017) and are a key example of educational platform technology that has started to be used at scale in schools' worldwide, such as SmartSparrow in Australia and Gynzy and Snappet in the Netherlands (Molenaar, 2021). Underlying these learning platforms are algorithms that tailor exercises (arithmetic, mathematics,

spelling and grammar) to pupils' needs while they work on a laptop or tablet in the classroom. Teachers (and students) interact through these platforms' interfaces, which mediate teachers' pedagogical actions through analytics and visualisations. Research indicates that the use of learning platforms like Gynzy and Snappet has had positive effects on student performance (Molenaar & Knoop-van Campen, 2016) and can improve the feedback practices of teachers (Knoop-van Campen & Molenaar, 2020). Yet, platform-based learning and teaching also raise key questions about pedagogical autonomy, with learning analytics underpinning algorithms and dashboard interfaces conditioning student behaviours and shaping teachers' pedagogical practices.

To better understand platforms' impact on teachers' professional pedagogical autonomy, it is helpful to look at how their algorithmic operations challenge student autonomy in terms of self-determination. At the level of algorithms, several scholars have argued that 'embedded analytics,' adaptively adjusting exercises to students' progress (Molenaar & Knoop-van Campen, 2016), leveraged in personalised learning design and technology are grounded in a behaviourist model of learning and usher in a revival of 'new behaviorism' in primary school classrooms (Friesen, 2018; Watters, 2021). Algorithmic adaptivity subjects students to new forms of operant conditioning, nudging them towards behaviours predefined by learning analytics that personalise learning paths by predicting students' performance based on past data about learning. Such 'machine behaviorism' (Knox, Williamson, & Bayne, 2020) is seen as a significant challenge to student autonomy (Regan & Jesse, 2019) because it appears to be inconsistent with modern notions of self-regulated learning oriented towards instilling in children a sense of ownership over their own learning and accountability for their actions and behaviours (Friesen, 2018). At the same time, such pedagogical control over student learning through embedded analytics challenges teachers' pedagogical autonomy. Artificial intelligence (AI)–driven learning platforms encode pedagogical decision-making previously done by teachers who, in turn, have very little insight into algorithmic processing of data flows and how these shape classroom pedagogies (Zeide, 2020).[4]

Extracted analytics, the real-time display of data about learning on a teacher dashboard (Molenaar & Knoop-van Campen, 2016), may have an even more direct effect on shaping teachers' professional pedagogical decision-making, as dashboards create a false sense of autonomous control over learning while nudging teachers' interpretations and pedagogical actions through particular views. First, the visual display of student data in Gynzy's or Snappet's dashboard presents an assumed objective and complete view of the reality of learning – what critical data scholars Kitchin, Lauriault and McArdle (2015) describe as a dashboard's 'realist epistemology' – rendering learning into something instantly knowable, manageable and manipulatable. These platforms' dashboards make learning visible through colour-coded information in various modes of display: real-time results, skill metres and growth graphs. They make it seem as if teachers can know and perceive the complexity of

learning 'at a glance' (Schwendimann et al., 2016). Moreover, these visualisations provide a '"frame" of human agency' (Mattern, 2015); they motivate teachers to pull a dashboard's actionable levers to fine-tune learning at will, fuelling their sense of control over the complex and messy reality of learning.

This becomes an issue because dashboard views are always biased reductions of learning – and not in any way neutral representations – steering teachers' interpretations and actions towards certain pedagogical choices. Through data selection and processing, particular understandings of 'good' education are encoded into dashboard design (Decuypere, Grimaldi, & Landri, 2021). Teacher dashboards included in Gynzy and Snappet, for example, are structured around a performance-based pedagogy; learning metrics are rendered visible and actionable through colour-coded information in various modes by displaying performance-related information on real-time progress, competence level and performance relative to target levels and peers (Kerssens, 2022). Performance as expressed in the design of these learning dashboards is ultimately about creating focus. Dashboards encode a model of teaching and learning in which performance metrics serve as a central organisational principle while making invisible 'all variables that have nothing to do with key performance' (Mattern, 2015). In this way, dashboards spotlight performance as the true locus of teacher control and manipulation, providing teachers with actionable intel for pushing students to shift from 'red' to 'green,' from below average to average.

By encouraging particular pedagogical practices to optimise learning, dashboards in adaptive learning platforms may help construct a new 'ambience of performance' (Bartlett & Tkacz, 2017) in classrooms by 'driving out poor performance, inefficiencies and redundancies' (Ball, 2008, p. 27). Mediated by platform dashboards, performance-based pedagogy is embedded into day-to-day classroom practices, pushing teachers towards behaviours that conform to a particular model of learning inscribed in automated metrics that they never helped design. Teachers' growing dependence on dashboards' pedagogical framings may work to further erode their own pedagogical judgement and intuition and possibly reshape them into performance managers dedicated to learning optimisation.

Digital education platforms can deeply impact the way pedagogical intervention is understood and practised and risks displacing the professional autonomy of teachers. The concern is not about platforms replacing teachers; it is about pedagogical authority and judgement being transferred from teachers to platform algorithms and interfaces and about their pedagogical actions increasingly being shaped through platform analytics. Platformisation at the classroom level necessitates renewed critical attention to the ways learning and classroom interactions are being co-constituted through social-technical assemblages of teachers *and* educational platform technology that shape, and share responsibility for, pedagogical practice. Platformised and cloudified classrooms raise serious questions about pedagogical control shifting from public schools and teachers to the black boxes and imperceptible infrastructures of

private edtech providers (Kerssens & van Dijck, 2021). When pedagogical 'intelligence' is outsourced to non-education experts, such as platform developers, and then mediated through learning analytics or interface design, teachers are left on the outside looking in, deprived of insights that help them meaningfully scrutinise what pedagogies inform and encode algorithmically driven architectures (Zeide, 2020). Educators' growing platform dependence makes it increasingly urgent for education scholars to uncover the shaping powers of platform pedagogies (Sefton-Green, 2021) and to critically investigate how student and teacher engagement with platform ecologies in digital classrooms offers possibilities for contesting platforms as they work against teachers' pedagogical autonomy in public education.

Conclusion: governing edtech as a public good

This chapter highlighted how platformisation and cloudification of schools and classrooms challenges pedagogical autonomy at the institutional level of schools and the professional level of teachers. At the heart of both issues is a shift in control over education – from schools and teachers to (ed)tech service providers. Importantly, untangling both issues of autonomy in classroom platformisation has become increasingly difficult as this shift increasingly intertwines power reconfigurations at the professional teacher level with those at the institutional level. The choice of a school for a particular DLP does not exist apart from the implicit choice for a cloud infrastructure on which these applications are built. While these learning platforms are anchored in the daily practices of classroom operation and interaction – steering and framing student and teacher agencies through the pedagogies encoded into these platforms' algorithms and interfaces – global tech companies like Google and Amazon provide the infrastructural cloud services – hosting, storage, machine learning and data analytics – that are increasingly determining the functioning of these data-driven applications in classrooms (Williamson et al., 2022), beyond the sight and decision-making power of the school.

In response to the major challenges edtech and the penetration of digital platforms in classrooms present for the public value of autonomy, over the last five to ten years sector-wide initiatives in the Netherlands have invested in enhancing public control over online learning by drafting public–private agreements and translating them into procurements for technical standards to facilitate an open, modular system of learning resources, support systems and infrastructures (Kerssens & van Dijck, 2021). Moreover, tools have been developed to support schools and teachers with value-based implementation of digital technologies. The Ethical Compass, for example, is an online tool that helps teachers and school boards evaluate the impact of ICT tools on public and ethical values like safety, equality and autonomy of schools and teachers (Kennisnet, 2019). Yet, despite these early efforts of the Dutch public education sector to govern educational digitisation, we have witnessed the growing influence of glocal efforts involving not just Big Tech corporations like

Amazon and Google but also national and local edtech companies that are inevitably locked into and absorbed by these corporate ecosystems. While these developments led us to reflect on the technological, economic, social and political consequences at stake, further research is needed to address the implications for the governance of public education. More specifically, the question arises of how to further counteract current trends and secure schools' and teachers' (legal) freedom of organisation by exerting public control at the level of classroom practices, at the level of building platform infrastructures for learning and at the level of regulation.

At the level of classroom practices, we suggest a few possible actions. First, pedagogical impact assessments (PIAs), as a pedagogical variant of DPIAs, might serve as a procedural mechanism to foster the pedagogical accountability of digital education platforms. PIAs at the school level can proceed through dialogical and decision-making frameworks, similar to the Data Ethics Decision Aid (Utrecht Data School, 2022a) – developed for reviewing the social impact of government data projects (Franzke, Muis, & Schäfer, 2021) – and the Impact Assessment Fundamental Rights and Algorithms – which facilitates making well-informed and responsible decisions about the development and deployment of AI systems in the public sector (Utrecht Data School, 2022b). These frameworks could assist education professionals in reflecting on a tool's or platform's pedagogical impact, on their embedded theories and values of learning and teaching, and required teacher literacy, thus extending the scope of the Ethical Compass from the purely ethical to the pedagogical.

Yet, with pedagogical models hidden in user interfaces and algorithms, and with pedagogical actions steered by invisible data flows behind walled gardens of intraoperability, educators have few insights into the pedagogic dimensions of platforms, thus obstructing a dialogical review. To enhance the visibility and accountability of pedagogical decision-making processes encoded into platforms, guidelines should be developed for platform developers to make the algorithmic backend of their systems transparent to educators and more open to scholarly investigation, following Sefton-Green and Pangrazio's (2021) platform pedagogies research agenda. These assessments should work towards developing platform-compliant literacy conceptualisations. Many teachers view educational technologies as simple, neutral tools and view literacy as the ability to use these tools effectively. Yet digital education platforms are not pedagogically neutral instruments, and educators need to make sense of how they impact teaching and learning (Garcia & Nichols, 2021). PIAs can make an important contribution to governing edtech as a public good; it is important that their development and application proceed through democratic debate and evaluation within the education field and through cooperation among education scholars, education service organisations and education professionals. Again, we emphasise that these visions for governing edtech as a public good at different levels need to be approached in tandem. PIAs at the school level cannot and should not be separated from an open design of a digital

infrastructure – that is, one governed by the public sector rather than developed out of public sight by for-profit platform companies that value market interests over educational values (Teräs, Suoranta, Teräs, & Curcher, 2020).

Recommendations around building platform infrastructures could be addressed to school managers and policymakers at the local and national levels. Instead of expanding their dependence on Big Tech ecosystems, schools and educational institutions across the world could cooperatively articulate and validate a set of joint technical standards and governing principles – such as interoperability, open standards and data portability – as basic values to regain governing power over the organisation of their online learning environments. Individual schools have little power to negotiate such requirements; however, if national school systems and their policymaking organisations unite in a principled stance, they may be able to form a national force. This is what is currently happening in the Netherlands, where public schools have joined forces in forming SIVON (2020), an organisation for collective tendering. Besides negotiating business propositions and value-based conditions with (Big) tech companies, they can also decide to develop their own (open-source) software supported by Kennisnet and SURF, two Dutch support organisations for developing digital infrastructure for education. In securing public infrastructural services, schools cannot fend for themselves; they need societal and political support to help them prioritise public values in education and to anchor these priorities in digital infrastructures.

Our third recommendation is directed at politicians and regulators at both the national and supranational levels. There is currently no national (Dutch) or supranational (European) legislation that protects and empowers public institutions like schools or universities in a fully privatised digital environment. In the current proposals submitted to the European Commission, the Digital Markets Act and the Digital Services Act (DSA), there are no special provisions for public institutions; education in the digital age is still clearly envisioned as a market rather than as a public or common good. In the European context, it should be clear that public institutions like schools are increasingly becoming dependent on non-European corporate platform ecosystems that invisibly impose specific technological logics and market economic values. In response to the various failed attempts at crafting educational interests into the DSA, professionals and institutions have called for better policymaking procedures that take into account the position of public educators in an increasingly commercial digital landscape (Liber, 2022).

We hope these three recommendations help translate analytical insights into pedagogical autonomy into active ideas for professional intervention and future policymaking for the benefit of institutions. The bifocal lens of platform studies has helped us shape the closely intertwined levels of education research. Such multidisciplinary perspective will hopefully enable and empower researchers in other parts of the world to evaluate specific – glocal – platform pedagogies and digital educational infrastructures, including their sociotechnical architectures and political-economic implications for governance.

Notes

1 Cloud infrastructure is commonly termed 'private' as the cloud infrastructure is operated solely for a single organisation; they are considered 'public' when they are delivered over the public internet, and they may be offered as a paid subscription, or free of charge. However, in the context of this chapter, we prefer to use the term "big tech cloud services" to indicate their origin in the public–corporate cloud.

2 Basispoort is a single-sign-on system that facilitates the distribution of digital learning resources from various Dutch publishers and offers schools easy online access to these resources based on a prepaid licensing system. The ECK-iD sign-in service is grounded in strict principles of privacy protection and data sovereignty and is aligned with the General Data Protection Regulation.

3 When Cloudwise started in 2013, it exclusively contracted with Google. More recently, Cloudwise contracted with Microsoft to become an authorised education partner.

4 Platforms' influence on teacher autonomy became more significant once Dutch schools began increasingly implementing adaptive learning platforms like Gynzy and Snappet as key components of their curricula.

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