

New governing experts in education: Policy labs, self-learning software, and transactional pedagogies

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GOVERNING EXPERTS

The governance of education is increasingly intertwined with database technologies. This chapter examines the emergence of the 'public policy lab' as a new actor in educational governance with governing expertise in data technologies and techniques. Public policy labs are a hybrid organizational form combining elements of the political think tank, the social enterprise, and the R&D lab from the computer technology industry. Such labs operate as cross-sectoral mediators who translate ideas and processes from the domain of database-driven computing into educational policy proposals. They are becoming increasingly significant policy actors with the governing expertise and capacity to contribute to national positioning and the 'fabrication' of comparability in the wider global policy competition (Ozga, Dahler-Larsen, Segerholm & Simola 2011).

Drawing on a study of the think tank Demos, the social enterprise the Innovation Unit, and Nesta (the National Endowment for Science, Technology and the Arts) in England, the chapter shows how these organizations promote themselves as intermediary governing experts. They exercise the capacity to diagnose the problems of contemporary schooling, and activate the competencies of learners as governing resources to solve those problems. My emphasis is on their aspirations, ambitions and objectives for the future of education: on their attitudes towards the present and the models of invention they adopt. Focusing specifically on analysis of reports and web materials produced by Demos, the Innovation Unit and Nesta, I argue these texts act as relays for ideas that are intended to change ways of thinking about

education. Methodologically, I view these texts as material and virtual forms which assemble, circulate and implant potentially agenda-changing ideas, and as intermediary devices or 'intellectual techniques' for 'producing conviction in others' (Rose 1999: 37). These material and virtual techniques transform education by making it problematic, thinkable, intelligible, and hence practicable in new ways.

By mobilizing such techniques, these policy intermediaries act cross-sectorally through relationships with government agencies, commercial organizations, and the third sector to promote reformatory ideas in education. They contribute to 'policy networks' of new governing experts in the UK (Ball & Junemann 2012), as well as in European education policy (Lawn & Grek 2012) and globalizing policy processes (Rizvi & Lingard 2010), who are carving out an interstitial governing space in-between the think tank, the social enterprise, and the digital R&D lab. Within this emerging space of governance, new policy discourses, ideas, practices, knowledge and data are constantly being mediated between the public, private and third sectors, and between the political, academic, and commercial fields. They are linked to wider transnational 'governing discourses' of the knowledge economy, lifelong learning, data collection and comparison (Lawn 2003). The discourse of 'soft' is a key element of these governing discourses, found in soft governance, soft power, soft paternalism, soft systems thinking, soft behavioural competencies and soft skills, as well as in software and soft computing (Williamson 2013).

Significantly, these cross-sectoral organizations take particular technological forms as 'diagrams' (Barry 2001) for reinventing public education. These diagrams, drawn from the discourses and imagery of computational forms and experimental R&D processes in the ICT industry, include soft computing, data analytics, adaptive technologies, big data, and other Web 2.0 technologies based on database-driven processes. These technologies are today significant since 'the sociotechnical instantiation of many aspects of the contemporary world depend on database architectures and database management techniques' and the technical processes of 'ordering, sorting, counting, and calculating' that they mediate (Mackenzie 2012: 335, 338).

Through the entwining of such database-driven technologies with public services in England, many services are now being reconfigured to meet specific individual needs; a process which requires knowledge and information about service users to be 'collated, monitored and interpreted by service providers, and even used as the basis for forecasting future needs' (Grek & Ozga 2010: 285). Person-responsive public services require the collection and analysis of individuals' 'digital traces,' or

‘data that is generated routinely as a by-product of our everyday experiences,’ and the ‘pervasive mobilization of transactional data to know and evaluate the performance of populations’ (Ruppert & Savage 2012: 74). For Thrift (2005) the mobilization of powerful technologies to know, calculate, act upon, and ultimately ‘make up’ individuals as new kinds of citizens, workers, or learners is a key technique in ‘knowing capitalism.’

Consequently, within the field of public services, the collection and storage of digitized datasets and the availability of analytics software is generating and making available new ways of managing and mediating the relationship between service provider and service user. The focal public policy labs in this chapter are seeking to usher in new forms of learning in which transactional data generated as a product of their use of data-based computational applications may be used to know and act upon learners. In particular, they are promoting new data-based computational forms such as adaptive technologies, learning analytics, and self-learning software that can (or have the potential to) automatically collect, collate and calculate learner data.

The mobilization of database technologies in education is intensifying an emerging form of ‘governing knowledge,’ or ‘governing through data,’ which uses knowledge about learners as a ‘governing resource’ (Ozga 2008). It augments existing disciplinary regimes of monitoring and surveillance of learners for ‘these technological devices do not merely mobilize already existing actors but are active in making them up’ (Ruppert and Savage 2012: 87). Through the governing expertise of self-learning software, individual learners are to be reassembled and reactivated according to measurable performance criteria that can be collected, collated and calculated in databases. Individualized performance data may then be utilized as evidence of ‘what works’ best in education reform, thus signalling the legitimacy of the governing strategies used to construct, promote, disseminate and implement them. This produces a feedback loop within which individual learners’ data may be used to inform policy on which pedagogies and practices work best. In the process, learners are to undergo a series of transformations or ‘translations’ (Ozga *et al.* 2011): school pupils are to be translated into learners, learners into performances, performances into data, and data into locally, nationally and globally comparable databases, tables and visualizations. Learning is to be made knowable, measurable, and calculable, and learners made up as transactional data resources to be collected, collated and calculated into comparable governing knowledge. In these ways, education is to become a self-regulating system which uses database-driven

processes both to generate new pedagogies and as comparable evidence in a wider global policy competition.

In outline the chapter examines the emergence of the idea of the public policy lab as a new kind of intermediary policy actor that is operating to mediate and translate key governing discourses into policy and practice. These constitute an emerging form of cross-sectoral governing expertise. The chapter proceeds to focus specifically on how such public policy labs are seeking to promote and mobilize their expert knowledge on particular computational forms, especially database-driven soft computation, data analytics and self-learning software. This is generating new kinds of transactional pedagogies facilitated by the capacity of databases to identify and know learners through their mediated transactions. Through such database-driven systems, learners are to be activated as 'calculable' governing resources whose individual competence and performance is to be collected, collated and calculated as data for comparison in globally competitive educational policy programmes.

GOVERNING SOFTLY

The governance of education is increasingly understood as taking place through cross-sectoral networks of public, private and third sector interdependencies that criss-cross national and transnational borderlines. 'Networked governance,' as this style of governing is termed, is decentralized and characterized by fluidity, looseness, complexity and instability (Ozga, Segerholm & Simola 2011; Williamson 2012). As opposed to the hard bureaucratic power of centralized government authority and control, 'post-bureaucratic' networked governance is conceived as 'soft power' which works through techniques of attraction, seduction, persuasion, and the cultivation of support and shared interest across networks of loosely associated actors. Soft forms of governance include self-regulation, self-evaluation, self-governance, and governing through the capacities of the governed, rather than the hard government of centralized targets and external regulation.

Educational 'policy networks' are a specific form of post-bureaucratic governance. Policy networks consist of individual intermediaries, interlockers, and 'policy entrepreneurs' whose 'good ideas' straddle sectoral problems (Ball & Exley 2010). Made up primarily of experts from think tanks, policy institutes, multilateral agencies, media consultancies, and experts in public relations, they 'perform the role of conveying ideas between different areas of the production, distribution, or circulation of ideas' in order to 'influence the decision-making process' (Lawn &

Grek 2012: 75). Their participation in ‘reinventing public education’ involves ‘moving from a bureaucratic/professional knowledge about education, a part of the public sector, to individualized, personalized and integrated knowledge about a society’ (Grek & Ozga 2010: 272). The shift to individualization and personalization is bringing about the emergence of new forms of governing expertise, and a new kind of governing expert whose claim to authority rests on the capacity to know, assess and act upon the individual—through the collection, collation and calculation of data—rather than to seek to reform the more cumbersome bureaucratic systems of the public sector.

These claims depend on innovative new database-driven technologies which can perform complex processes of data collection, aggregation and analysis on the performance of individuals and populations. The use of powerful databases and analytics software to collect and generate performance data on education, or ‘learning’ as it has been reconceived, has been integral to the formation of new techniques of governance. The soft governing logics of data seek to link the supranational to the individual ‘through their collective but individualized investment in their own learning’ (Ozga, Segerholm & Simola 2011: 85).

Individualizing technologies of personal performance data are part of how individual actors have come to construe their own ‘responsibilized’ autonomy, interests, problems and aspirations for the future as intrinsically linked with those of governing authorities (Rose 1999). In the specific education context, soft governance, learning and data are intertwined as data is used ‘to govern by activating the capacities of the individual’ (Ozga, Segerholm & Simola 2011: 88).

ASSEMBLING PUBLIC POLICY LABS

What are public policy labs and how do they operate as actors in educational governance? In this section I identify some key characteristics of the public policy lab and explore how their objectives and aspirations are contiguous with wider governing discourses.

Network mediators

The Innovation Unit is a social enterprise first formed within the Department for Education and Skills in 2002 and spun-out as an independent not-for-profit organization in 2006 with a mission to innovate in public services. The Innovation Unit is an important actor in the genealogy of public policy labs, both in terms of its discursive production of ideas about cross-sectoral innovation in education and its

role in assembling the concept of the public policy lab itself. In the field of education, its aim is to create an ‘innovation ecosystem’ for education in which ‘schools no longer have a monopoly on ‘academic’ learning,’ and learning is supported beyond school by the internet, mobile technologies, and a ‘vastly increased number of education providers’ (Innovation Unit 2012a: n.p.). In this ecosystem, education is reimagined as a dispersed, boundary-free zone of suppliers that bisect and traverse sectoral borderlines and digitally networked pedagogies that break free of the classroom. The monopoly of the school and its pedagogical, curricular and assessment techniques are challenged by a market of competitors from outside of the bureaucratic organs of the education system. The imagery of the innovation ecosystem for education acts as a template both for reimagining education and for generating new positions of reformatory expertise.

What kinds of experts are being positioned to do this work? An Innovation Unit pamphlet entitled *Honest Brokers: brokering innovation in public services* (Horne 2008: 3) describes ‘innovation intermediaries’ that ‘have existed in other sectors for years—such as innovation and science parks, incubators, accelerators, exchanges, labs and studios.’ The blurb asks, ‘Where is the Silicon Valley for public services in Britain?’ Horne (2008: 4) focuses on emerging ‘brokering organizations that have succeeded in fostering innovation in education.’ These organizations ostensibly mediate both knowledge and relationships for their clients, and their work is characterized as being concerned with affecting the culture of the system to make it more conducive to the development and spread of innovation.

Another Innovation Unit pamphlet, *A D&R system for education* (Bentley & Gillinson 2007), similarly translates models from other sectors into education. Both authors were formerly associated with Demos, the ‘radical centre’ think tank responsible for making cross-sectoral thinking possible in public services reform. Drawing on agile methods from ‘open source’ R&D, the authors propose ‘an education R&D system and strategy which is more open and flexible,’ involves ‘open communities of collaboration,’ ‘opportunities for innovation that is both multi-disciplinary and interdisciplinary’ and ‘makes the most of user-driven innovation and demand to shape new methods and create knowledge’ (Bentley & Gillinson 2007: 19). Their version of ‘D&R’ puts the emphasis first on experimental development, rather than traditional R&D with its ‘pipeline’ model of basic research followed by application. They use examples of networked ‘hubs and clusters’ of cross-sectoral relationships between commercial ICT, university research labs, independent research institutes and think tanks, and policymakers; and advocate the creation of a ‘National Evidence Centre’

which would ‘synthesize, test and validate evidence of effectiveness for new research findings and methods, and develop and diffuse this knowledge base in direct collaboration with users of that knowledge’ (Bentley & Gillinson 2007: 32).

Honest Brokers also announces the formation of a ‘Public Services Innovation Laboratory,’ to be ‘run by Nesta, in partnership with many existing innovation intermediaries’:

The Laboratory will trial new methods of supporting innovation, search for innovation in public services around the world, disseminate lessons to delivery organizations, develop training, tools and services for practitioners and influence policy. ... The Laboratory could become a service provider to other innovation intermediaries, helping them build capacity, educate demand ... and create an evidence base for what works in social innovation.... The Laboratory could become a ‘system influencer’ campaigning for changes in policy.... (Horne 2008: 33-34)

The Public Services Innovation Lab is now a permanent department within Nesta. Formerly a public body, Nesta became an independent not-for-profit organization in 2012 to promote innovation in public services. Its webpage states that ‘Nesta’s Innovation Lab supports innovators in public services, society and business to develop radical new responses to the most pressing social and economic challenges.’ Its key themes include ‘Digital Education,’ and some of its cross-cutting topics include ‘data and technology,’ ‘open innovation,’ ‘digital disruption,’ ‘civic engagement,’ ‘creative economy,’ ‘social good,’ ‘video games’ and ‘Web 2.0,’ and ‘transformation.’ It assumes an intermediary role to iterate between the big picture and individual innovations. It has been closely involved in establishing the national network of ‘What Works Centres,’ including a major report on *Making Evidence Useful: The case for new institutions* (Mulgan & Puttick 2013). These centres are being tasked with collecting evidence on ‘what works’ in innovation across sectors, primarily by carrying out randomized control trials. The centre for education, managed by the Educational Endowment Fund (EEF) shares its evidence through a ‘Teaching and Learning Toolkit’ which summarizes educational research for teachers and schools. Relatedly, Nesta has established the ‘Alliance for Useful Evidence’ and a ‘Standards of Evidence Framework’—a common language for talking about data and evaluation—and is involved in the creation of a free online ‘app’ called ‘Randomise Me’ which permits anyone to set up and carry out their own randomized control trial (Mulgan & Puttick 2013). Demos and the Innovation Unit are interorganizationally networked with the lab through a variety of relationships, partnerships and co-authored publications.

Nesta documentation describes the lab as a prototype for ‘social science parks’ and ‘public policy labs.’ The public policy lab is defined as ‘not so much a think tank but an experimental workshop that prototypes new forms of public service delivery’ by working across ‘the public, private and social enterprise sectors to create socially useful and usable ideas’ (Nesta 2013a). Based on the Nesta prototype, the public policy lab is imagined and promoted as a new kind of cross-sectoral actor in public services reform which works by actively trialling and evaluating new services. The public policy lab extends the role of the think tank into the domain of R&D, with a particular emphasis on innovative experimental development and the production of evidence and data of what works in public service reform.

Discursively, the lab acts to position education as a public service which is to be made governable as a networked, interconnected system rather than a centrally controlled bureaucracy. In the Nesta report *Systems Innovation*, Mulgan and Leadbeater (2013: 7)—both formerly of Demos and associates of the Innovation Unit—argue that public services could be improved through an ‘interconnected set of innovations, where each influences the other, with innovation both in the parts of the system and in the ways in which they interconnect.’ The report represents systems innovation as a networked and interconnected phenomenon; a form of soft systems thinking. It is illustrated with a series of ‘systems maps’ and ‘diagrams’ of the ‘dynamics of the system’ which detail the ‘feedback or feed-forward loops,’ points of ‘influence or leverage,’ and their ‘critical causal links’ (Mulgan & Leadbeater 2013: 10). Again, the ‘intermediaries’ such as networks, research institutes, consultancies and think tanks are positioned to ‘link big ideas to individual innovations,’ ‘orchestrate advocacy and campaigns,’ promote policy, develop coalitions and networks, and ‘change minds,’ ‘attitudes and cultures’ (Mulgan & Leadbeater 2013: 20-21). Internet companies Google, Apple and Amazon are identified as visible recent examples of systems innovations, and the form of the network is specified as a reformatory diagram:

We have embraced vast new systems for creating, sharing, processing and analysing information from the Internet and the world wide web, through to new generations of mobile phones, and social media to the possibilities of cloud computing, the semantic web, and the Internet of Things. These digital platforms could allow us to create more distributed, networked, systems to achieve feats of coordination previously associated with large hierarchical organizations. (Mulgan & Leadbeater 2013: 30)

In the report the potential of networked systems to develop and deliver digital and open online learning is counterposed with the overt problematization of schooling as an outdated relic of industrialization.

How can the public policy lab be understood? Demos, Nesta, and the Innovation Unit are cohabitants of an emerging interstitial space in educational governance, an experimental space in which new ideas may be combined from across sectors and fields. They work by gathering, balancing and assembling various institutionalized resources from across the academic, political, and commercial domains, and assembling those resources into unique packages, and their power 'lies in their ability to claim for themselves a kind of mediating role' between 'resources captured from other fields' (Medvetz 2012: 178). The liminal, cross-sectoral hybridity of these organizations creates the new expert position of the 'mediator,' who is able to seize or appropriates big abstract ideas generated in one place and move them on through new combinations and interactions in order to make them practical, usable, 'buzzy,' and marketable (Osborne 2004: 441). Mediators must be able to produce, brand and market their ideas as unique new policy packages in order to appear innovative and to mobilize political, public and media support simultaneously. Understood as a governing expert in the education policy context, the mediator is a participant in policy networks whose effect is 'to create a thick tapestry of communication, organizational and network relations, stable and unstable linkages' which combine traditional actors in the field of education with 'those conventionally considered peripheral to education governance,' such as 'commercial interests and technological innovators' (Lawn & Grek 2012: 82). The notion of the networked mediator captures the expert governing style of the public policy lab organizationally and discursively established by Nesta, Demos and the Innovation Unit.

Material techniques

A central element in how public policy labs operate as networked mediators is their capacity for communication. These organizations all deploy a variety of printed materials and online, virtual materials which are, to paraphrase Demos co-founder Mulgan (2006), intended to 'change the way people think' about education. All publish reports and pamphlets as free internet downloads on a Creative Commons license for widespread access and redistribution. Their websites are promoted as accessible, useful and evidence-based sources of expert knowledge. The Nesta website features extensive blogging facilities which enable its teams to communicate their projects on an ad hoc basis. Many of the virtual and printed materials generated by Nesta, the Innovation Unit and Demos contain illustrative diagrams, visualizations and images which act to transform complex abstract problems into seemingly practicable courses of action.

The Innovation Unit's school reform programme *Learning Futures*, for example, has produced a guidebook, *Learning Futures: A Vision for Engaging Schools*, from an ensemble of text, imagery, infographic and diagrammatic forms. It features a diagrammatic visualization of an imagined educational system in which the individual learner is to be linked up to a network of other relationships, institutions, spaces and practices. The visualization freezes into one single position a set of 'extended learning relationships' with teachers, tutors, experts, mentors, coaches, peers, employers and families; an image of the 'school as basecamp' which is connected to industry, local businesses, cultural institutions, community organizations, and the internet; and a commitment to a 'learning commons' of project-based learning, co-construction, democratic community, and collaborative enquiry pedagogies (Innovation Unit 2012b: 11). In the accompanying text, the document refers to 'the 4 Ps of engaging activities' that include a 'place-based curriculum, purposeful projects, passion-led teaching and pervasive opportunities for research and constructive challenge' (Innovation Unit 2012b: 8). These '4 Ps' juxtapose physical and virtual settings, the idea of authentic and practical activities that 'foster agency,' the importance of personal emotions, and ideas about 'learning outside the classroom' through online research, into a set of 'criteria' and 'design features' for 'every aspect of the way the school is organized: its structure, culture, and the use of space, place and time' (Innovation Unit 2012b: 8). Throughout, the publication is punctuated with break-out boxes, testimonials, bulletpoints, buzzphrases, and other visual imagery and photographs. Together, these discursive and bibliographic elements capture and stabilize a complex assemblage of concepts, ideals, possibilities and proposals for the future of schools.

A critical perspective would suggest that materials such as these put a highly mediatized gloss on educational problems. This would be an analytical simplification of the mediating techniques mobilized by the Innovation Unit, Demos and Nesta. Another analytical approach is to view their reports, pamphlets, and websites as material techniques that mediate policy ideas from amongst political, social scientific, and digital R&D resources and embed them in material form within educational policy discourses. They perform what Latour (1986: 3) would describe as the transformation of ideas and concepts into 'inscriptions' such as 'signs, prints and diagrams' that can affect how we argue, think and believe; they are material techniques of thought. For Latour (1986: 7) the power of an inscription device such as a graphic, image, diagram, and so on, is to stabilize ideas, problems, concepts, explanations and arguments in one place; make those ideas legible and intelligible; amenable to being moved around and copied and reproduced in other places; and

reshuffled, recombined and superimposed with others. Ultimately, through such processes, inscriptions can be used to measure and modify what is 'out there.' As Latour (1986: 27-28) puts it, 'realms of reality that seem far apart' are just 'inches apart, once flattened on to the same surface.' This makes it possible to see and make connections previously unthinkable.

Public policy labs act by producing material and virtual inscription devices that are innovative and make use of cutting edge techniques to be mobilized, reproduced, and made amenable to combination and juxtaposition. Fenwick & Edwards (2010: 11) argue that educational texts, pedagogic guides, curricular documents, web resources and other materials themselves act as 'mediators' which translate and fix a complex network of relationships in one place. As virtual forms which are circulated through informational networks, the material and virtual forms generated by public policy labs are themselves mediating techniques which combine ideas from across the academic, political and commercial ICT arenas, stabilize them in new forms such as pamphlets, diagrams and infographics, and then mobilize them as unique policy packages. These material and virtual techniques of thought translate problems, ideas, practices, and concepts from different sectors and arenas into shared vocabularies, interests and agendas for intervention, and they superimpose the seemingly distant governing discourses of the knowledge society and lifelong learning, with the commercial ICT arena, and the mundane practices of pedagogy. Through such juxtapositions, combinations and superimpositions these intermediary devices generate a shared representation of a governable educational domain.

Based on an initial genealogical exploration of the public policy lab in education governance, then, we can summarize that Demos, Nesta and the Innovation Unit act as cohabitantes of a new kind of interstitial governing space that is in-between the think tank, the social enterprise, and the digital R&D lab. They operate as mediators of ideas from the political, social scientific and digital arenas, re-assembling them into unique material and virtual packages that can be branded, marketed, promoted and reinserted anew into educational policy debate. These organizations are commensurate with wider educational governing discourses and new forms of governing expertise amongst cross-sectoral policy networks.

DATA PROCESSING PEDAGOGIES

What do public policy labs want to happen? This section explores some of the particular policy packages which have been assembled by the public policy labs now

operating in England. These intermediary policy packages seek to make particular computational forms legible, intelligible and thinkable as potential solutions to the contemporary problem of schooling. In particular I focus on how schooling is being reimagined in terms of big data and data analytics.

Big data

The role of big data in education needs to be put in the wider context of the reimagining of public services by Demos, Innovation Unit and Nesta. In a Demos pamphlet entitled *The Civic Long Tail: Big data and the wisdom of the crowd*, Leadbeater (2011) suggests making big data a template for governance. In the report's reformatory vision, technological diagrams of data mining, algorithms, cloud computing, the social web, intelligent systems, and the 'hopeful web' are interwoven with the political imaginary of a smarter, more open, and more intelligent form of 'Government 2.0':

Government 2.0 is about improving people's relationships with government, either as citizens through the political process, as funders through taxation or as service users. Community 2.0 is about enlarging and empowering citizens' relationships with one another ... about communities looking after themselves more effectively and the web providing a platform for unfolding communitarian creativity. (Leadbeater 2011: 18)

Demos researchers Wind-Cowie and Lekhi (2012: 63) likewise argue that big data 'should be viewed as a transformative agent that has the potential to revitalize, reinvigorate and renew public services.' Moreover, Demos researcher Bartlett (2012: 20) claims that the benefit of collecting and analysing users' personal information and behavioural data is the production of 'services and applications that are more tailored to users' needs.' The discourse here is both of technological innovation and the 'democratization of public services' in parallel, as Wind-Cowie and Lekhi (2012: 10) articulate:

The dynamics of service improvement through data use draw equally from technological and democratic sources. From the technological perspective, identifying problems in service delivery can be seen as a similar process to debugging software.

Such approaches presuppose that analytics software and data, and its networked and interactive forms, now offer diagrams for more democratic and participatory forms of public service, particularly for education.

Commensurately, the learner at the centre of Demos's vision of education is imagined as a self-managing and autonomous individual able to use the web to facilitate more personalized and self-directed educational services, while teachers are reimagined as 'brokers' guiding learners to mobilize their own resources and

knowledge in order to ‘make better choices for themselves’ (Leadbeater, Bartlett & Gallagher 2008: 11). Big data is positioned as a resource for personalized learning which would operate by mobilizing ‘democratic intelligence: the ideas, know-how and energy of thousands of people’ in a ‘liberal, open society’ where ‘public institutions and professionals’ are repositioned to ‘educate us towards self-help and self-reliance as much as possible’ (Leadbeater, Bartlett & Gallagher 2008: 79-80).

Data analytics

As part of its Digital Education programme, Nesta is promoting discourses that legitimate, justify and work to persuade people to act in relation to the database-driven processes that increasingly ‘make up the material-social life of people and things’ in ‘contemporary information societies, network cultures and so on’ (Mackenzie 2012: 335, 337). Mobilizing the powers of such thinking as a ‘diagram on the basis of which reality might be rashioned and reimaged’ (Barry 2001: 87), Nesta has sought to reconstitute the future of learning through database-driven practices.

Consequently, Nesta has advocated ‘adaptive learning technologies’ which use student data, algorithmic ‘learning analytics’ and feedback mechanisms to adapt and personalize learning:

Adaptive learning technologies use student data to adapt the way information is delivered to a student on an individual level. This data can range from online test scores to session time (how long users spend on a single exercise) to records of where a user has clicked or touched while figuring out a problem. Based on this feedback, the programme will understand which content to point the user at next – planning a personalized learning journey. (Nesta 2013a)

According to Nesta (2013b) statements, these adaptive technologies have potential to provide ‘digital tutors’ that are responsive to learners; and intelligent online platforms that can use data gathered from learners to become smart enough to predict, and then appropriately assist and assess, their progression. Importantly, these adaptive technologies depend on constructing datasets of vast populations of learners, so that any individual’s profile in the system can be compared to the entire population of learner profiles, in order to generate real-time predictions and automatically change pedagogy. The database-driven logic of comparison between the individual and population in adaptive learning software runs paralleled to the governing discourses of data and comparison in education policy.

Similarly, in Innovation Unit documents proposing new ideas for the future of schools, the role of data-based analytics technologies is represented in the ideal of personalized learning driven by automated digital performance assessment technologies which can generate ‘playlists’ of lessons for students based on prior

assessments (Hampson, Patton & Shanks 2012). These automated performance assessment technologies are programmed with the capacity to learn through interaction with other devices and users. Self-learning software which depends on human-computer interaction, calculative technologies and feedback loop mechanisms, has the potential to 'second-guess the user, becoming a part of how they decide to decide' — a key technique of 'knowing capitalism' (Thrift 2005: 184). As Demos researchers have argued (Wind-Cowie & Lekhi 2012), public services platforms including those in education should be equipped with the most up to date analytics software in order to generate the kind of everyday personal, behavioural and transactional data about citizens that commercial ICT companies such as Amazon, Google and Facebook utilize to generate targeted search results, recommendations, and tailored online services. Translated into education in the form of learning analytics, digital tutors and intelligent adaptive technologies, the result is the automatic production of personalized pedagogies through database-driven calculating technologies.

After the notion of 'transactional politics' which describes the political power of identifying and knowing people on the basis of their transactional data (Savage & Ruppert 2012), learning analytics and adaptive educational technologies may be seen as *transactional pedagogies*. Through transactional pedagogies learners are to be known, calculated and acted upon on the basis of their mediated transactions, human-computer interactions, and the collation and analysis of their personal, informational and behavioural data through database-driven and automated self-learning software. In putting transactional data and automated analytics software at the centre of the personalization of pedagogy, Demos, Nesta and Innovation Unit are acting as gatekeepers with the mediating power to make such database technologies into significant pedagogic actors. This is a transactional politics which 'knows' learners, sorts and aggregates them on the basis of personal and behavioural data, responds with an algorithmically generated personalized pedagogy, and then generates measurable metrics of data which can feed back into the policy process.

A key issue emerging from these developments concerns the assumptions about the learner that are programmed into learning analytics and its subjectifying effects. Learning analytics does not merely measure, evaluate and produce data for the judgment of teachers. Instead, these increasingly automated systems can come to their own pedagogic judgments, autonomously forecast learners' future development, and calculate the most appropriate courses of pedagogic intervention. These database technologies close the loop in the relationship between the objectives

of governance, and the aspirations of individuals whose learning is now to be translated and expressed in the dominant governing discourses of data, evidence and comparison in an increasingly globalized educational policy arena. They make up learners as 'calculable persons' with 'calculating mentalities' who are enmeshed in 'networks of calculation' both as active and self-calculating participants and as the objects of others' calculations (Rose 1999). Learners are made up by such subjectifying techniques both as calculable resources and as self-calculating individuals whose competencies are to be activated to generate data for comparison in a global competition between policy programmes. Indeed, beyond this, the transactional pedagogies of analytics and adaptive software are disassembling individual learners into 'transactional actors' defined by their specific transactions through data switches, impulses, profiles, and circuits (Ruppert & Savage 2012). Education is increasingly to be governed through transactional learning data, and through the measurement and comparison of nonhuman transactional learners.

Calculative technologies of individualized performance data and feedback have made data into the dominant governing resource in education, and data analysis and processing into one of the central components in the forecasting, controlling and shaping of the knowledge economy (Lawn & Grek 2012). In the future visions of intermediary public policy labs such as Nesta, Demos and the Innovation Unit, education is not to be governed through its national education systems, but through activating the self-calculating competences of individuals. The new database-driven transactional pedagogies govern by knowing, evaluating, and then acting upon the capacities and subjectivities of learners. In this way, as they are promoted and inserted into learning practices through the interventions of public policy labs such as Nesta, these calculative technologies have the potential to become part of the flow of data that now constitutes a dominant source of educational governance in England as well as transnationally. Through public policy labs, learning is being reconstituted as continual calculative process and learners are being transformed through automated pedagogies both into self-calculating individuals and into calculable data resources for collation and comparison in the databases of global educational policy.

CONCLUSION

Public policy labs are an emerging, prototypical form of cross-sectoral governance in public services generally and education specifically. The public policy labs of Demos,

Nesta and the Innovation Unit act as policy intermediaries to broker alignments between commercial R&D in the ICT industry and the policies and pedagogies of public education. They deploy reports and other virtual and material forms which are intended to inject new ideas into education policy. These texts act as material techniques of thought and their objective is to make particular policy problems and solutions thinkable and their solutions practicable. The ideas they contain are created from a constant juxtaposition and recombination of ideas from the public, private and third sectors and from the fields of politics, social science and digital R&D. These public policy labs act as new kinds of 'governing experts' which are contributing to new forms of educational governance through interstitial, cross-sectoral policy networks whose interest is in marketable ideas and techniques that could change the ways that people think about education.

Discursively, these policy intermediaries have begun to interweave ideas about smart self-learning software, big data, analytics and other database-driven processes with ideas about personalized and lifelong learning. Self-learning software can collect, collate and calculate learner data, and automatically generate prescriptions for subsequent pedagogy. The juxtaposition of self-learning software with schooling is leading to the possibility of the automatic production of pedagogy facilitated by calculative techniques and algorithmic processes. The new policy package of 'learning analytics' and adaptive self-learning software being promoted and supported by Nesta is a current example of how governance by cross-sectoral intermediaries is ushering into the policy space a concern with database-driven computational forms. Learning analytics puts smart self-learning software based on adaptive algorithmic processes into school. This is introducing into education new 'transactional pedagogies' in which the pedagogic act is being socio-technically co-constituted by individual learners in interaction with commercially-produced data analysis devices, self-learning software and automated calculative techniques which depend on comparison between big datasets of individual and population data. Transactional pedagogy is the ideal form for schooling in 'knowing capitalism' and is part of the shift towards 'governing knowledge' practices which monitor and assess data on individuals' learning in order to forecast or calculate any necessary interventions. With the emergence of transactional pedagogy, learners are being reconstituted as transactional learners and governing resources to be activated through self-learning software in order to fabricate globally comparable and calculable policy data.

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