Governed by Edtech? Valuing Pedagogical Autonomy in a Platform Society

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In this essay, Niels Kerssens and José van Dijck discuss the implications of platformization on the key public value of pedagogical autonomy in K–12 education. They focus on two interconnected concerns: how the integration of education into a global digital infrastructure contests the institutional pedagogical autonomy of schools and how the integration of digital platforms with educational practices in classrooms challenges the professional pedagogical autonomy of teachers. The authors engage with the symposium contributions by Williamson, Gulson, Perrotta & Witzenberger on the Amazon infrastructure and by Pangrazio, Stornaiuolo, Nichols, Garcia & Philip on platform practices at the classroom level. With this dual focus, Kerssens and van Dijck explore how critical research in the emerging field of platform studies in education pertains to both the political-economic level of building educational platform infrastructures and the social-technical level of how teaching and learning are (re)shaped by digital platforms. The essay concludes with a brief discussion of recommendations for the future governance of edtech to serve the pedagogical interest of schools and teachers.

Keywords: institutional autonomy, professional autonomy, educational technology, influence of technology, platformization

The platformization of education—the integration of digital platforms into daily school practices—is a major cause of concern worldwide 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 services into the edtech market (Outsell,

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2017) and increasingly seizing control over the shaping and organization of online learning environments in schools around the globe. Second, through increased interweaving of a diverse set of educational platform technologies—digital learning platforms, learning tracking systems, learning apps, learning analytics—in everyday classroom teaching and learning (Kerssens & van Dijck, 2021), control over pedagogical decision-making shifts from teachers to platform algorithms and dashboard interfaces (Zeide, 2020).

The COOL learning platform—advertised by its Dutch owner Cloudwise (2021b) as "one place for all your apps, managing your classroom and organizing schoolwork"—epitomizes these two important global trends and concerns in the platformization 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 toward an international market that, with COOL, is offered as a package deal to schools.[1] Platforms like COOL facilitate the integration of national primary online education into global private 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 (including Google Classroom)—by employing Google 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 follow 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 services of Big Tech to all kinds of educational applications for classroom use.

The strong effort of tech companies to equip classrooms with integrated packages of digital infrastructure for automating and aligning processes of infrastructural services with those of learning and teaching offers schools a one-stop shop for all layers of the platform stack that is commonly motivated by arguments of efficiency and user convenience (van Dijck, 2020). These all-in-one services offered by intermediaries like Cloudwise strongly appeal to schools that want to be relieved of the hassle of selecting and implementing digital tools. This illustrates how educational institutions understand transformations to online learning first and foremost as technical and instrumental concerns rather than complex issues affecting the pedagogical autonomy of schools and teachers. To critically attend to these issues, this article 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 organize 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 make pedagogical decisions in daily classroom teaching practice independent of digital education platforms.

The article is structured around three research questions triggered by the COOL example: How does the integration of K–12 online education into global private infrastructures affect schools' institutional pedagogical autonomy? How does the integration of digital learning platforms in classroom teaching and learning affect teachers' professional pedagogical autonomy? What is needed to safeguard the institutional pedagogical autonomy of schools and the professional pedagogical autonomy of teachers within a platformizing educational landscape?

Before addressing these questions, we discuss the value of pedagogical autonomy in the Dutch education system and its connection with intensifications of educational platformization, privatization, and commercialization. We then use the critical lens of platform studies to highlight the *political-economic* and *social-technical* levels of analysis. To address the research questions, we first discuss how the integration of digital school systems into private global platform infrastructures operated by Big Tech companies may challenge the institutional pedagogical autonomy of public schools. Reflecting on the analysis provided by Williamson, Gulson, Perrotta & Witzenberger (2022) in this symposium, we argue that Google, like Amazon and Microsoft, can wield unprecedented power in its walled garden of intraoperability. This political economic strategy, or "infrastructuralization" (Plantin, Lagoze, Edwards, & Sandvig, 2018), points to the reign of Big Tech's digital governance beyond the sector of education. Next, we discuss how the implementation of digital platforms in educational practices in classrooms contests the professional pedagogical autonomy of teachers. Commenting on the contribution of Pangrazio, Stornaiuolo, Nichols, Garcia & Philip (2022) to this symposium, which focuses on the impact of platformization on the datafication of teaching and learning and discusses interventions at the classroom level to challenge the tenets of plaformized schooling, we underscore the importance of social-technical analyses of educational practices. 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 platformization 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.

Autonomy as a Key Public Value in the Dutch Education System

Autonomy is a key concept in education—one that has been widely contested and continuously (re)conceptualized (Wermke & Salokangas, 2015). Schools' institutional autonomy is often distinguished from teachers' professional autonomy, and both concepts have been fiercly debated worldwide in public as well as in academic discourse (Wermke & Salokangas, 2021). Debates are generally around schools' or teachers' ability and capacity to self-rule their educational activities vis-à-vis the constraints put on such autonomy by governance forces (e.g., legal restrictions, government policies, market). As a unifying term for referring to these self-govering abilities and capacities of both schools and teachers, we employ the notion of *pedagogical autonomy* and split it between an institutional dimension and a professional dimension. We use *institutional pedagogical autonomy* to refer to schools' capacity to design and arrange their online learning environments and *professional pedagogical autonomy* to refer to teachers' ability to shape pedagogical practices and decisions in their classrooms.

Pedagogical autonomy is, conceptually, a fundamental public value within the Dutch education system, which over the years has been subject to various forms of control and constraint. It has a fundamental position within the Dutch education system; primary and secondary schools enjoy considerable protection by law to shield them from state pedagogy. Under the label of pedagogical autonomy, all publicly funded schools, and the educational professionals they employ, enjoy the freedom to organize teaching and learning (*inrichtingsvrijheid*) guaranteed under the Freedom of Education Act, article 23 of the Dutch Constitution (Scheerens, Luyten, & van Ravens, 2011).[2] In addition to the freedom of organization are the freedom of founding a school (*stichtingsvrijheid*) and the freedom to do so on the basis of religious or secular denominations (*richtingsvrijheid*). The freedom to organize teaching and learning specifically grants schools autonomy to make independent decisions over all matters related to the administration, organization, and shape of daily classroom practices (Education Council, 2019). A national curriculum does not exist, and schools have a lot of leeway in terms of "what to teach and how to teach it, as long as they meet established standards and learning objectives" (Neeleman, 2019, p. 33). For example, schools are free to shape and arrange their school curriculum and classroom learning environments with purchased or self-designed learning materials and teaching methods. As a result, schools in the Netherlands, along with a few other national institutional systems, "enjoy the greatest autonomy" as compared with other OECD countries (Organisation of Economic Co-operation and Development [OECD], 2016, p. 37).

Yet, schools' and teachers' pedagogical autonomy in the Netherlands has never been absolute. It has always been shaped and constrained by political governance, governmental oversight, and financial control mechanisms, mostly aimed at securing the quality of education. For example, to be eligible

for public funding, the Ministry of Education, Culture and Science imposes a number of statutory quality standards that prescribe, for example, the subjects to be studied, the content of national examinations, and minimal achievement targets for Dutch language and mathematics (Patrinos, 2013). This indicates that the Dutch government stresses output control, or steering by results, which significantly affects how schools organize their learning environments (Frissen, van der Steen, Noordegraaf, Hooge, & de Jong, 2016)—including the systematic and intensive measurement of student and school performance and output by national standardized tests—and seriously erodes pedagogical autonomy of schools in primary education (Waslander, 2010). These quality standards also shape the daily teaching practices of educational professionals. Minimal achievement targets intensify performance measurement through systematic assessment, which in turn steers the interpretation and analyses of test result data to maximize learning outcomes in teachers' core professional practices (Kerssens & de Haan, 2022). Moreover, pedagogical practices of teachers employed by a school must always conform to the institutions' prescribed pedagogy. In sum, although schools are relatively free to design and arrange their learning environment, and teachers do enjoy considerable autonomy in shaping the daily practice in their classrooms—making decisions in direct contact with students, whether or not in consultation with colleagues—such autonomy is not free from external constraints.

Moreover, since the 1980s, schools' and teachers' pedagogical freedoms have further been constrained by marketization**,** exogenous privatization (Ball & Youdell, 2008), and commercialization (Hogan & Thompson, 2020). Different from governmental constraints dedicated to safeguard the quality of education, these market constraints are the result of commercial education products aimed almost exclusively at unburdening schools and teachers from concerns about the organization of learning and teaching. For example, based on a for-profit model, a small group of educational publishers design, develop, and manage comprehensive teaching methods that many Dutch primary schools purchase and employ as organizational centers of their learning environments. While these methods offer teachers ready-made educational packages that substantially shape everyday classroom teaching and learning, they can significantly erode professional pedagogical autonomy if teachers are not involved in their development (Frissen et al., 2016). Since the Dutch market is rather small, there is only room for a few private market actors that inevitably have a considerable impact on curriculum shaping. However, in the last two decades the national educational publishing market has gradually expanded into an edtech market as a result of significant trends in digitization, platformization, and more general trends of globalization, privatization, and commercialization (Kerssens & van Dijck, 2021).

In this essay we emphasize how platformization—as driver of privatization and commercialization of online education—may further erode schools' institutional pedagogical autonomy and teachers' professional pedagogical

autonomy. Public values fundamental to Dutch primary education, including pedagogical autonomy, are at risk as platformization challenges not only the belief that education is a public good but the public values in which education is rooted (van Dijck, Poell, & Waal, 2018). In our work on the platformization 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)—as the leading logic of building platformized infrastructures for online learning redistributes organizational and educational power to benefit platforms rather than schools. Our research is part of a growing body of scholarship investigating how digital education platforms reconfigure teaching and learning at the classroom level, reshaping teacher and student roles according to platform logics of "good" education (Friesen, 2018; Perotta, Gulson, Williamson, & Witzenberger, 2020; Williamson, 2017; Zeide, 2020) while producing and intensifying classroom surveillance (Kumar, Vitak, Chetty, & Clegg, 2019; Manolev, Sullivan, & Slee, 2019).

These critical perspectives demonstrating how educational platformization imposes severe constraints on fundamental freedoms of schools, teachers, and students have become even more urgent since 2020 and the COVID-19 crisis. The effects of platformization and commercialization were particularly visible when the pandemic forced many schools to hastily implement new digital tools to accommodate the demand for online remote teaching (Cone et al., 2021). Due to a lack of time and resources, schools often resorted to mainstream platform environments, operated largely by Big Tech companies, thus increasing the risk of becoming even more dependent on these integrated commercialized infrastructures (Williamson, Eynon, & Potter, 2020; Williamson & Hogan, 2020; Williamson, Macgilchrist, & Potter, 2021). In the Netherlands, the integration of local public online education into global private platform infrastructures affected schools' institutional pedagogical autonomy.

Glocal Infrastructures: How Platformization Affects Schools' Autonomy

In their contribution to this symposium, Williamson and colleagues (2022) present a convincing case for "Amazonification" of education—the role one Big Tech company plays in shaping K–16 education's digital infrastructure. They expose the expanding role of Amazon into educational infrastructures not just in the US but around the world. This is due to the company's growing presence in the edtech market as well as the ubiquitous infiltration of its hardware, infrastructure, and software into every sector of society. These global online facilities increasingly penetrate local school systems, resulting in global-local, or "glocal," tech infrastructures. 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. Williamson et al.'s (2022) analysis demonstrates how, through the dynamic relations of cloud infrastructure, application programming interfaces (APIs), and platform integrations, "Amazon is positioning itself as the underpinning architecture to facilitate the governance of education systems, institutions, and practices at a global scope and scale" (p. 251). Their case study underscores how platformization promotes infrastructuralization, turning dominant platforms into digital infrastructures so users become dependent on their services (Plantin et al., 2018, p. 306). Whoever owns and operates the infrastructural layers at the bottom of the platform stack, or at the roots of the "platformization tree," can design the architecture of the global platform ecosystem and hence provide the blueprint for the layers (van Dijck, 2020).

Obviously, Amazon's educational strategy 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 social-technical and 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 Google Workspace for Education (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 aggregrated data input, which can be used to personalize online advertising. Moreover, Google can offer individual schools good deals on its cloud services, providing server storage space with very attractive conditions while emphasizing security and efficiency.

Tech companies' deployment of social-technical 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, with its COOL platform, is an example of how Dutch start-ups helped connect local school systems to global corporate ecosystems. Significantly, this was not the intention of the development of online education. During the first two decades of the twenty-first century, a large and diverse edtech landscape emerged in the Netherlands, featuring locally developed digital

learning platforms and applications and learning management and support systems. 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 centralized 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.[3]

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. Google Workspace for Education, including Google Classroom). To provide these services, these companies had to turn to Big Tech infrastructural suppliers like Google, Microsoft, or Apple and engage in partnerships. Through these partnerships, companies such as Cloudwise were able to offer schools and school systems the ability to outsource all their technological needs, allowing Big Tech to become a bottleneck. 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 standardization agreement Basispoort, which included ECK-iD; instead, it promoted its own single sign-on Google ID to give students access to all its services. Such links allow Google access to all its proprietary data flows, and the company's refusal to sign agreements that guarantee standards of interoperability "underscores [its] vested interests in data monetization" (Kerssens & van Dijck, 2020, p. 8). However, operating in the Netherlands, Google must comply with the European privacy regulation that includes clear rules about data minimization 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 Google Workspace for Education to investigate whether Google's data flows comply with the European privacy regulation (SIVON, 2021). Results indicate that Google's processing of data does not comply with the General Data Protection Regulation and involves significant privacy risks that contest the very legal foundations of the European privacy regulation. It is not clear which data about young learners and learning Google processes or for what purposes these data are being processed. Based on the DPIA, the board of the Dutch Data Protection Authority (2021) advised the Dutch Ministry of Education and Dutch schools to avoid using Google's educational package until further notice.

Through the lens of its social-technical system (the seamless integration of Google's platform services) and the political-economic lens of its imposed

governance (Google enforcing its ID service onto the Dutch edtech provider Cloudwise), we are able to understand how Google deploys these local intermediaries to plug their global monetization strategies directly into school systems. At stake 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 Googlization 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 DLE providers have engaged in similar partnerships to become official "Apple Solution Experts" or "Microsoft Authorized Education Partners."[4] Like car dealers who have committed to selling and servicing specific brands, these local DLE 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 dealers, Google also partners directly with schools through its Google Reference School Program, 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 a (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 costly to switch. Rather than investing in modularity and interoperability, the alliance between local DLE 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 privatization and commercialization of education.

Most importantly, the social-technical design of dominant platform systems and their political-economic strategies promoted as partnerships shift the onus of organizational power over teaching and learning to platforms, rather than schools, thus eroding schools' institutional pedagogical autonomy. The Googlization of education in the Netherlands, much like Williams et al.'s (2022) example of Amazonification in K–16 education in the US, shows how

platformization (and the infrastructuralization that comes with it) poses a risk to public education and the values in which it is rooted. One such public value is the pedagogical autonomy of schools to design and arrange their learning environments: schools should be in charge of organizing their own (user-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 and diversity in resources, they push schools toward intraoperability under the guise of user convenience, system security, and seamless connectivity.

Big Tech's power is not restricted to one sector or to one nation. Platformization 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. Williamson and colleagues (2022) convincingly argue that Amazon's impact on institutional pedagogical autonomy—detailed through the five-step model of inscribing, habituating, interfacing, platforming, and re-infrastructuring—extends to all levels of education. We demonstrate how this expansive role is not limited to Amazon but also applies to Google. Google's substantial investment in the edtech market is not surprising given how Big Tech has crucial stakes in the ability to enforce connections between several layers of the platform ecosystem stack—digital infrastructure, hardware, 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. As Williamson et al. (2022) argue, "Amazon is increasingly acting as a 'statelike corporation' and a globalized governance actor in education at international scale and scope." To this we add that these companies' social-technical logic and political-economic strategies increasingly penetrate state-funded institutional structures, pushing them further down the road of platformization, privatization, and infrastructuralization. Big Tech's growing impact on the European education landscape, where the overwhelming majority of schools are state funded and organized in independent institutions, should lead to critical reflection on educational governance.

Digital Classrooms: How Platformization 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 digital learning platforms in classroom teaching and learning affect teachers' professional pedagogical autonomy? In

their contribution to this symposium, Pangrazio and colleagues (2022) convincingly argue that research into the datafication of education necessitates that attention be paid to its manifestation through platformization, especially when it concerns digital platforms' impact on teaching and learning in classrooms. As they point out, platforms have become pivotal sites of data production and analysis and are used at all levels of education. They are designed for educators and students whose teaching and learning are increasingly mediated by platform data analytics and interfaces. For that reason, Pangrazio et al. emphasize the important point that platforms provide "a powerful object of analysis" (p. 256) for making sense of datafication's impact on the social-technical level of all platform-mediated classroom practices. This focus on platformization as a unit of analysis is essential for understanding the significant challenges platforms 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; Sefton-Green & Pangrazio, 2021) reformat teacher roles and erode teacher authority (Bradbury & Roberts-Holmes, 2018; 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 behavior 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 visualizations. 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 behaviors 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 personalized learning design and technology are grounded in a behaviorist 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 toward behaviors predefined by learning analytics that personalize 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 toward instilling in children a sense of ownership over their own learning and accountability for their actions and behaviors (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 have very little insight into algorithmic processing of data flows and how these shape classroom pedagogies (Zeide, 2020).[5]

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 manipulable. These platforms' dashboards make learning visible through color-coded information in various modes of display: real-time results, skill meters, 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 visualizations provide a "'frame' of human agency" (Mattern, 2015); they motivate teachers to pull a dashboard's actionable levers to fine-tune learning at will, fueling 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 toward 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 pedagogy of performativity; learning metrics are rendered visible and actionable through color-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). Performativity 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 organizational 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 optimize 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 toward behaviors that conform to a particular model of learning inscribed in automated metrics that they never helped design. As Pangrazio et al. (2022) emphasize, "Over time and with repetition, such reductions [of learning] can become reified." Teachers' growing dependence on dashboards' pedagogical framings may therefore work to further erode their own pedagogical judgment and intuition (Biesta, 2009) and possibly reshape them into performance managers dedicated to learning optimization.

Digital education platforms can deeply impact the way pedagogical intervention is understood and practiced and risk displacing the professional autonomy of teachers. The concern is not about platforms replacing teachers; it is about pedagogical authority and judgment being transferred from teachers to platform algorithms and interfaces and about their pedagogical actions increasingly being shaped through platform analytics. Platformization at the classroom level, as supported by the case studies discussed by Pangrazio et al. (2022), 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. Platformized 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 noneducation 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 scrutinize 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, as Pangrazio and colleagues (2022) demonstrate in their vignettes, 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.

Governing Edtech as a Public Good

In assessing major developments in edtech and the penetration of digital platforms in classrooms, it is necessary to discuss the long-term implications of platformization, privatization, and datafication for pedagogical autonomy in education. The articles in this symposium raise critical questions about the design, development, and implementation of online tools, particularly in relation to their underlying digital infrastructures. We address these questions from both social-technical and political-economic perspectives and conclude that they can hardly be separated when trying to understand the full implications of the digital transformations that are happening at a global scale.

In the Netherlands, initiatives over the last five to ten years have invested in designing online learning under public control through public-private agreements and their translation 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 digitization, 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 giants' 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 organization 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 frameworks similar to the Data Ethics Decision Aid developed for reviewing the social impact of government data projects (Franzke, Muis, & Schäfer, 2021). These frameworks could assist education professionals in reflecting on a platform's pedagogical impact, 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 make pedagogical decision-making processes encoded into platforms fully visible and accountable, PIAs should be informed by scholarly investigation of platform pedagogies following Sefton-Green and Pangrazio's (2021) research agenda. These assessments should work toward developing platform-compliant literacy conceptualizations. Many teachers view educational technologies as 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 organizations, and education professionals. Again, we emphasize that these visions for governing edtech as a public good at different levels need to be approached in tandem. Pedagogical impact assesments 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 policy makers 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 organization of their online learning environments. Individual schools have little power to negotiate such requirements; however, if national school systems and their policy-making organizations 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 organization for collective tendering. Besides negotiating with (Big) tech companies, they can also decide to develop their own (open-source) software supported by Kennisnet and SURF, two support organizations 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 prioritize 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 privatized digital environment. In the current proposals submitted to the European Commission, the

Digital Markets Act and the Digital Services Act, 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. The articles in this symposium have shown how the governance of education has increasingly been captured by global technologies owned by private multinationals. 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. To counter this development, regulatory frameworks in Europe need to be updated, rearticulated, and enforced.

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

Notes

1. The COOL platform was developed by Cloudwise, which provides it to more than two thousand schools in the Netherlands, Belgium, Spain, and the United States. In the Netherlands, Cloudwise supplies approximately 30 percent of Dutch schools with information communication technology products, including COOL (Cloudwise, 2021a).
2. In the Netherlands, almost all primary schools are "independent schools"; they are publicly funded but administered by private school boards. Because of full public funding being adopted early on, the number of private schools in the Netherlands—those that are privately funded and privately operated—has remained very small (Waslander, 2010).
3. 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.
4. When Cloudwise started in 2013, it exclusively contracted with Google. More recently, Cloudwise contracted with Microsoft to become an Authorized Education Partner.
5. 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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