THE DATAFICATION OF EDUCATION

Edited by Juliane Jarke and Andreas Breiter

The Datafication of Education

This book attends to the transformation of processes and practices in education, relating to its increasing digitisation and datafication. The introduction of new means to measure, capture, describe and represent social life in numbers has not only transformed the ways in which teaching and learning are organised, but also the ways in which future generations (will) construct reality with and through data.

Contributions consider data practices that span across different countries, educational fields and governance levels, ranging from early childhood education, to schools, universities, educational technology providers, to educational policy making and governance. The book demonstrates how digital data not only support decision making, but also fundamentally change the organisation of learning and teaching, and how these transformation processes can have partly ambivalent consequences, such as new possibilities for participation, but also the monitoring and emergence/manifestation of inequalities.

Focusing on how data can drive decision making in education and learning, this book will be of interest to those studying both educational technology and educational policy making. The chapters in this book were originally published in *Learning, Media and Technology*. Chapter 4 is available Open Access at www.routledge.com/products/9780367357191.

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Juliane Jarke and Andreas Breiter

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Chapter 1

Datafied at four: the role of data in the 'schoolification' of early childhood education in England

Alice Bradbury

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Chapter 2

Configuring the teacher as data user: public-private sector mediations of national test data

Helene Ratner, Bjarke Lindsø Andersen and Simon Ryberg Madsen

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Chapter 3

The datafication of discipline: ClassDojo, surveillance and a performative classroom culture

Jamie Manolev, Anna Sullivan and Roger Slee

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Chapter 4

The social value of anonymity on campus: a study of the decline of Yik Yak

Sian Bayne, Louise Connelly, Clair Grover, Nicola Osborne, Richard Tobin, Emily Beswick and Lilinaz Rouhani

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Reconsidering data in learning analytics: opportunities for critical research using a documentation studies framework

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Objectivity as standardization in data-scientific education policy, technology and governance

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Datafication, testing events and the outside of thought

Greg Thompson and Sam Sellar

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Chapter 8

Cruel optimism in edtech: when the digital data practices of educational technology providers inadvertently hinder educational equity

Felicitas Macgilchrist

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Introduction

The datafication of education

Juliane Jarke and Andreas Breiter

Increasing datafication, in particular the availability of data and corresponding algorithms, introduces new means to measure, capture, describe and represent social life in numbers. The education sector is one of the most noticeable domains affected by datafication because it transforms not only the ways in which teaching and learning are organised but also the ways in which future generations (will) construct reality with and through data. The datafication of education comprises collection of data at all levels of educational systems (individual, classroom, school, region, state, international), potentially about all processes of teaching, learning and school management. This proliferation of data changes decision-making and opinion-forming processes of educational stakeholders such as education policy makers, school inspectors, school authorities, teachers, students and parents. For example, data are used to improve school development, to hold schools and teachers accountable, to control access to schooling or to compare student achievements across countries. Such use cases raise expectations with respect to increased transparency, accountability, service orientation and civic participation but also associated fears with respect to surveillance and control, privacy issues, power relations, and (new) inequalities (e.g., Anagnostopoulos, Rutledge, and Jacobsen 2013; Eynon 2013; Selwyn 2015; Livingstone and Sefton-Green 2016; Lupton and Williamson 2017).

Within the educational context, more and heterogeneous data are being generated – deliberately – for monitoring, surveillance or evaluation purposes, but also – automatically – through routine operations of a manifold of digital devices and systems (Selwyn 2015), producing ‘digital traces’ (Breiter and Hepp 2017). Schools, for example, are being transformed into ‘data platforms’ in which ‘a wide range of data tracking, sensing and analytics technologies are being mobilised’ (Williamson 2015a, 134). These digital educational data are distinct from pre-digital forms as they may be exhaustive in scope, highly detailed, and can be combined in a flexible manner and at different aggregation levels (Parks 2014). Such possibilities have always existed on a small scale, but new data infrastructures and algorithmic capabilities allow for analytics of an ‘unprecedented complexity and scope’ (Parks 2014, 356). However, the underlying algorithms and the ways in which data are produced by data providers, statisticians as well as the role of software companies and educational technology providers are hardly understood (Eynon 2013; Williamson 2015b).

This book aims to shed further light on the dynamics of datafication and related transformation of education. Contributions consider data practices that span across different countries, educational fields and governance levels from *early childhood education* (Bradbury), to *schools* (Thompson

and Seller; Ratner et al.; Manolev et al.), *universities* (Bayne et al.; Jones and McCoy), *educational technology providers* (Macgilchrist) to *educational policy making and governance* (Williamson and Piattoeva). In the following, we provide a brief overview of datafication in these different educational domains and subsequently reflect on the ambivalent consequences described in the contributions of this book.

Depending on the national educational governance structures, the relevance of digital data for educational processes in schools such as teaching and learning as well as for educational administration and educational policy has increased continuously. This has had an impact on how education is measured, managed and controlled. ‘Governing by numbers’ (Grek 2009) has become a new paradigm. National and international student assessments, standardised achievement tests, school inspections and rankings are part of new forms of educational governance covering all three levels (Altrichter 2010). At the macro level, public pressure on changing education policy is often shaped by international non-governmental organisations such as the OECD and is based on data (Martens and Jakobi 2010). It is part of a larger movement towards standardisation in education, output measurement and accountability (Jacobsen and Young 2013). While the political perspective has been studied intensively, the underlying data practices of key stakeholders (students, teachers, parents, administrators) are under-researched (Breiter 2016). This relates to the meso level of school administrations by introducing methods of new public management for budget control, benchmarks and goals to measure effectiveness. The role of districts and educational authorities in handling data and using data for accountability (Anagnostopoulos, Rutledge, and Jacobsen 2013) varies significantly between countries and makes an international perspective necessary. At the micro level of the school, different forms of data use have been identified at both the managerial level of principals to teachers at the classroom level (Schildkamp, Poortman, and Handelzalts 2016). Learning analytics (Papamitsiou and Economides 2014; Perrotta and Williamson 2016) are promoted as a powerful tool to better support students and their learning.

In this book, Thompson and Sellar (Chapter 7) question the ways in which datafication (e.g. in the form of computer adaptive tests [CATs]) may ‘revolutionise education’ and ‘represent a new generation of learning’. Based on the philosophy of Gilles Deleuze and Felix Guattari, they argue that rather than generating ruptures in educational thought CATs translate student learning into information along well-established patterns of ‘dogmatic or orthodox’ educational thought. This, they argue, limits the conditions for thinking about learning differently, and restricts students’ possibilities for ‘learning to think’. Ratner et al. (Chapter 2) analyse how teachers become configured as data users and consider otherwise ‘hidden’ data mediators and their role in making sense of data visualisations. Manolev et al. (Chapter 3) present the case of ClassDojo, an educational technology that transforms discipline and student behaviour, and in so doing normalises the surveillance of students. Williamson and Piattoeva (Chapter 6) look at evidence-based education governance and examine practices of ‘objectivity-making’ related to new data-driven technologies. Their particular focus is on data about students’ social-emotional learning and skills (SEL). While most of these accounts are rather critical about the ways in which educational technologies and educational data transform education, Macgilchrist (Chapter 8) gives voice to educational technology providers ‘who are not simply making token gestures towards justice and equality’. She presents examples of ‘cruel optimism’ along three distinct data stories relating to ‘(i) generating data to close the achievement gap, (ii) protecting data to ensure student privacy and (iii) using data to expose inequities’.

While the datafication in schools (as the main institution in compulsory education) has received increased attention by scholars, the role of data in early childhood education is often overlooked and under-researched (Bradbury, Chapter 1 of this book; Roberts-Holmes 2015). As digital media find their way into pre-schools and nurseries (e.g., through pedagogical concepts or through parents and the media use practices of their children), collecting data will become more than a side effect. This is particularly relevant, since young children require an even more thoughtful and responsible approach (Livingstone 2018): children’s rights in the digital age are under scrutiny, requiring special

treatment regarding privacy and asking for a new agenda (Livingstone and Third 2017). In particular, in England the extent of datafication (e.g., through a formalised curriculum) is noteworthy (Bradbury, this book). Bradbury describes how organisations of early childhood education are subject to the demands of compulsory data collection and argues that an increasing datafication of early childhood education leads to its 'schoolification' and produces 'data-driven subjectivities for both teacher and child'.

Higher education institutions (HEI) are widely affected by datafication and have a long tradition of being measured on their research outputs, teaching evaluations, transfer activities and research project money (Apple 2005). Various rankings are available to compare their performance internationally, which led to an increase of data practices within universities in order to cope with external pressure and to shape/massage the internal data in an appropriate way to climb up the rankings ladder (Stack 2016). With the advent of massively open online courses (MOOCs, see Van Dijck and Poell 2015), the amount of collected data about learning processes has increased dramatically (Selwyn 2015). Hence, the practices of data collection in higher education are manifold and stretch along all processes of teaching, learning, research and administration. Starting with comprehensive learning management systems as well as campus management systems, the variety of data infrastructures has steadily increased. Entrance tests are automatically analysed, student success predictions are based on learning analytics (Heuer and Breiter 2018) and e-assessments with multiple choice are common in basically all subjects. In this book, Jones and McCoy (Chapter 5) propose a documentation studies framework to critically research data on learning analytics. The framework allows the investigation of how individuals are 'made into' data points and data become 'considered as' representations of particular phenomena. Such learning analytics are part of the 'dominant business models of the new capitalism' in education (Bayne et al., Chapter 4 of this book) and rely on 'surveillance and the routine plundering of personally-identifiable data.' To counter such developments, Bayne et al. (this book) argue in favour of considering the social value of anonymity on campus, in particular in response to the increasing surveillance practices in educational technologies. They analyse the rise and fall of the social media application Yik Yak which (at its core) promised anonymity to its (at its height, 2 million) users.

In sum, digital data allow for the analysis of different educational practices to a degree of complexity not previously possible and to a much greater extent, as they can be very detailed, cover a more complete scope and can be flexibly combined. This is increasingly happening in real time due to the power of computers and algorithms. In the near future, sensors will provide further data. As such, digital data not only serve to support decisions, but also fundamentally change the organisation of learning and teaching. These transformation processes of mediatised communication lead to partly ambivalent consequences (Hepp 2017). We will outline some of the most prominent consequences in the following.

First, datafication leads to new spatio-temporal entanglements and transforms translocal relationships. The boundaries of educational institutions as learning places change when activities within the learning environment come to be represented on digital platforms and measurable learning outcomes are translated into assessment data based on standardised tests of students, teachers, professors or an entire institution. Digital (data) practices form a translocal space that links and associates different, previously distant actors. To date, parents have only been able to participate to a limited extent in their children's school activities. Manolev et al. (this book) however, describe how parents may receive daily updates on their child's behaviour via the ClassDojo platform. This platform facilitates the interaction of different user groups such as teachers, students, parents and school management and in so doing expands the space of communication between educational actors and transforms their relationships. Bradbury (this book) reports on the changing relationships of teachers and children but also parents and children through digital assessment practices that commence in early childhood education. She reports how reception teachers experience the need to produce data as 'detrimental to the process of building relationships with children to make them feel secure.' The necessity to use tablet-based assessments changed the previous interaction and 'reduced

focus on building relationships' (ibid). Parents however, having access to these assessment data, become constant observers of their child's 'progress'. Bayne et al. (this book) describe a different transformation of translocal relationships: The tool they analyse allowed its users to post anonymous posts, and rate and respond to posts. These posts and responses were hyper-local in that only posts in a certain location/radius were made visible to users. According to Bayne et al., Yik Yak was hence a tool for enabling hyper-local communication while at the same time allowing for anonymity. They argue that this encouraged 'freedom of thought and expression by removing individuals from risk of ridicule, [and] enable people to seek help particularly for "socially stigmatized problems" such as sexual issues, suicidal thoughts or domestic violence'.

The structuring and experiencing of time also changes: The temporal structure of education has always been determined by the school or academic year. The digital data practices in our book describe a cycle in which the spatio-temporal entanglements relate pupils, school classes and school districts as well as students and HEI to each other and define new temporal sequences. As Thompson and Sellar (this book) point out, computer adaptive tests (CATs) 'promise to capture greater volumes of data (e.g. log file data) in real time and they dramatically reduce the time between data generation, analysis and action'.

In Manolev et al.'s account (this book), the 'timeframe from which data is represented within student reports is adjustable'. Such adjustable (and potentially immediate) feedback loops apply to all educational actors. For example, Williamson and Piattoeva (this book) describe how emerging technologies to capture data on students' socio-emotional learning and skills (SEL) rely on biometric sensors to measure and track body signals in real time rather than relying on student self-reporting at long periodic intervals.

Second, the datafication of education allows for and requires new forms of participation. The increasing evaluation at all levels of educational institutions and the subsequent publication of evaluation results change the options for action and the scope of possibilities of all actors involved. These new forms of participation are partly possible because classrooms are transformed from a physical location with teacher grade lists to a – to some extent – transparent and distributed datascape (e.g., Manolev et al., this book; Bradbury, this book; Williamson and Piattoeva, this book). For example, Manolev et al. (this book) argue that regular updates on student behaviour via systems such as ClassDojo may 'foster parental engagement'.

However, datafication may not only allow for new forms of participation; it also requires them. For example, Jones and McCoy (this book) discuss the limits of Big Data methods and their ability to detect previously unknown patterns. They argue that 'too often computer scientists identify and analyse data without the aid of individuals for whom the studied phenomena would be familiar'. Yet 'without the proper contextual lens through which to look at data patterns, the patterns themselves stand to become meaningless, if not harmful' (ibid). Similar to participatory design approaches, which aim to involve future users in the design of systems because of their use-context expertise and because they will be affected by new systems (e.g., Vines et al. 2013; Bratteteig and Wagner 2016), Jones and McCoy promote an approach that considers questions such as: 'Are the data analytics intelligible by those for whom they were designed to be used?' or 'Will a diverse set of institutional actors see the usefulness of the data analytics in the same way?'

Third, these new possibilities of participation depend strongly on the respective competences to interpret data (critically) and may increase inequalities and thus contribute to a new digital divide. For example, Ratner et al. (this book) raise the issue of the intelligibility of Danish national test data to 'help teachers assess student abilities and how (much) students learn'. They describe how 'schools and municipalities are offered advice on interpreting and using national test [data] for pedagogical aims by "learning consultants"'. Ratner et al. argue that it is important to understand how specific representations of teachers' needs are inscribed into data visualisations and configure them as (literate) data users. Dealing with data at all levels of the educational system requires new forms of training for educators (Mandinach and Gummer 2013; Schildkamp, Poortman, and Handelzalts

2016) which at the same time reinforce the role of data in educational decision making. Macgilchrist (this book) reflects on how different educational actors strive to translate values into ‘ethical socio-technical practice’. However, in at least one of her data stories, she argues that the optimism to use data to expose inequity may result in the individualisation of responsibility to ‘become informed and expose injustice’. Moreover, all her data stories ‘show how the fantasy of equality is projected onto a socio-technical mediator (a personalised literacy platform, data privacy practices, and active parents armed with data visualisations)’ (ibid). A new digital divide may shift responsibility to those socio-technical mediators.

Fourth, inevitably, the datafication of education leads to a redistribution of agency across socio-technical networks. Thompson and Sellar (this book) argue that educational actors ‘come to believe that they need *something* to solve their problems and this lack is felt as a lack of data’ (emphasis in original). Such data then come to be used to structure education (e.g., the composition of smaller learning groups with classes): it is not the teacher who determines the composition of small learning groups, but algorithms identify groups (e.g., based on ‘student performance’), and receive special attention (Bradbury, this book). Wehner, Passoth, and Sutter (2012) described this phenomenon as ‘numerical inclusion’; others speak of the construction of public spheres or collectivities by algorithms (Gillespie 2014; Ruppert and Isin 2015). In Bradbury’s account, data and grouping practices work together: ‘data facilitate the allocation of children to groups by providing evidence of different “abilities”’. In so doing they ‘mutually reinforce the dual ideas of fixed “ability” and reliable measurement’ (ibid). Another example in this book is provided by Jones and McCoy who report on predictive analytics used at US universities to identify and group students unlikely to succeed in their studies and dismiss their applications in order to ‘improve the university’s retention data, which accreditors, prospective students, and national rankings [...] use to make judgements about an institution’. Similarly Ratner et al. (this book) conclude that ‘important decisions about how teachers are to interpret and engage with student learning [are distributed] to new digital and computational centres of expertise’. And Williamson and Piattoeva (this book) describe a process of ‘objectivity-making’ in the field of socio-emotional learning (SEL) that ‘closes down room for subjective personal judgment’ and distributes it in ‘dynamic sociotechnical networks of people, policies and technologies which together produce new ways of measuring, evaluating, and governing education’.

Finally, digital data practices may allow for new forms and possibilities of monitoring and surveillance, while at the same time promoting transparency. The orientation on educational performance and success goes hand in hand with increased monitoring and control of and by educational information systems (Behn 2003). This is also reinforced by neoliberal reforms (new public management; Pollitt and Bouckaert 2000) towards an ‘audit culture’ (Apple 2005) as well as by the broad availability of data. As Anagnostopoulos, Rutledge, and Jacobsen (2013) put it, the original intention of supporting school development was diminished by the sudden realisation that an effective control instrument was also available; these became ‘infrastructures of accountability’. And along with an expansion of translocal relationships comes the expansion of student surveillance that ‘penetrates the family’ (Manolev et al., this book), when parents have all-time access to their children’s school records. In response, Bayne et al. (this book) argue, anonymity in educational technologies needs to be reconsidered as it may address the long-term effects of ed-tech surveillance on trust, reciprocity and academic freedom.

In sum, data do not provide a window to the social world, but rather the relationship between data and what they are meant to represent is recursive: Data are not natural by-products of social actions, but must always be understood in the context of their origin and the affordances of the respective digital infrastructure. The datafication of education does not only transform education but also our understanding of education, of what is understood as good education, associated objectives and good practices.

The contributions to this book take you on an exciting journey across a variety of educational domains and aspects of their datafication. They exhibit ambivalent and at times contradicting

consequences of datafication using different theoretical and conceptual frameworks as well as empirical approaches. More research is needed to understand the continuously shifting and situated educational data practices and their ambivalent consequences. For now, we hope you find the contributions stimulating and thought provoking.

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1 Datafied at four

The role of data in the 'schoolification' of early childhood education in England

Alice Bradbury

ABSTRACT

This paper examines processes of datafication in early childhood education (ECE) settings for children from birth-five years in England and how this relates to increased formalisation. Unusually, ECE in England includes a standardised curriculum and formative and statutory assessments; thus it has been described as subject to both datafication and 'schoolification', a term used to describe the adoption of school-like practices and values in ECE. Using interview data from ECE settings over the last decade and a theoretical framework drawing on Foucault and Deleuze, the paper sets out the ways in which settings in schools and nurseries are subject to the demands of data, and how this produces data-driven subjectivities for both teacher and child. These developments are then linked to aspects of 'schoolification' including more formal teaching, a focus on literacy and mathematics, and use of 'ability' grouping.

Introduction

Early childhood education (ECE) in England is an international outlier in terms of the extent of statutory assessment and a formalised curriculum. Unlike in the rest of the United Kingdom, settings in England for children from birth to five years, including schools, are required to follow the Early Years Foundation Stage framework (EYFS) and children are assessed regularly against developmental stages, with a final assessment at the age of five, the EYFS Profile. Children are not required to attend school until the academic year they turn five, when they attend Reception classes in schools, but many younger children attend nursery settings in schools and private and voluntary nurseries.¹ Recent developments have included an attempt to introduce a new assessment on entry at age four, called Baseline Assessment. This policy context has led to the datafication of ECE in England (Bradbury and Roberts-Holmes 2017c), where practices, values and subjectivities shift towards a focus on the production and analysis of data, most often related to assessments. At the same time, the statutory curriculum and assessment have been criticised as the further evidence of the formalisation or 'schoolification' of ECE (Alexander 2009; Moss 2013; OECD 2006).

In this paper I describe the process of datafication as it relates to ECE in England, both in school settings and nurseries, and then consider how the increasing role of digital data in ECE in England interacts with the shift towards formal learning for very young children, creating a mutually reinforcing need for more data and more activities to produce those data. I use research data from four projects in ECE settings conducted over the last decade, and a theoretical framework drawing on Foucault (1980) and Deleuze (1995), to consider how schools and nurseries are subject to the demands of data, and how this produces data-driven teacher subjectivities and a 'data double'

(Simon 2005) of each child. I then explore how this relates to processes of ‘schoolification’, including more formal teaching, a focus on literacy² and mathematics, and use of grouping by ‘ability’. Overall, it is argued that these two processes of datafication and increased formalisation are mutually reinforcing, and underpinned by the same rationality that prioritises measurement over wider conceptions of learning. I begin with a discussion of datafication as a concept before setting out the theoretical perspectives that frame this work and the detail of the ‘schoolification’ critique.

Datafication in ECE

The ECE sector (or ‘early years’ as it is known in England) has, like many phases of education, been subject to a process of datafication in the last decade (Bradbury and Roberts-Holmes 2017c). This term is used to refer to a complex process where data has increased significance and this affects the practices, values and subjectivities in a setting:

It is helpful to think about how data is produced from multiple sources and has multiple forms in classrooms, how it is transferred from one site to another and with whose permission, who has the power to alter it, and of course who controls how it is processed and delivered back to serve some purpose. [...] [Datafication] is not simply a change to what is done and how, but also a change to *who people are*, or who they are expected to be. (Bradbury and Roberts-Holmes 2017c, 6)

This work in early years draws on and adds to the growing body of work in other education sectors internationally which identifies ‘the naturalisation of data as the most sensible medium for thinking about teaching and learning’ (Lingard and Sellar 2013, 652), and the related impact on teachers and school cultures (Finn 2016; Hardy 2014; Pratt 2016; Sellar 2015; Selwyn, Nemorin, and Johnson 2016). Throughout education systems, ‘new modes of data-driven rationality’ (Sellar 2015, 138) drive what we see as important and worthy of our time; data become fundamental in shaping behaviours and beliefs:

This wave of interest in the constitutive power of data, software and code is increasing as it becomes clear that data are, in a number of ways, central to the make-up of contemporary social formations of different types. (Beer 2015, 3)

The social formations of early childhood education are an exemplar of a sector in thrall to data, and to the production of what Millei and Gallagher call ‘ad-hoc numbers’ in reference to Australian ECE (2017), which influence practices and attitudes. In England, huge volumes are required to be collected, particularly in Reception, and the associated processes have an impact on practices, identities and values in early years (Bradbury 2013; Bradbury and Roberts-Holmes 2017c). First, there is a requirement that children be assessed at the end of Reception against 17 Early Learning Goals, using a three point scale of ‘emerging’, ‘expected’ and ‘exceeding’, based on teachers’ observations and recording of each child’s activities and work over the year. This produces a large volume of formal data, as children are assessed against these 17 goals every six weeks in order to demonstrate progress, and informal data in the form of photographs, notes and short assessments. Furthermore, the role of Reception year in providing the first set of statutory data in primary schools’ assessment data profiles has brought more attention from school leaders to the early years; research suggests the EYFS Profile is key in a school’s ‘Ofsted story’, the narrative of progress produced for the purposes of school inspectors (Bradbury and Roberts-Holmes 2017a). This role as a ‘baseline’ for progress measures was formalised in 2015 when the government introduced a new assessment at the start of the Reception year called Baseline Assessment, which allocated each child a score which could then be compared against their attainment at age 11, in order to judge the school’s effectiveness. There were three different providers of the assessment, two of which used a system of assessing one-to-one using a tablet (the other through observation). Baseline assessment was abandoned in 2016 due to problems with the comparability between different assessment providers, but there are plans to reintroduce it in 2020. Some of the research data discussed below is drawn from a project on the introduction of Baseline in 2015.

Finally, in addition to these developments, England will be one of three countries to take part in the OECD's new International Early Learning Study, known as the 'mini-PISA' (DfE 2017a; Moss et al. 2016a; Urban and Swadener 2016). This controversial development has further invigorated the debates about assessing young children and the reliability and validity of those data, and adds to the argument made here that children are 'datafied' at very young ages (Lupton and Williamson 2017).

Thus the Reception year is the main focus of this paper and this age group (four-five years) is the locus of many debates about increasingly formal education for young children internationally (Gunnarsdottir 2014; Moss et al. 2016b; Smith 2016). This year group was also the focus of a report from Ofsted, the school inspection service, which suggested that Reception classes were too often a 'missed opportunity' and should involve more formal structured learning. This report titled 'Bold Beginnings' focused on examples of 'successful' schools:

These successful schools made sure that they gave reading, writing and mathematics in their Reception classes sufficient direct teaching time every day [...] The headteachers made sure that their curriculum was fit for purpose, so that children were equipped to meet the challenges of Year 1 and beyond. (Ofsted 2017, 4)

Recommendations arising from this report include a greater focus on formal direct teaching and that children are taught 'how to sit correctly at a table' (5). This report was heavily criticised by early years organisations on the grounds that could encourage 'developmentally inappropriate practice' (KEYU 2017) and a narrow focus on literacy and mathematics. The Bold Beginnings report has been seen as aligned to political statements about shifting the Reception part of the EYFS framework to focus more on Literacy and Maths in preparation for the rest of primary school, as indicated in recent plans to:

improve the Early Years Foundation Stage Profile by: revising the Early Learning Goals to make them clearer and align them more closely with teaching in key stage 1; this will support us to meet our manifesto commitment to strengthen the teaching of literacy and numeracy in the early years. (DfE 2017b)

Thus Reception continues to be a key focus for those who question the formalisation of early years and the narrowing of the curriculum; I consider here how data drives and reinforces this shift. However, it should be noted that alongside this datafication of Reception, settings for younger children both in schools and private nurseries are also subject to the demands of data, as practitioners are required to catalogue children's progress against developmental norms from birth. I consider the ECE in the wider sense in this paper, but with a specific focus on the Reception year.

Theorising datafication

In line with previous work on data, surveillance and education, I use concepts drawn from the work of Foucault, particularly *disciplinary power* (1977, 1980), and Deleuze, particularly his description of *societies of control* (1995), to conceptualise datafication. It has been argued that contemporary digital forms of surveillance through data (or 'dataveillance') represent a shift from Foucauldian forms of discipline to Deleuze's more fluid forms of surveillance and control (Lyon 2014). This is a useful distinction between power as exercised within a particular place, and power as operating more flexibly spatially and at different times. For Foucault, the idea of the panopticon provides a metaphor for an all-seeing position which demands that we internalise expectations and can be relied upon to police ourselves, thus disciplinary power is exercised through 'conscious and permanent visibility' (Foucault 1977, 201). Foucault describes disciplinary power as operating within particular sites or enclosures, such as the school, prison or hospital; it 'imposes on those whom it subjects a principle of compulsory visibility' (1980). This analysis has been used in relation to how teachers are made visible and expected to 'self-govern' in response to demands (for example, in Ball 2003). The idea of disciplinary power as operating through data – governing what teachers do, how they judge each other and themselves – is an adaptation of Foucault's argument, which takes into account how computing

technology has enabled ‘a whole variety of new calculable spaces [to be] brought into existence’ (Rose 1999, 213). As described by Ball:

Measurement, comparison and examination, numbers of many sorts, are embedded in and serve the techniques to produce domination and responsibilization and construct ‘calculating selves’ and ‘centres of calculation’. (Ball 2013, 59)

Deleuze argues, in contrast, that control has taken over from discipline as there has been a ‘progressive and dispersed installation of a new system of domination’ (Deleuze 1995), as power operates beyond and between the institutions. Deleuze’s argument is that instead we now experience ‘ultra-rapid forms of free floating control’; this is represented by a shift ‘from targeted scrutiny of “populations” and individuals to mass monitoring’. Through this change, people become ‘dividuals’ rather than individuals:

We no longer find ourselves dealing with the mass/individual pair. Individuals have become “*dividuals*,” and masses, samples, data, markets, or “*banks*.” (Deleuze 1995 emphasis in original)

This idea is helpful in thinking through how data can reproduce the child as a ‘data double’, stripped of all complexity, and how this *dividual* can be subject to visibility rather than the person:

the ‘dividual’ is fundamental here, in societies of control the individual is doubled as code, as information, or as simulation such that the reference of the panoptic gaze is no longer the body but its double, and indeed this is no longer a matter of looking but rather one of data analysis. (Simon 2005, 15)

Thus Deleuze’s work allows for further scrutiny of the ways in which digital technology and data collection methods can operate even when there is no ‘direct line of sight in the production of panoptic space’ (Simon 2005, 15). The production of data through assessments conducted on online tablets (as in the case of Baseline and the planned IELS) is an example of this.

However, this does not mean that Foucault’s theoretical tools become irrelevant; they can be complementary:

While discipline stabilizes and objectifies bodies, control modulates them. One way to understand this difference is that control does not act on the body so much as the environment through which the body moves. (Simon 2005, 15)

In education we can see how freer flowing forms of surveillance through data collection, described by Bauman and Lyon as ‘liquid surveillance’ (2013), can be combined with more traditional forms of disciplinary power within classrooms. I would argue therefore that both perspectives are useful here in thinking about the operation of data in ECE.

The ‘schoolification’ critique

The argument that ECE is undergoing a process of ‘schoolification’ is based on evidence that settings for pre-school children are adopting practices traditionally associated with primary schools. Moss refers to an ‘intensifying relationship’ between ECE and compulsory schooling across Europe (Moss 2013), and notes that the OECD have acknowledged the imbalance of power between schools and ECE and the risk that settings ‘adopt the content and methods of the primary school’ with ‘detrimental effects on children’s learning’ (OECD 2001; 129 cited in Moss 2008, 225). Indeed, the OECD’s Starting Strong II report is often cited as the origin of the term itself (OECD 2006). This influence from schools, or ‘academic shakedown’ – a term used in relation to US kindergartens (Goldstein 2007) – is evident ‘when free play and learning through play are no longer considered appropriate routes to knowledge’ relationships (Gunnarsdottir 2014, 246). Rose and Rogers refer to the ‘increasing pressure to prepare children for entry to formal schooling emphasising skills in literacy and numeracy’ (2012, 44). As part of the drive to see early years as the start of ‘lifelong learning’, the sector is seen as preparation for schooling, and thus takes on the characteristics of more formal education settings. This conception of the aim of ECE as ‘school readiness’ is linked to

human capital theory, and involves ‘a particular construction of childhood, one where children are becoming rather than being’ (Campbell-Barr and Nygård 2014, 355; see also Uprichard 2008).

For the purposes of this paper I regard this term ‘schoolification’ as referring to several elements of an overall process:

- greater prominence of formal teaching activities (such as children sitting at tables doing adult-directed tasks or sitting on a carpet listening to a teacher);
- a reduction in free play time;
- an increased focus on ‘core’ subjects of literacy and mathematics;
- and pedagogical practices associated with older age groups such as formal grouping by ‘ability’.

These practices are concomitant with a reduction in the value placed on spontaneous play, creativity, and the building of relationships (Gunnarsdottir 2014). I argue here that the process of datafication is interrelated with all of these elements of increased formalisation; data are an enabling technology for schoolification.

The research studies

The research data here are drawn from four projects focused on early years education, conducted in 2008–9, 2013–4, 2015 and 2017. All four projects focused on classroom practices and assessment in ECE. The first project explored how the statutory assessment system, known as the Early Years Foundation Stage Profile, operated in Reception classrooms (age 4–5). Data collection consisted of ethnographic non-participant observation in two Reception classrooms in London over the course of one year, and in depth repeated interviews with teachers at the schools. The second project was an exploratory project focused on assessment policy in early years settings including schools, children centres and nurseries. It involved interviews with teachers, nursery staff and managers. The third project focused on the introduction of a new assessment system to Reception, Baseline Assessment, in 2015. Methods included a nationwide survey of teachers focused on the new assessment, and in-depth interviews with Reception teachers and senior leaders at five case study schools across England. The final project, on the use of grouping by ‘ability’, conducted in 2017, used similar methods: a nationwide survey and interviews at four case study schools. In addition, four focus groups were conducted with teachers on the subject of grouping. Data drawn from the second, third and fourth projects were collected with a co-researcher, Guy Roberts-Holmes.

All the studies were conducted in line with ethical guidelines of the British Education Research Association and the host university. All names of individuals and schools are pseudonyms.

Interview data and comments from the surveys from these four projects are used in this article to demonstrate the complexity of datafication processes in ECE in England during the last decade. The data presented here are not intended to be used as evidence of a shift over time, but they do represent a broad range of settings over a substantial period and thus indicate how established the discourses of datafication have become in ECE in England.

Findings: datafication in ECE

School-based settings

Across the four research projects there were clear demonstrations of datafication, as defined as a shift in the practices, values and subjectivities in a setting (Bradbury and Roberts-Holmes 2017c). Beginning with the earliest data, from when teachers used the previous system of assessing children against 117 points on the EYFS Profile, the dominance of numbers in Reception is clear:

It’s really hard because they’re asking for a number. [...] You’re quantifying something that’s not quantifiable. Some of it is quantifiable but for the majority of it, it’s not. (Reception Teacher, EYFSP Project)

There's 117 profile points, you know, and you're supposed to have evidence, three pieces of evidence, for each. There is no way that you can do that. (Reception Teacher, EYFSP Project)

These teachers identified two problems: the difficulty of translating complex information about a child into simple yes/no decisions in order to produce 'a number', and the volume of data required to justify these decisions. These are examples of the practical implications of what Dahlberg and Moss describe as:

... a rationality that cannot imagine any other way to justify and evaluate preschools except in terms of their ability to produce pre-specified outcomes and through the application of measurement techniques that are assumed to be objective and universally valid. (Dahlberg and Moss 2005, 5)

Datafication is based on the principle that objective, valid data can be collected in an educational environment, and that this is a reliable method of assessing 'quality'. This reasoning was clear to one Reception teacher in the EYFSP project:

It's just government statistics really ... you have to quantify something, I mean the way that it works at the moment is, if you're funding stuff and you're giving all these schools money, you need to know, the government need to know that they're getting their money back from it; that they are, the people who you're giving money to are doing their work, so you need a figure, you need a percentage. (Reception Teacher, EYFSP Project)

These comments suggest that Reception classrooms were brought, through the EYFS Profile, into the 'ever-expanding systems of measuring, costing, monitoring and ranking' which 'converts them into manageable and auditable entities' (Shore and Wright 2015, 25). Similarly a teacher commented in the more recent Grouping project that assessments in Reception were 'linked to a curriculum that you can measure, therefore you can measure your teachers and link it to performance related pay' (Teacher, FG3, Grouping Project). This shift to an 'auditable entity' has been intensified with the revised version of the EYFS Profile, now 'slimmed down' to 17 statements (Bradbury 2014), and the introduction of Baseline Assessment, as early years results have become an important part of the whole school analysis of data and the school's narrative of progress. One teacher commented:

You have to track children all the time and I have to add everyone's data at the end of each term to the school tracker. Have they performed appropriately and if not why not and what interventions are going to have go in? Nobody's allowed to fall behind. The tracking begins from Nursery in the Prime Areas and right through to year 6. If you are exceeding at the end of Reception you have to show that you are exceeding at the end of KS1 and if not then we are not doing our job'. (Deputy Head teacher, Easthorne Primary School, EY Policy Project)

This tracking of children – often using commercial software such as TargetTracker (EESforSchools nd) or OTrack (OTrack nd) – begins in early years and continues throughout primary school. However, the early years have an important role in that the data they input form the first judgements on a child, from which progress will be assessed. The Reception classroom becomes one of the 'calculable spaces', subject to the 'principle of compulsory visibility' (Foucault 1980).

Importantly, the data are seen as evidence of 'doing our job'; these teachers' professionalism is tied up in producing the right data. This 'data-driven' teacher subjectivity (Bradbury and Roberts-Holmes 2017c) is formed through pressure on results, training on appropriate 'tracking' and through policies and inspection arrangements which define success as adequate proportions of 'progress' from children.

We start tracking from nursery ... so that's all entered onto the OTrack. [...] So we would also use that to see if there's any particular gaps. So if we're looking through and we think, 'Oh actually we don't have very many observations' or 'very few things about this particular area' then we would be able to go 'Okay well that's what we're going to be doing in the next half term is make sure that we're doing ...'. (Nursery teacher, Moore Primary School, Grouping project)

The collection and analysing of data is just too overwhelming. It makes you constantly think of how to *improve* it and what to do with this group and how to plug this hole and that one. I fill in trackers frequently and *I feel a personal pressure* to make them progress. (Reception Teacher, Easthorne Primary School, EY Policy Project)

The use of statutory assessment (both the EYFS Profile and Baseline) in ECE in schools demands that data become an important part of teachers' lives and their sense of worth. It feeds back in their decisions about pedagogy and curriculum, and monitoring the data collected becomes another task, producing data on the data. This is particularly the case where the information accumulated is observation-based and non-numerical, a point even more relevant to ECE settings for younger children in nurseries, as I discuss below.

These data-driven subjectivities are informed by processes of monitoring which elevate the status of data as representations of teacher quality; 'pupil progress meetings' with senior management and 'hit visits' from the local authority focus on children's progress individually and as part of key groups such as 'pupil premium' children (those for whom the school receives additional funding³):

The other thing we started doing because of the fear of Ofsted, because we're due one soon and we're worried about going back into required improvement, is we've started doing [pupil progress meetings]. We do three pupil progress meetings a year, then we do three midpoint ones in between each of them, where we go back and we reassess any child that wasn't at the right point and any child who is on the pupil premium list. We reassessed them so their data has to go up in between. Then when you come to the pupil progress meeting, it has to have gone up again. The idea almost being that you can double their rate of progress by meeting more often. (Teacher, Focus Group 2, Grouping Project)

[We] have a hit visit to check on how well the school is doing. Obviously there's agendas to those visits. So we have to look at our groups, we have to look at our PP [pupil premium], our ethnic groups. We have to hit the targets so you're constantly looking at those because you know, I know as EYFS leader, I know my Key Stage 1 leader is the same, we have to feed back to our heads about how well those groups are doing ready for the EYFSP. I have to look at predicted levels of development. (Teacher, Focus Group 4, Grouping Project)

Here we see how data from early years form a key part of the school's presentation to the outside world – to the inspection service Ofsted and to the local authority who monitor standards in the area. As the first quote suggests, these data do not necessarily have to relate to a child's learning, but there is a constant need to show progress between meetings. Similarly, the second quote shows the pressure to 'hit the targets' and feed back to the headteacher means you are 'constantly looking'. The data have a disciplinary function; the early years teacher as professional is subject to 'permanent visibility' (Foucault 1977, 201) through the production of data for statutory assessments.

Settings for younger children

While private and voluntary nursery settings are not subject to a statutory assessment, practitioners are required to track children's progress against the set stages of the government document 'Development Matters'. This tracking involves regularly updating a child's profile, usually in digital form, on a spreadsheet or via tracking software such as Parentzone (Parentzone nd). This allows for comparison over time and between children, and forms part of the performance management process for nursery staff.

In order to justify the decisions made on these profiles, where children are designated as 'commencing', 'emerging' or 'secure' for statements organised into age bands, practitioners are required to collect evidence of what children can and cannot do. This takes the form of photographs and observations, which are often recorded on a tablet and stored on a child's digital profile. This evidence is linked to colour-coded designations so that the information can be easily cross referenced, and the information is available to parents. Profiles include comments on emotional, social and physical development, and writing and reading skills for older children. As a parent I have received these detailed profiles from my children's nursery; one memorable example was when one of my daughters was designated at 11 months as 'secure' in 'having a can do attitude' (age band 15–20 months); the evidence for this was that she took a bottle of milk from her key worker and held it herself. Although these profiles amass large volumes of detailed data about the child, the need to include these designations means they simultaneously produce a reductive 'data double', an extracted and distilled version of the child, measured against standard criteria and labelled as 'ahead' or

'behind'. Thus datafication is reductive, oversimplifying the complexity of children, reducing them to a 'data double' (Simon 2005) or 'data doppelganger' (Williamson 2014).

At age two, a summary assessment is produced which designates the stages of 'Development Matters' which a child has achieved, and similar summing up reports are passed on to children's first teachers as they make the transition to school at age four-five. Thus the child is already 'datafied' when they arrive at school, designated through data in relation to standardised norms, and this continues as they are measured using Baseline assessment and the EYFS Profile in Reception.

As I have discussed elsewhere (Roberts-Holmes and Bradbury 2016), younger children are similarly judged in order to measure 'progress', and to make predictions. At one state-run ECE centre, a senior leader explained:

We record how the children enter when they are two, so we have a baseline and then throughout the year we do three assessments with the children at set points and then compare them with each other to check that they are on track are making progress. You have to show that you have made 'value added' by the time they reach end of Reception. The LA [local authority] are using that information to predict how 2 year olds are going to do at the end of FS, KS1, and KS2 [age 5, 7 and 11]. (Senior Leader, Children's Centre, EYFS Policy project)

Thus the child is already tracked, labelled and predictable, from age two onwards. Datafication occurs across ECE settings, both in schools and in the range of pre-school provision found in the ECE market in England. I now turn to how these processes of datafication relate to the schoolification critique.

The relationship between producing data and 'schoolification'

As discussed, the critique that ECE is becoming 'schoolified' is evidenced in a range of changes, which can be summarised as: formalisation of teaching activities; reduction in free play; increased focus on literacy and mathematics; and pedagogical practices used with older children. I begin by considering the first two of these in relation to increased use of statutory assessment.

Data and pedagogy: reducing free play and relationship-building

One of the clear findings from the third project on Baseline Assessment was that the pressure to collect and record data affected how teachers organised their classrooms. In the case of teachers using the observation-based assessment, the need to see children demonstrating particular skills (such as using number names, or linking sounds to letters) meant that they engaged in more formal activities:

Rather than go with the children's interests - of what they were interested in - I have geared what I have been setting up in the class to try help me gather information for the purpose of this assessment. (Teacher 3, Cedar Primary School, Baseline project)

[We] thought that actually we haven't really looked at that [some areas] so we had better do something about that, so we might put out a particular activity to almost cover those points. (Teacher 1, Beech Primary School, Baseline project)

We assessed usually one activity by activity. So we set up an activity that we knew would fulfil the criteria for certain statements and then watched the children access it and then we just went down [the list of names] and said, yes they can do it. (Teacher 2, Elm Primary School, Baseline project)

This year it is very much a case of find our way through it I suppose, working out how to change our curriculum to meet the needs of what we need to do for Baseline. [...] We are having to do activities to find that information, so that has taken away from being able to get into the areas of provision and work with the children. (Teacher 1, Alder Primary School, Baseline project)

These changes to activities are changes in the curriculum in Reception, which in these cases became driven by the need to collect data against the 47 statements on the Baseline Assessment. They also mark a greater formalisation, as children are required to engage with the task so that the data set is complete. Some of these set up activities might be part of free play, where children circulate and choose what they engage with, but many will require some formal intervention from the teacher.

Thus the requirements of data require and demand greater formalisation. This practice was noted in the recent Ofsted report on Reception, which noted ‘Many teachers devised tasks simply to tick off elements of the early learning goals so that they could provide evidence of children’s achievement’ (Ofsted 2017, 4).

Similarly, for those teachers using the tablet-based assessments, these necessitated a change to normal practice and a reduced focus on building relationships:

The reception teacher in our school found it impossible to administer the baseline test and teach a class of new reception children. A supply teacher had to be drafted in so that the tests could be carried out. The result was that our reception teacher was not able to work with her new class in setting expectations for behaviour, rules, routines or getting to know the children. The test caused a lot of disruption to learning and had a negative impact on relationship building. (W, Baseline project)

Although I agree with baseline in principle, the NFER package prevented us from building relationships with children at a crucial stage. (W, Baseline project)

It has to be done as early as possible at the crucial time when you should be developing relationships with them not ignoring the majority and looking at a screen 1:1 with 1 child. (W, Baseline project)

As suggested in these quotes, the need to produce data was regarded as detrimental to the process of building relationships with children to make them feel secure. This reflects a policy failure to engage with ‘the notion of care as a public good’ (Urban 2015, 297), and a preference for measurement over social and emotional development, seen as symptomatic of ‘schoolification’. The tension between data collection and building relationships was a repeated theme in teachers’ responses:

[Baseline Assessment] took me away from getting to actually know the class. We didn’t gain anything from it. Some children looked at me and said “I can’t read” when asked to read parts of the assessment. It was heart-breaking to see their reaction to it and I spent a lot of time reassuring children. (W, Baseline project)

You had to set it up so you could actually assess these things which makes it very difficult to make, to start forming a relationship with the children, which is so important at this time of year. (Teacher 2, Cedar Primary School, Baseline Project)

As a teacher I would rather spend time supporting children settle in properly, talk to them, get to know them as individuals, use my experience to identify needs and interest, not just fill in more forms. (W, Baseline project)

This shift can be conceptualised as a process of *dividuation*, following Deleuze (1995), where children are ‘*dividuals* rather than individuals; they become data to be mined, aggregated, analysed and acted upon’ (Bradbury and Roberts-Holmes 2017c, 64). Relevant here is Thompson and Cook’s argument, in relation to school teachers, that ‘one of the logics of *dividuation* is the end of care for individuals; instead there is ‘a new logic in which care is not registered’ (2014, 138). This is important in ECE where caring is a fundamental principle in many professionals’ practice. Thus datafication produces not only a shift in pedagogy but also in values and priorities, towards those more aligned with the rest of the primary school.

The dominance of literacy and Maths

The current EYFS curriculum is made up of three prime areas: communication and language, physical development, and personal, social and emotional development (PSED); and four specific areas: literacy, mathematics, understanding the world, and expressive arts and design (DfE 2014a). However, one of the criticisms associated with ‘schoolification’ is a shift towards focusing on literacy and mathematics, rather than a ‘whole child’ approach (Moss 2016), as ECE is reconceptualised as preparation for school. I would argue this is further motivated and enabled by the need to focus on subjects that are easily measured and therefore more productive of data.

The primacy of literacy and mathematics was highlighted in the requirement that providers of Baseline Assessment focus on these two subjects:

The clear majority of the content domain must [...] demonstrate a clear progression towards the key stage 1 national curriculum in English and mathematics. (DfE 2014b, 1)

This request was related to the dominance of these two subjects in the later tests with which the Baseline results were to be compared (though the inclusion of the PSED element limited this connection). However it also represents a wider shift away from the broad curriculum of the EYFS in Reception towards a narrow focus on literacy and maths. Teachers commented, in both the Baseline and Grouping projects:

[Tablet-based test] doesn't take into account anything other than literacy and maths. What happened to "the unique child"? (W, Baseline project)

[Baseline test] is based purely on literacy and maths, and whilst there were some PSHE⁴ comments, it in no way encompassed the whole child. (W, Baseline project)

We were told at the beginning of the induction of the Foundation Stage that in the EYFS the whole child is important and every area of the EYFS has the same importance. It no longer has - we group children for "Learning Groups" by the "important" areas (as seen by Primary schools - Number and Phonics!) (W, Grouping project)

The early years curriculum is narrowing and schools are becoming only interested in literacy and maths. (W, Grouping project)

Furthermore, there was evidence of this shift in relation to younger children in nursery classes in schools, and similar concerns were raised in relation to three-year-olds:

I am now pushing information into three-year-olds rather than developing meaningful relationships. Even in the nursery I now feel that pressure. If a child doesn't recognize a number or a letter I go "agggghh" and hold my breath. I have to remind myself the child is three and not yet ready for it. (Teacher, Easthorne Primary School, EY Policy project)

We see here how the pressures of data demand that children are engage with literacy and maths before they are 'ready for it'. I would argue that in early years settings for younger children the practices of collecting data are also linked to pedagogical and curricular shifts which represent schoolification, particularly the tendency to focus on skills in preparation for literacy and maths, and increased use of teacher-lead activities designed to process information for assessments.

This shift demonstrates how datafication and schoolification both reproduce the other – literacy and maths are more easily translated into numbers, while their increased prominence in assessments encourages teachers to spend more time on these 'core' subjects. This produces a narrowing of the curriculum, as noted in the rest of primary education (Wyse and Torrance 2009; Alexander 2009; Wyse and Ferrari 2015).

Data and grouping practices

Finally, one particular practice can be seen as evidence of 'schoolification' – the use of set 'ability' groups in Reception – as this grouping practice increases in prevalence with children's ages (Baines, Blatchford, and Kutnick 2003; Hallam and Parsons 2013). Grouping practices are controversial (Francis et al. 2017) but are increasingly prevalent in younger ages groups (Bradbury and Roberts-Holmes 2017b; Campbell 2014). In the research project on grouping, direct links were made (often unprompted) between data analysis and grouping decisions:

[The] realities of resource constraints (e.g., Lack of support staff etc), constant fixation on data results and so on, mean that grouping becomes necessary just so that basic teaching can happen. (W, Grouping project)

[Grouping] has pros and cons but in a data driven world it seems to be becoming the norm. This sadly takes away from child led play time as we are forced into writing and reading constantly rather than appreciating the real heart of EYFS. (W, Grouping project)

The 'data driven' context requires grouping, which is seen as a solution to the problems of producing the right data (see also Bradbury 2018). Moreover data facilitate the allocation of children to groups by providing evidence of different 'abilities'; for example, in several schools phonics assessments every six weeks were used to determine groups. These differences are solidified and made credible through data, even when there are doubts about the reliability of the information collected. For instance, in the case of Baseline some teachers commented it was used to group children, though there were doubts:

It helps us group the children in differentiated maths and phonics groups. (W, Baseline project)

Also there is no time given to these poor little children to settle in before they are assessed and in our school they are put into ability groups based on these results! (W, Baseline project)

Thus data and grouping work together, mutually reinforcing the dual ideas of fixed 'ability' and reliable measurement. In particular grouping was seen as necessary for literacy and maths, reflecting the greater prominence discussed above.

I feel comfortable grouping for phonics, literacy and maths in my year group (reception) because it enables us to teach the right level which I believe helps the children's progress. (W, Grouping project)

I think grouping for some EYFS areas of learning, specifically Literacy and Maths can be beneficial as it enables staff to plan and deliver focused adult inputs which are appropriate to specific learning and development needs. (W, Grouping project)

The increase in data in Reception facilitates the adoption of grouping practices, and the result is seen to be an improvement in children's results. We see how the discourses of 'ability' and data work together, contributing to increased formalisation.

Discussion

Throughout the paper, I have used research data from four projects to argue that the process of datafication in early childhood education facilitates and accelerates the increasing formalisation of learning with young children, while simultaneously the greater use of formal assessments and set subjects produces yet more data. Datafication and schoolification are two sides of one coin, and dominate notions of 'good practice' and 'quality' in official discourse in England (though they are resisted by teachers and early years professionals).

The close links between the dual processes of datafication and schoolification described here can be understood through a consideration of the underlying discourse which dominates ECE. This is a technical, instrumental discourse of education associated with 'regulatory modernity' where political questions are removed 'to reduce everything to a technical practice of problem-solving and performance' (Moss 2016, 12). As in other education sectors, what matters is what can be measured; and in early years if there is nothing that can be measured, practice must change so that scales, statements and norms can be applied. In all of this, we risk 'losing sight of the child' (Campbell-Barr and Nygård 2014); there is little known or understood about how data processes relate to children's rights (Lupton and Williamson 2017). As Clausen et al. (2015) argue:

The pressures of individual child-profiling and external inspection hinder English children's freedom and democratic participation, promoting individualism and 'technical performance', and restricting the understanding of children's learning. (Clausen et al. 2015, 366)

These concerns have been raised again in relation to recently announced plans to include English children in the OECD's International Early Learning Study (IELS), known as the 'mini-PISA', in recognition that it mirrors the OECD's PISA assessment at age 15. This development suggests a further shift towards formalisation and the production of data over children's play-based learning (Moss et al. 2016a). IELS will bring early years into the 'global measurement industry' (Biesta 2017). It will assess 'social and emotional skills as well as their cognitive abilities' in four 'early

learning domains': executive function, i.e., early self-regulation and attention; emergent literacy, language and verbal skills; numeracy and mathematics; and empathy and trust (DfE 2017a, 2). Thus the data collected on children will be detailed, personal and will allow for predictions to be made. As with Baseline, the information gathered will form a datafied version of the child, a 'databased self', 'more easily accessible, observable, manageable and predictable than we are' (Simon 2005, 16), visible far beyond the classroom in a fashion symptomatic of Deleuze's societies of control (1995).

Furthermore, given that PISA has been seen as the cause of 'a dramatically increased reliance on quantitative measures' with older children (Meyer and Zahedi 2014; also Ozga and Segerholm 2015), it seems likely that the publication of data on five-year-olds as part of IELS will similarly encourage national systems to see young children as measurable subjects – miniature 'centres of calculation' (Ball 2013; Williamson 2014) – to be brought into the regime of accountability. Technology plays an important part in this, as the use of touch-screen tablets with audio instructions supposedly resolves the problems of assessing children who cannot yet read or write; current plans for IELS suggest it will use a tablet, like the latest iteration of Baseline Assessment (DfE 2017a). But there are additional ideological tensions involved in bringing ECE into this system, beyond those identified in the continued debates about testing as neoliberal forms of accountability in schools. Importantly, the dominance of data in ECE brings with it a reduction in the value placed on care, and on building relationships between child and adult which allow the child to learn. ECE data are not just more data, they are data produced at a human cost.

Conclusion

I have examined here how data are an enabling technology for schoolification in ECE, and a catalyst for this formalisation. Both shifts are driven by a rationality based on measurement and accountability that dominates current notions of worth and value in education. In light of the research evidence presented here and the wider context of the 'mini-PISA', I would argue that broader discussions of data in education need to be cognisant of the volume of data collected on children *before* they begin formal schooling and the extent to which children are unknowingly 'quantified selves' (Lupton 2016) at young ages. Children are already datafied at age four, as huge volumes of information have already been collected on them, forming a 'data double' (Simon 2005) which demarcates them as fitting the norm or deviating from it. Thus I would argue that the wider concerns about data in schools – the loss of complexity, issues of reliability, the impact on pedagogy – must take into account what has already happened in early childhood education.

Notes

1. Confusingly, the term 'nursery' is used for private pre-school settings attended by children from birth-four, and also for the group of children attending primary schools before it is compulsory (aged 3–4). Some but not all schools have Nursery classes as well as Reception (age 4–5), and these form the 'early years' part of primary schools.
2. The subject of English, encompassing reading, writing and speaking and listening skills, is known as Literacy in primary schools in England.
3. Additional Pupil Premium funding is allocated to schools for each child who has been in receipt of free school meals (due to their family receiving certain state benefits) at any point in the last six years (£1320 per child in 2017–18), or who is or has been in local authority care (£1900 per child).
4. Personal, social and health education, which is a subject taught in primary schools.

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2 Configuring the teacher as data user

Public-private sector mediations of national test data

Helene Ratner, Bjarke Lindsø Andersen and Simon Ryberg Madsen

ABSTRACT

Datafication of student learning has carved out an influential space for public and private actors who design technologies for visualizing data. As data visualizations shape how teachers' interpret data, they are powerful devices. This paper examines how teachers get configured as data users in the making of Danish national test data visualizations for municipal primary and lower secondary schools. The paper is based on a qualitative study of the Danish Ministry of Education, which develops the official visualizations, and NordicMetrics, a private consultancy offering a supplementing visualization of student progression. We draw on science and technology studies (STS) to theorize techno-organizational dynamics of developing visualizations. We propose to understand data visualizations as contingent, situated and socio-material achievements that configure teacher as data users. Comparing two institutions' respective negotiations of different concerns when developing data visualizations enables us to consider the otherwise 'hidden' data mediators and the entwined relations between public and private data mediators.

Introduction

This paper examines how a public and private actor develop visualizations of Danish national test data. Research in educational governance exposes a growing interest in how digital infrastructures and datafication pave the way for private actors to enter the public school systems, providing digital solutions that offer support for teachers, but also influence policies and practices (Ball 2007; Burch and Good 2014; Breiter and Jarke 2016; Saltman 2016; Ramiel 2017; Sellar 2017). In Australia, standardization of digital education infrastructures provides 'a space in which commercial actors shape the demands of users, which in this case are often governments, thus creating the demand for products and services that can be profitably provided' (Sellar 2017, 349). In the UK, 'the private sector is increasingly important as a mediator of policy between the central state and local institutions' (Ball 2007), and in the US 'schools and other education agencies are contracting more with primary for-profit vendors at rapid rates – *buying* as opposed to *making*.' (Burch and Good 2014, 1). Research in this area has also pointed out that 'digital systems and software (...) [reflect] the agendas of software designers (...) rather than education policy makers' (Selwyn 2018, 738).

These statements indicate two rather opposing ways of understanding the relationship between public and private actors in education. Firstly, there is a concern with the increasing influence of private software at the *cost* of public policy. Here, the issue of public versus private education often takes on a somewhat abstract tone, posing it as a binary choice between education as a market for profit or

a public good (Belfield and Levin 2015, 2). In the second instance, software providers are simply *the means* for public policy, “‘speeding up” (...) education policy’ (Williamson 2017, 441). Here, the concern is with a transnational standardization in how schools and students are governed. The private-public complex, we suggest, is not that clear-cut and may vary over time. Insofar as we are witnessing the ‘displacement of educational governance to new digitized sites of expertise in data collection and analysis’ (Williamson 2017, 94), it is important to investigate these ‘data mediators’ (Hartong 2016) including the entwined relations between public and private sector software providers.

In this article, we inquire how one public and one private actor develop visualizations of Danish national test data, which are to help teachers assess student abilities and how (much) students learn. The National Agency of IT and Learning (Styrelsen for IT og Læring - STIL) under the Danish Ministry of Education is responsible for developing the official web-based visualizations of students’ national test results, including one of students’ progression. The small private enterprise NordicMetrics produces an alternative visualization of students’ progression. While showing students’ progression in different ways, the two different visualizations are based on the same data, and hence they offer an interesting case for exploring the socio-material and situated circumstances of mediating data to teachers. The questions framing our inquiry are: How do the two institutions configure teachers as data users through data visualizations? How to they articulate what a teacher needs in order to interpret students’ progression? How do socio-material and practical circumstances influence their visualizations? To engage these questions, the article is based on a qualitative study of the two institutions. The study predominantly consist of interviews with people involved in developing visualizations.

The next section introduces the national test, STIL, and NordicMetrics further. Then a theory section comes, introducing concepts from science and technology studies (STS) for theorizing visualizations as situated and socio-technical achievements that configure the user. The theory section is followed by a methods section, detailing the empirical material for this paper. The two analytical sections explore how the two institutions’ visualizations are to configure the relation between teachers and national test data. They do so by analyzing their institutional circumstances and how they represent teachers as data users. The concluding discussion explores the wider implications of the study. Focusing on the ‘hidden data mediators’ underscores the often-invisible contingency of otherwise persuasive visualizations. Moreover, the study has implications for how we understand the relation between public and private. We suggest that, the term information ecology is helpful to understand this relation in our case as it emphasizes ambivalent interdependencies and co-involvement rather than standard distinctions between public (for good) and private (for profit).

Background

The production of uniform performance data enables the classification and comparison of students and educational institutions, and standardized national testing has become a popular tool in the digital governance of education worldwide (Benavot and Tanner 2007; Piattoeva 2015). In 2006, the Danish government decided to introduce a digital national test, in the wake of an OECD review, which criticized the lack of ‘evaluation culture’ and standardized criteria for assessment in Danish municipal primary and lower secondary schools (Ekholm et al. 2004).¹ The OECD review was, in turn, a response to disappointing Danish PISA results in 2000, which in public discourse was referred to as the ‘PISA shock’. The relatively mediocre Danish performance drew political interests towards improving Danish students’ achievements in reading and math (Breakspear 2012). As a consequence, the national test has been mandatory since 2010. The purpose of the test is twofold (Danish Parliament 2005a, 2005b). Primarily, the test results are to serve as an indicator of the individual student’s performance and provide a better foundation for teachers to intervene pedagogically. Secondly, the results are used for monitoring national performance. In 2014 a substantial school reform introduced national achievement targets for schools, operationalized through national test data, and

thus integrated the national test in accountability relations between the ministry, municipalities and schools (Regeringen and Folkeparti 2013).

The national test was developed after a public tender run by the Ministry of Education. Jakob Wandall, the co-founder of NordicMetrics, was employed as a chief advisor in the Ministry of Education at this time and became project leader on the tender and implementation of the national test.² Originally, the public tender included a requirement to develop longitudinal measurements of students' test performance (progression). Yet, this was dropped due to various delays in the development and implementation of the national test (see REVIEW-panelet 2007 for some initial challenges). Instead, test results are reported (and visualized) using a norm-scale, which ranks students and classes against students taking the test in 2010. Official evaluations of the national test problematized afterwards that teachers primarily use the test results for summative monitoring of students' proficiency rather than the intended formative, pedagogical use (Rambøll 2013, 2). This speaks to a wider international experience where 'benchmark assessment data' renders systematic and formative use of data difficult (Datnow and Hubbard 2015). The school reform's introduction of achievement targets in 2014, however, resulted in the development of a criteria-scale, which enables the visualization of progression.³ Currently, the official test system reports test results with the use of both scales (norm-based and criteria-based).

From 2010 and onwards, the Ministry of Education has undertaken the task of maintaining, updating and improving the national test system, and STIL is tasked with updating the visualizations. In 2011 Jakob Wandall left the ministry to establish the private consultancy NordicMetrics which specializes in psychometrics and provides education and workshops about how the national test system works. In 2012, the municipality of Copenhagen commissioned NordicMetrics to develop the open-access software *Beregneren* ('The Converter'). *Beregneren* is a spreadsheet application where teachers copy their students' test results from the official test system and paste them into a spreadsheet that converts test results to a different scale and provides a visualization of progression. Today, 50 municipalities (out of a total of 98) access *Beregneren*.

Studies critical of standardized national testing are not uncommon in the academic literature (Ball 2015, 1993; Lingard, Thompson, and Sellar 2016). This is also the case for the Danish national test. Critiques point to detrimental effects on educational quality, of 'teaching to the test', students' negative experiences with testing, high levels of uncertainty in test results, and the teachers' poor knowledge of how to interpret the results of the test (Bundsgaard and Puck 2016; Kousholt 2016). While raising important concerns, engaging with these critiques is outside the scope of this paper. We acknowledge that national tests are cogs in a wider change from 'education' to 'learning' (Ramiel 2017), but in this paper we focus on contingencies and particularities of the development of data visualizations and their resulting configurations of teachers as data users. In the same vein, we do not engage directly with the literature focusing on how teachers can improve education and students' learning through better use of data (but see Schildkamp, Karbautzki, and Vanhoof 2014; Datnow and Hubbard 2015). However, we do hope that casting light on data mediators, their circumstances and considerations when developing visualizations, can contribute to existing debates, whether critical or optimistic. If data visualizations are an important aspect of how teachers interpret and work with students' learning, then our study provides an understanding of how data visualizations themselves result from various circumscriptions and circumstances.

Visualizations as socio-material configurations of the user

Visualizations are powerful devices that turn the psychometrics of national testing into interpretable 'depictions of the social world that organize the attention of their users and provide them with useful empirical sensitivities' (Madsen 2013, 11). Visualizations, of course, only comprise one moment of a series of processes producing, analyzing and sorting data (Flyverbom and Madsen 2015). It is also just a rather small component of the national test digital infrastructure, which includes test item

databases, testing software, instructions for teachers, and psychometric algorithms to estimate proficiency.⁴

Rather than assuming data visualizations to ‘provide direct, neutral or “objective” observations’, we explore visualizations as situated, socio-material, and contingent achievements (Flyverbom and Madsen 2015, 157). Here, we follow a long tradition in STS of abandoning *a-priori* separations between ‘technology’ and ‘sociality’ (cf Callon 1986). Rather than assuming (information) technology, their designers and users as distinct entities, we explore the ‘techno-organizational dynamics’ endowing designers with particular capacities and restrictions for developing visualizations (Bloomfield and Vurdubakis 1997). One important contribution here is Lucy Suchman’s work (2007). She contributed substantively to the idea of human-machine configurations in the study of socio-technical systems. Emphasizing how human and machine agencies are joined, configuration is a relational ‘mode of ordering’ that shapes and designates agencies ‘pre-supposed by and built into particular technological artefacts’ (Suchman 2012, 49). The configuration of (future) users of technology, in this case teachers, is thus central in understanding the making of data visualizations.

There is much literature on how designers configure users (Woolgar 1990; Akrich 1992; Oudshoorn and Pinch 2005; Suchman 2012). Rather than exploring the relation between designers and users as negotiations between different social groups, Woolgar (1990) suggests that designers’ *representations* of users are important in how designers ‘struggle to configure (that is, to define, enable and constrain) the identity of putative users’ (p. 73–74). In exploring visualizations as *achievements* it is thus important to investigate how *designers represent users* when developing visualizations.

That said, designing visualizations is not ‘a one-way process in which the power to shape technological development is attributed only to experts in design organizations’ (Oudshoorn and Pinch 2005, 8). While designers configure users, designers are also ‘configured by both users and their own organizations’ (Mackay et al. 2000, 752). The agency of designers is shaped by ‘sets of cultural, political and economic relationships as well as institutionally sanctioned commitments’ (Jensen 2007, 239). As Suchman writes regarding the identity of ‘the designer’, this is a category describing ‘persons differently positioned, at different moments, and/or with different histories and future investments in projects of technology development’ (Suchman 2007, 278).

Visualization, in this view, is a stabilization of distributed interests, emerging from other time-spaces than the offices of the designers and users (Suchman 2007, 267). While keeping in view how designers represent and configure users by inscribing particular users in the visualization, it is thus also important to explore how wider institutional, socio-material circumstances that both restrict and enable designers when developing visualizations. Although visualizations shape how teachers can interpret test data, it is also important to note that designers’ configurations of user do not determine the actual use of visualizations as digital technologies may well be reconfigured or appropriated in surprising ways (Akrich 1992).

Methods and data

In order to explore how visualizations are achieved in respectively STIL and NordicMetrics, this analysis primarily draws on interviews (Spradley 1979) with people who have been central in designing the scales and/or visualizations. These comprise a statistician and user experience (UX) designer from STIL, involved in developing the official visualizations of national test data, and Jakob Wandall, the owner of NordicMetrics (and former employee at the Ministry of Education). A wider foundation of data and experience also form an important backdrop to the analysis. Ratner has conducted a qualitative study (2015–2017) comprising observations, interviews and archival research of STIL’s use of data and data visualizations in the governance of municipal primary and lower secondary schools (Ratner and Gad 2018). Madsen has a personal experience working for NordicMetrics (September 2016 – January 2018). Apart from providing access, these experiences helped select designers

for interviews and to structure the interviews. The paper makes occasional references to observations gathered from these experiences.

We also collected written instructions explaining visualizations to teachers, downloaded from the websites of the Ministry of Education and NordicMetrics. Since the Ministry's website only holds the latest version of instructions, we obtained four historic versions (2010, 2014, 2016 and 2017) of those instructions through the Wayback Machine, an online web crawler that stores historical copies of websites and data (<https://archive.org/web/>). This historical insight into the changing visualizations of national test results helped us focus the interviews.

The aim with the interviews was two-fold: to map important decisions and ambivalences when developing visualizations and to get accounts of how the designers learned about teachers' needs as well as how their work depends on wider institutional circumstances. National test instructions and transcribed interviews were coded in Nvivo, applying 'theme coding' and labeling data according to the identity of the speaker and the specific visualizations (in the interviews, we used the visualizations as a proxy for having our participants explain its development and how they would like teachers to use it). We used theme codes to summarize the participants' accounts of 'what [was] going on (...) [and suggestions of] why something is done the way it is' (Rubin and Rubin in Saldaña 2013, 176). We applied both pre-defined themes, which reflect the theoretical concept of configuration and the interview guides (e.g. teacher representation, circumstances and conditions for developing visualizations, dilemmas in visualizations) but also allowed for new themes to emerge during the coding.

Given that Madsen at the time of the interview was a close colleague of Wandall and an insider to NordicMetrics, an important concern for us was both to generate sufficient analytical distance but also to make good use of this familiarity when producing and analyzing the data for this article (Neyland 2007). In anthropology, 'immersion' in the field is generally considered a virtue, giving access to cultural insider knowledge and knowledge of power conflicts that may be difficult to see from an outside perspective (de Jong, Kamsteeg, and Ybema 2013). At the same time, it holds the risk of being too sympathetic and involved at the cost of losing analytical distance. We worked with this tension by including Madsen as one of the interview subjects in the interview with NordicMetrics. This offered the advantage of both rendering explicit his own situated understanding of 'teachers' needs' whilst using his knowledge to articulate ongoing, often passionate, discussions between him and Wandall for inclusion in our analysis. One finding here was that Madsen found NordicMetrics' visualization of progression more intuitive for teachers than STIL's. In order to ensure impartiality in the analysis, we have been careful to not evaluate the different visualizations but instead explore how they are developed. In that regard, our own socio-material circumstances for researching this paper, desk-situated activities of coding and theorizing the data, played an important role in 'disengaging the "immersed" researcher' (de Jong, Kamsteeg, and Ybema 2013).

The National Agency for IT and learning (STIL)

When STIL develops national test visualizations, organizational procedures and different articulations of users (teachers) play an important role. As a political and bureaucratic organization, the Minister of education needs to approve that the civil servants spend their time developing new visualizations, and generally user surveys conducted by external consultancies precede major developments (e.g., Deloitte 2016). These circumstances frame how the civil servants can *represent* users. As an example, the civil servants negotiated their own concerns with the norm-based showing of test results with a user survey's articulation of teachers' needs:

Our sister agency STUK had Deloitte carry out this user survey for us (...) We were interested in knowing whether teachers understand both the norm-based and criteria-based visualization of test results or whether having two different visualizations of test results is confusing. And we also had an underlying agenda (...): we wanted to abolish the norm-based visualization (...). It has some unfortunate statistical characteristics [that are the source of misinterpretations] and we cannot communicate it in a good way. (...) We would

like teachers to use national tests to understand how much the students and the class progress. And [the norm-based visualization] is not very good for that [as it benchmarks a student against the students taking the test in 2010]. (...) So we said, all right, if a user survey supports [abolishing the norm-based showing], well, if the teachers are very happy with the [new] criteria-based showing [which visualizes progression] (...) then we could consider phasing out the norm-based. (...) but the survey showed that they (...) were content to have both visualizations and we decided to keep both visualizations. (statistician, interview February 1, 2018)

This quote illustrates how STIL has to negotiate different ideas of user's needs. Their own concern is to enable a particular use of national test results (understanding how students progress between tests) and constrain others (wrong interpretations of norm-based visualizations). Against this, the Deloitte user survey, 'mobilizing' (Callon 1986) teachers' preferences, articulated the norm-based visualization as helpful. In this case, the civil servants reconsidered their 'underlying ambition' and decided to maintain the norm-based visualization, with reference to the Deloitte survey.

While schools and municipalities are offered advice on interpreting and using national test for pedagogical aims by 'learning consultants' (employed by the other ministerial agency, The National Agency for Teaching and Quality 'STUK'), the civil servants in STIL need to assume that not all teachers participate in events where advice is offered. As a result, 'it is important to us to make the visualizations as self-explanatory as possible' (UX designer, 1 February 2018). To this end, the UX designer's interactions with teachers, cast in the role of authentic users, is an important resource. Once STIL has developed mock-ups of new visualizations the UX designer visits a variety of teachers and asks them to tell her what they see. By showing visualizations to teachers, the civil servants can anticipate future misinterpretations and use this as input to redesign. Usability trials articulate to what extent their visualization configures the user in the right way:

My job is really to talk to them about what they think they see in the visualization. (...) I mean, we have had an unbelievable number of templates for this one (...) And perhaps they said 'well, then 60% of the test items in this profile area were solved', or were of the difficulty 'very good' (...) Then I make a note to myself 'ok, this is how the screen speaks to them'. Then I go home and talk to [statistician], saying that this is not the right way either because not one single person [had it right]. (UX designer, interview February 1 2018).

Listening quietly to their descriptions, she assesses the visualization's capacity to generate correct user interpretations. The user experience consultant collects incidents of correct and wrong interpretations, which in turn configure how the civil servants understand the teacher as data user. Wrong interpretations feed into redesigning existing visualizations, used to preempt and control imagined future users' interpretation of test results. In the words of Woolgar (1990), usability trials entail boundary work between the user and the national tests, as 'there is still considerable ambiguity both about the capacity of the machine and about the character of the user' (p. 92).

The civil servants' further use these visits to generate ideas for new visualizations. In the interview, they emphasized several times that their priority is developing useful visualizations. For this reason, they also ask teachers 'what do you need?'. Several of the most recent (august 2017) visualizations materialized from such inquiries:

[Viewing test results] is time consuming and this is important, right, how long does it take to understand a test result. And there is no doubt that our new class proportion visualization, that's something to follow up on (...) instead of saying 'no, Peter can't do this, language comprehension, how can I help Peter', then it's much easier to say 'half of the class is scoring bad in this area'. This visualization of test results in proportion to the class is developed entirely through our interactions with users. We are in the field and talk to them about how they use results. (UX designer, interview February 1, 2018)

Here, configuring the teacher as data user is a matter of civil servants learning about the context of test data use. Showing test data results in class proportions, categorizes students in groups where students have similar test results. We see here how the civil servants' ideas of the meaningful visualization takes its sense from the teachers' articulations of their context: teachers are busy and

have little time for many and complex visualizations. In that regard, the visualization and their understanding of its context ‘mutually elaborate each other’ (Woolgar 1990, 72).

Yet, teachers’ wishes for visualizations are always subsumed to the issue of statistical correctness. The UX designer represents teachers’ needs to the statistician with a view to negotiate these against statistical rigour: ‘[Statistician] has to guarantee that everything is 100% correct. We are very diligent. We can’t just do something because we want to. Our work has to be unshakably objective.’ (UX designer, 1 February 2018). The two civil servants here talked about walking the line between what the teachers would like to have visualized and what is statistically possible within the test system. In addition to negotiating their own priorities with those of user surveys, usability trials, and identification of teachers’ wishes for new visualizations, statistical rigor is thus another condition negotiating teachers’ needs.

Configuring teachers as data users also takes place when learning consultants from the other ministerial agency STUK advice municipalities and schools on appropriate use of the national test. One of them explained at a conference presentation how the Ministry’s approach to national testing has changed:

Over the years, we have actually toned down the national test as a didactic tool. National testing is a great tool for monitoring the Danish population, and it is a great predictor of how students perform in their graduation exams and it should be used as a risk assessment in this regard. Yet, qualitative data and other diagnostic tests are more instructive for teachers’ didactic data use. When we visit municipalities, however, we experience that they really like the national test – perhaps because it’s a centrally mandated and authorized test. When they prioritize the national test, we tell them that there’s a risk that teachers will pay less attention to other sources of data that are more helpful. So we recommend municipalities to also look at different kinds of local data when assessing schools’ performance and to exert less pressure on school principals and teachers to use the national test as the single tool for tracking progression and student ability. (observation notes, Data-oriented School Development workshop, Danish Ministry of Education 2018).

While developing visualizations is important for configuring the teacher’s use of national test data, learning consultants at the same time emphasize that the national test should not take up too much focus in teachers’ didactic practices. This change in the ministry’s approach to the national test is also reflected in the newest official national test instructions, which to a higher degree than earlier reiterates that national tests are *a supplement* to other sources of qualitative and quantitative data on students’ abilities and learning (almost on every page, as the learning consultant joked during his presentation). While the visualizations are to configure teachers’ interpretations, the written instructions and learning consultants also emphasize that the national test should not become a dominant or primary assessment tool in teachers practices. This approach of limiting the use of national testing, from the consideration that it is not the best didactic tool, is interesting, considering the next example of NordicMetrics, which seeks to expand teachers’ use of national test as a pedagogical tool.

Nordicmetrics

When Jakob Wandall started up NordicMetrics, the Ministry only visualized test results using the norm-scale, ranking a student performance against the 2010 norm. Thus, the Ministry did not provide the contemporary visualization of progression (based on the criteria-scale). Wandall had, however, worked with this aspect during his time in the ministry but had to abandon it, as mentioned, due to delays in implementation of the national test. During a public presentation where he spoke about this possibility, Wandall encountered the future director for Copenhagen Municipality’s Children and Youth Administration who in 2012 commissioned him to materialize this idea.

The municipality of Copenhagen was looking for a possibility of using national tests for formative evaluation – their teachers experienced several challenges in putting the test results to pedagogical use. They couldn’t really use the existing reporting of test results, which reflect a student’s proficiency level in relation to a norm, for assessing how much students learn. Also, in 2012, the Ministry of Education launched a new indicator of ‘persistent poor school quality’, which was based on final examination results. The ministry’s website exposed the name of the schools with the lowest average (schools in the bottom 10 percent three years in a row), among

those *Rådmandsgade Skole* [a school in the municipality of Copenhagen with a large number of socio-economically marginalized students with non-Danish ethnic background]. Just before, that school's principal had been nominated and elected as the 'Danish Leader of the Year 2011' by the Confederation of Danish Industry (DI). Something was obviously wrong with this [the ministry's] assessment method of school quality. The municipality was interested in providing an alternative assessment of school quality, to that of the ministry's. It wanted to make the schools focus on how much their students learn rather than on which students are the best performing. (Wandall, August 28 2018).

The municipality's interests, according to Wandall, is twofold: to make better use of the mandatory national test results and to have an alternative metrics for educational quality. This moment of 'problematization' (Callon 1986) allows for a conjunction of interests in the development of a tool for visualizing progression. At once, it supports the municipality's twofold interest in strengthening the relationship between teaching and test data and in severing the relationship to the ministry's quality assessment. It also supports Wandall's ambition to develop a tool for visualizing progression in national tests in the context of NordicMetrics. Copenhagen Municipality buys the consultancy of NordicMetrics to organize the development and collecting/processing data from additional national tests administered by some of the schools in Copenhagen. This data was a pre-condition for producing a national test scale converter and the associated visualization. Wandall develops the converter, *Beregneren*, and acquires the intellectual property rights. In return, NordicMetrics makes it freely available for schools in Copenhagen and other municipalities that Copenhagen municipality grants access. Compared to STIL's socio-material circumstances for developing visualizations, NordicMetrics needs a partnership with a municipality, providing data for equalizing across different norm-scales, in order to develop *Beregneren*. Many other relations, between teachers and the municipality's experience of little pedagogical use of test results, between *Rådmandsgade Skole* and the indicator for 'persistent low school quality', also shaped NordicMetrics possibility for configuring the teacher as data user through visualizing progression.

When articulating the needs of teachers, Wandall refers to the difference between the existing norm-based visualization and *Beregneren*'s visualization of progression. In a feature article, co-authored with the deputy manager of *Rådmandsgade Skole*, he writes:

In the worst case, the test is used to celebrate the highest achieving students at the cost of the lowest achieving students. (...) teachers work in the dark (...) if you want to quantify progression, you need to test twice and look at the difference in the test results. However, this requires reporting test results on the same scale. (...) The challenge is that it is not possible to compare results from the different national reading tests when they are presented on different scales. (Wandall and Wählin 2014)

At this point in time, the *Beregneren* has been developed. Configuring the teacher is a matter of visualizing test results on the *same* scale, making visible how much a student has learned. *Beregneren* enables this capacity, configuring the teacher to engage with students' progression between tests rather than their achievement in a single test. Configuration work here, however, is not simply the organization of teachers' attention towards learning instead of ranking. In order to convert the national test results, teachers have to copy the results that they wish to compare from the official test interface and paste them into *Beregneren*. The teacher, then, is not simply a user but also an intermediary, necessary for producing the relationship between the official digital test interface and *Beregneren*'s spreadsheet application. Without data, *Beregneren* is simply a scale converter providing no visualization about progression. The teacher here becomes an intrinsic part of the machinic set-up of *Beregneren*, integrating human activities of copy-pasting with *Beregneren*'s automated conversion and visualization of scores.

NordicMetrics' visualization, however, becomes an issue of attention when the Ministry, 1½ years later, offers its own visualization of progression, based on the criteria-scores that are added with the 2014 school reform: 'At workshops, teachers ask me about the difference between the official visualizations and *Beregneren*'s' (Wandall, January 2018). Configuring the teacher as data user is no longer a matter of making a distinction between rank and progression. Instead, it becomes a matter

of producing a relationship between different *versions* of progression. NordicMetrics articulates this as a difference between ‘absolute’ and ‘relative’ progression:

There are different possibilities for calculating progression in the national test. There is an important difference between the absolute progression, visualized in *Beregneren*, and the relative progression, visualized in the test system’s criteria-based scores. (...) [Here] **progression** is growth [in reading ability] in relation to the **ministry’s expectations** to students’ academic level in different grades. (...) The visualization below [Figure 1] illustrates this difference by showing the same student’s test result, using *Beregneren*’s scale [left] parallel to the Ministry’s criteria-based progression [right]. (...) Although the student has regressed in text comprehension, in relation to the academic expectations to the grade level built into the system’s criteria scores (to the right in the illustration), the student has actually improved his absolute progression in text comprehension [reading ability] (to the left in the illustration) (Wandall 2016, original emphasis).

As teachers by default access national test results using the official system, NordicMetrics has to take that visualization into account in order to establish a meaningful relation to *Beregneren*’s different version of progression. Visualizing with colors how the ministry’s expectations to students at a given grade level compares to *Beregneren*’s scale produces a relationship between the two visualizations and articulates their differences. Incorporating into *Beregneren* the criteria-scale’s categories as *lines* rather than *categories*, Nordic Metric’s visualization at once articulates how the student has progressed, e.g., the student is better than in the fourth grade, but we also see that s/he has not progressed sufficiently to remain in the category of ‘good’ (moving below the green line, representing the category of ‘good’). When presenting this to teachers, Wandall makes use of the analogy of weight curves, used to monitor babies’ weight gain:

It’s like looking at growth charts for babies, right. And they like to see that the weight needs to be there [points to ‘good’ curve], in order to be normal, right. And if you’re above that, then it’s a fat baby that has lost some weight, right. (...) If you look at a low performing student and say – and this is what teachers really notice when using [*Beregneren*] (...). Then they can show it to the student and say, ‘look maybe you’re in the 7-percentile, right, but I can see that y have moved from the 1st to 7th percentile, and this is a good progress.’ (...) The student can intuitively understand progression if they see that the line goes [up]. (Wandall, January, 2018).

For NordicMetrics, configuring the teacher as data user becomes a matter of producing a relationship – and a differentiation – between the two visualizations of progression (the ministry’s and NordicMetrics’). The teacher is here configured to compare the two visualizations of progression. This further multiplies the relationship between the official test system and *Beregneren*. From being a source of data that needs to be copied and pasted, the official test system’s criteria-scores now also figure as ‘weight curves’ in NordicMetrics’ visualization, producing a relationship between *Beregneren*’s ‘absolute progression’ and the criteria-scores representation of the expected academic development (‘relative progression’). Like the civil servants at the Ministry of Education, Wandall emphasizes the context of the user – here as someone communicating to the student his or her progression in an ‘intuitive’ manner. At the same time, this particular version of the visualization is a negotiation of the changing position of NordicMetric, from offering the only visualization of progression to becoming an addition to the ministry’s visualization.

Likewise, the Ministry of Education’s learning consultants from STUK are asked about the difference between the two visualizations of progression. While refusing to comment directly on private companies’ products, they express concerns with a predominantly upwards curve:

There is a risk that students will not be helped, right. With a curve sloping upwards, you might think that the student is in the right development even when in risk of failing his final exams. (...) We also prefer the broader criteria categories as the statistical uncertainty is too high if we simply look at the percentiles, even when converted to other scales. The statistical uncertainty is probably higher than the progression if we test once a year and we may end up making the wrong interpretations.’ (observation notes, Data-oriented School Development workshop, Danish Ministry of Education 2018).

While Wandall articulates progression in terms of an envisioned dialogue between teacher and student, the learning consultant worries that an upwards-sloping curve might not raise the alarm sufficiently for teachers to intervene. Moreover, showing progression with the use of percentile values

Absolute progression (in rel. to academic expectations), as shown in Beregneren

Relative progression (in relation to the ministry's academic expectations), as shown in the test system (<https://testogprøver.dk/>).

Please note that the underlying data, in both sides of the figure, are identical (it is the same student's test).

Figure 1. NordicMetric's comparison of *Beregneren*'s (left) and the ministry's (right) visualizations of progression. The colors indicate the different criteria categories in the national test, either as lines (left) or categories (right). *Beregneren* visualizes both the general growth of academic expectations to students through the colored lines and the actual student's progression (black line) whereas the ministry visualizes how a student has moved between two different criteria categories. In both visualizations, the two black dots articulate the two test results, 4th and 6th grade, and the line connecting the two dots shows how the student has regressed from 'good' in the 4th grade to 'mediocre' in the 6th grade. (Wandall 2016, translated by the authors).

fails to take into account the statistical uncertainty, which grows with the higher granularity. This speaks to the ministry's focus on statistical accuracy mentioned earlier. NordicMetrics and the Ministry of Education thus relate to each other's visualizations, articulating different matters of concern with mediating students' progression to teachers. Whereas NordicMetrics integrates the ministry's version of progression to highlight the 'absolute progression', the official test system cannot encompass such comparisons. Instead, these are communicated verbally in a more general tone at conferences or when learning consultants visit municipalities and schools.

Concluding discussion

Digital technologies and national testing have carved out a space for public and private actors to mediate data about students' learning to teachers. This distributes important decisions about how teachers are to interpret and engage with student learning to new digital and computational centers of expertise. We started out this paper with the ambition of exploring the public-private schism in education through the idea of shifting relations rather than a dichotomy between public good versus for private for profit. As the founder of NordicMetrics Jakob Wandall used to work with the Danish national test at the Danish Ministry of Education, our analysis provides an interesting example of how private sector software is rather intimately 'stitched on to (...) policy work', while operating independently of government (Williamson 2017, 66).

This paper has offered insights into the intricacies of such 'stitchings' between policy, public and private data mediators, visiting the back offices of STIL and NordicMetrics and inquiring how they develop visualizations of national test data. The concept of 'configuration' has allowed us to explore how data visualizations are achieved through incorporating socio-technical relations into the visualizations: the need for pedagogical and formative use, ideas of teachers' context, characterized by them having little time available for data use (ministry) and interactions between teacher and student (NordicMetrics), but also the changing relations between STIL and NordicMetrics as they develop new visualizations. We have explored how configuration work is related

to designers' representations of teachers' needs but also is shaped by their shifting socio-material conditions.

Opening the 'black box' of how data visualizations are developed underscores their contingency and elicits how they crystalize from situated circumstances and negotiations. These include the civil servants in STIL's negotiations of their own concerns with the norm-based visualization of test results, deemed difficult for teachers to interpret, against a survey's articulation of teachers' satisfaction with that visualization. They also include the staged meeting between teachers' needs, as reported by the UX designer, and the statisticians' assessment of whether those needs can be met in a statistically valid manner. Finally, the Ministry of Education's learning consultants also warn against the national test data becoming too powerful in teachers' didactic practices, given their experience with how municipalities use national test data at the cost of other didactic resources, deemed to be didactically better. NordicMetrics developed the first visualization of progression in collaboration with the municipality of Copenhagen. An important addition was to incorporate the Ministry's new visualization of progression in their own visualization, when 'progression' ceased to mark the contribution of *Beregneren*. Yet again, when advising on the use of national tests learning consultants from the Ministry of Education are also made to render explicit why they prefer to visualize progression with the broader criteria-categories in comparison with granular visualizations such as those offered by NordicMetrics. We might then think of the relations between STIL, NordicMetrics, teachers, and municipalities as an emerging 'information ecology' (Nardi and O'Day 1999). This concept emphasizes that different 'organisms' share the same 'habitat' and influence each other as they co-evolve and that they engage in complex, opportunistic relationships with one another. Whereas the Ministry of Education *enables* the production of national test results, the private consultancy NordicMetrics is the one arguing most fervently for its pedagogical use. While the Ministry's learning consultants support this use on an overall level, especially for identifying student populations 'at risk', they also warn against granting the national test too much power in the everyday practices of teachers.

The different versions of progression further raise interesting questions for teachers. Given that teachers become the medium for connecting the visual representations of progression with school realities, this also presumes a commitment to calculative data as important for teaching. Although NordicMetrics incorporates STIL's visualization and adds a distinction between 'absolute' and 'relative' progression, the ambivalence of having two visualizations, or having learning consultants warn against granular upwards-curves in alternative visualizations, also makes visible to teachers the contingencies of data visualization, which may add to their critical data literacy. On the other hand, the complexity of having two different visualizations may take important and already limited time from other tasks: inclusive teaching, qualitative descriptions of children (Ratner, 2018), curriculum that is not covered by national tests, etc. This paper concludes as it reaches the limits of our study. As Akrich (1992) has noted, while technologies anticipate the interests and contexts of future users, inscribing into the design 'geographies of responsibilities' (p. 208), we cannot make claims about how the visualizations are used by teachers. If we are to take a step deeper into the impact of public and private data mediators, pressing questions for future research are thus in which ways teachers realize, translate or work around the configurations provided by digital interfaces.

Notes

1. While Danish national test results are confidential by law, the Ministry of Education and municipalities use results to compare schools and hold them accountable for national targets whereas teachers, according to legislation, are to use testing pedagogically.
2. We respect Wandall's wish to figure by his true name. The civil servants from the Ministry of Education, however, are anonymized.
3. For instance, the target *all children should improve as much as possible* is operationalized with the objective that 'at least 80% of all students are "good" in reading and math' (Ministry of Education 2018). This, in turn, required the Ministry of Education to define criteria for the 'good' performance.
4. The probabilistic Rasch psychometrics, also used in PISA.

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3 The datafication of discipline

ClassDojo, surveillance and a performative classroom culture

Jamie Manolev , Anna Sullivan and Roger Slee

ABSTRACT

This paper critically examines the ways in which ClassDojo is altering the disciplinary landscape in schools through the datafication of discipline and student behaviour. ClassDojo is one of the most popular and successful educational technologies and is used internationally. It is a school-based social media platform that incorporates a gamified behaviour-shaping function, providing school communities with a centralised digital network in which to interact. We argue that ClassDojo's datafying system of school discipline intensifies and normalises the surveillance of students. Furthermore, it creates a culture of performativity and serves as a mechanism for behaviour control.

Introduction

Education is increasingly shaped by digital technologies (Selwyn 2017), providing schools and educators with opportunities to understand and approach educational issues in new ways. The current techno-friendly obsession within education encourages the prolific spread of such education technologies, resulting in their infiltration into people's everyday lives (Boninger and Molnar 2016). In recent decades, this pervasive infiltration of education technology has intensified the datafication of education, producing a vast assortment of data forms to interpret and understand (Cukier and Mayer-Schoenberger 2013; Selwyn 2015) including data associated with classroom management and student discipline. Datafication is a complex process one in which the significance of data is raised in such a way as to influence the practices, values and subjectivities in a setting (Bradbury 2018). Understanding what is meant by the term datafication is critical to the position of this paper; therefore, drawing on Mayer-Schönberger and Cukier (2013) we define datafication as the conversion of social action into quantifiable data in a manner that enables the tracking of people in real-time. However, this definition does not recognise the role of power within the datafication process. Therefore, we argue that datafication should also be understood through a lens of power, making visible the ways in which power is implicated in decisions such as what constitutes and is selected as data, who controls it, who can alter it, how it is interpreted, and what purpose it will serve (Bradbury and Roberts-Holmes 2017).

ClassDojo is one of the most prominent technological tools supporting schools to manage classrooms and student behaviour. 'Happier Classrooms, the simple way to build an amazing classroom community' is the cornerstone message greeting visitors to ClassDojo's immensely popular ed-tech (education-technology) website. ClassDojo is a classroom management and communication platform designed for use in schools and classrooms by teachers, school administrators, students and parents. It was first launched as a behaviour tracking and feedback tool; however, it quickly evolved

to function with a much broader purpose and scope. In its current form it resembles a school-based social media platform (Williamson 2017b) that incorporates a prominent gamified behaviour-shaping function, providing school communities with a centralised digital network in which access to, and interaction between members of the school community takes place. ClassDojo is continually expanding its features.

Research on ClassDojo is scant. However, arguably, of the existing literature, Williamson's critical investigations provide the most in-depth analysis. His research on ClassDojo unravels the active and influential subterranean network of actors and power relations that materialise in the processes and functions of the ClassDojo app (Williamson 2017a, 2017b). According to Williamson, ClassDojo's capacity to function as a technology of control is evident. He argues that ClassDojo acts as a key technology of government, enacting governmental policy agendas aimed at changing the behaviour of students, and that ClassDojo's focus on the psychology of students aligns neatly with existing dominant psychological approaches to school discipline. This psychologisation of students situates responsibility for behaviour entirely with the student, ignoring the broader structural and contextual factors of schooling that influence the ways in which students behave (Slee 1995; Sullivan et al. 2014a). Of the remaining literature, only one other peer-reviewed analysis of ClassDojo could be located. A comparative psychology study by Krach, McCreery and Rimel (2017), it compared the quantity and reliability of behaviour management chart data gathered, between ClassDojo and paper pencil methods. Findings indicated that ClassDojo produced more data, and more reliability than paper pencil methods, however, the authors did not endorse the use of ClassDojo due to concerns associated with student shaming, data privacy and family access equity. Despite these concerns, ClassDojo continues to increase its presence within education.

In this paper, we critically examine ClassDojo as a classroom management and communication platform. Despite ClassDojo's popularity, a scarcity of research has investigated the ways in which it is used and how it is influencing education, particularly at the level of the school and classroom. We draw on publicly available online material as a data source for this study. First, we undertake a brief theoretical exploration of the ideas we use to understand ClassDojo, and identify that schools are increasingly using data and surveillance to track and monitor students. Then we describe the speed and volume of ClassDojo's uptake, and explain why it is so appealing to educators as a rationale for its uncritical adoption, and how it works. We then shift the focus to problematise the uncritical uptake of ClassDojo as a school discipline tool. Examining ClassDojo using the concepts of surveillance and performativity we identify how the datafication of school discipline and student behaviour is implicated in both. Within this analysis, we describe how ClassDojo is influencing educational processes related to the discipline, management and measurement of students, the way in which teachers understand students and the way in which students understand themselves.

We argue that ClassDojo is a school-based technology of surveillance encouraging teachers to enact disciplinary practices underpinned by behaviourist principles that require intensified monitoring of students (Watters 2017a; Williamson 2017a). Moreover, we contend that ClassDojo's application in schools is part of, and contributing to, the expansion of established surveillance trajectories within contemporary education (Taylor and Kearney 2018). Behaviourism, in simple terms, is a behavioural learning theory that promotes the use of rewards and punishments to modify behaviour (McEwan, Gathercoal, and Nimmo 1999). This new data-based variation on behaviourism relies heavily on compliance techniques, while creating a performative classroom culture in which students are reconstructed as statistical data representations of normalised culturally produced behaviours. This reduction of students to data points based on the performance of behaviour facilitates data-driven techniques of governance that function through the classification, ranking and comparison of students. Furthermore, this process encourages a view of behaviour that is decontextualised and situated entirely within the student, possibly producing flawed behavioural data. Lastly, we argue that the construction of student identities is influenced by the creation of a performative classroom culture in which behaviour quality is framed against numerical parameters of behavioural success (Nairn and Higgins 2007; Keddie 2016).

The growing use of data and surveillance in schools

To understand surveillance in schools it is useful to refer to Foucault's (1979) ideas related to disciplinary power, in particular its relationship with the process of datafication, and how technological advancement has impacted educational practices in these areas. Foucault's ideas have been largely neglected in educational technology scholarship, therefore, they offer an atypical approach to critically engaging with the introduction of data and surveillance oriented educational technologies in schools (Hope 2014). To briefly step away from the individualised and granular focus of disciplinary power, we first situate schools and the disciplinary mechanisms they deploy within Foucault's concept of governmentality. According to Foucault, governmentality is the 'ensemble formed by institutions, procedures, analysis and reflections, calculations, and tactics that allow the exercise of a specific and complex power that has the population as its target' and functions through technical instruments he refers to as apparatuses of security (Foucault et al. 2009, 108). As apparatuses of security, schools are instrumental to governing the population. To this end, schools function as mechanisms of social control, using techniques of normalisation that serve the broader political strategy (Foucault et al. 2009) of securing the productive capacity of the future citizenry. Importantly, the surveillance, categorisations and data-based calculations that serve disciplinary power's purpose of producing specific individuals, may be simultaneously acquired in support of this broader objective (Ball 2013).

From its inception the 'school' has been a data-rich site of surveillance, architecturally designed to reflect the panopticon, in which hierarchised surveillance practices are deployed as a disciplinary mechanism (Foucault 1979) of control. Hierarchised surveillance in this context can be thought of as a system of observation featuring a ranked ordering of watchers and watched. Power is exercised through this ranked observational process, establishing an efficient system of surveillance that produces a totalising method of supervision. Foucault describes hierarchised surveillance as an instrument responsible for the success of disciplinary power. It is: 'An apparatus in which the techniques that make it possible to see induce effects of power, and in which, conversely, the means of coercion make those on whom they are applied clearly visible' (1979, 170–171).

Hierarchised surveillance enacts the school's disciplinary purpose, entrenching distinctly unequal distributions of power and rendering students visible through a range of coercive methods. Data occupies a central role within these techniques. The techniques are embedded throughout the system, existing in a multitude of forms including student testing and classification, and involve data recording, storing and analysing processes. Historically, early technology development introduced new efficiencies but still often required manual, time-consuming processes. Yet, over time steady technological advancement and a growing valorisation of data in education has seen the production of new technologies designed to increase the effectiveness, efficiency and productivity of surveillance and data-related capabilities in schools. This intensification is exemplified by the infiltration into schools of CCTV networks (Hope 2009); adaptive learning technologies that record students' keystrokes, answers and response times (Boninger and Molnar 2016); student drug testing systems (Taylor 2018); biometric tracking (Nemorin 2017); data-driven decision-making tools for teachers (Jarke and Breiter 2015); national and international school performance assessments (Hardy and Lewis 2018); emergent screen capture technology (Pinkerton 2017); and behaviour tracking and management technologies like ClassDojo. This list barely scratches the surface of surveillance and datafying practices used within education; however, it is illustrative of the extent to which practices are used within contemporary education to track and monitor students.

The rise of ClassDojo as an ed-tech success

The company behind ClassDojo is a model of entrepreneurial success, winning awards and recognition from the US business sector for being a leading technological innovator. Software developer Class Twist, which operates under the name ClassDojo, is its creator. Located in California's high-

tech Silicon Valley, ClassDojo has emerged from the highly competitive \$8.38 billion ed-tech industry (Richards and Stebbins 2014) to produce one of the most globally successful education technologies (Williamson 2017a).

A milestone timeline on the company's website reveals the extent of its remarkable growth and expansion from its earliest manifestation in 2011, primarily as a behaviour management tool. Starting with 80 users in its first week, by week ten the number of teachers signed up had increased to 35,000. Late 2012 and early 2013 witnessed the launch of ClassDojo on Apple iOS and Android respectively, opening up the prospective user base significantly. Considerable funding investments, as listed on the Crunchbase website, of \$8.5 million in 2013, and \$21 million in 2016 provided financial support for the company to continue product development and growth. These significant funding investments are a critical aspect of ClassDojo's continued operations and growth, as at the time of writing they are its sole revenue source due to the company's commitment to remain a free technology for teachers' to download and use. In 2015, ClassDojo launched 'Translate', a new feature enabling the translation of messages into more than 35 different languages, likely a response to the transnational appeal and adoption of the software, and a strategic move to embrace a globally expanding user base. According to ClassDojo co-founder and CEO Sam Chaudhary, adoption of the technology in Vietnam and Turkey has been impressive, and its spread into China and India indicates potential future market success in Asia (Hess 2015). The company promotes its product and engages with users in part through social media platforms like Facebook, with national-based ClassDojo community group pages set up to support and connect users across the globe, some of which hosting more than a thousand members. By 2016, ClassDojo had developed a partnership with Stanford University's Project for Education Research that Scales, delivering educational content focused on the concept of 'growth mindset' to students. In the same year the company claimed two thirds of US schools were actively using ClassDojo in classrooms, its reach extended into 180 countries worldwide, and more than three million teachers and 35 million children had signed up and were using the platform (Williamson 2017b). ClassDojo is targeted toward, and according to its website, predominantly active in K-8 schools. It is difficult to determine if ClassDojo's claims regarding user statistics are accurate due to a reliance on self-generated data (Watters 2017a), however independent data associated with app downloads provides at minimum an indication of how widespread ClassDojo's reach may be. According to leading mobile app analytics company App Annie (Clancy 2015), as of November 2018 ClassDojo is ranked within the top ten downloaded education apps on iPhones in the US (App 2018). Furthermore, according to metrics provided by Crunchbase in November 2018, ClassDojo's apps (ClassDojo, ClassDojo Messenger, and ClassDojo for Students) had been downloaded 969,409 times in the previous month (Crunchbase 2018). Therefore, despite ClassDojo's uncertain self-reported statistics the company has clearly expanded its reach over time, and is clearly a popular technological tool within education. The proliferation of ClassDojo into classrooms around the world has occurred within a six-year timeframe, suggesting its spread is unconfined by geographical borders and impervious to the typical bureaucratic gatekeeping processes of national education systems.

How does ClassDojo work?

At its inception, ClassDojo was a tool that digitised and datafied student behaviour and the process by which teachers sought to condition that behaviour. Its primary function was to provide teachers with a way in which to track student behaviours and provide immediate feedback to students about behaviour. Its functionalities introduced new data-driven possibilities for teachers, equipping them with a tool that automatically generates individual student and whole-class behavioural data records, and an ability to respond in real time, on the move and from any location to student behaviour. Theoretically, ClassDojo draws on a logic of behaviourism to influence student behaviour. Students are reinforced with positive, negative and neutral 'Dojo points' as a means to encourage and discourage particular behaviours (Goldstein 2013).

ClassDojo is free to download and its user-friendly interface makes it simple to operate. The software is compatible with most mobile devices and personal computers with online connectivity, ensuring that almost all teachers, administrators and parents are able to use the application. Moreover, for teachers, ClassDojo is a convenient and immediate administrative, behavioural and communicative support tool that allows teachers to use the programme from anywhere and at any time. Initially, teachers must create a class list in which each student is represented by a customisable ClassDojo monster avatar. Teachers then choose the behaviours and/or skills they wish to target and develop in students. Teachers can select from a range of default options, or they can customise their own. Once this is complete, teachers can begin implementing ClassDojo at its most rudimentary level.

However, ClassDojo has rapidly moved beyond functioning exclusively as a behaviour support application for teachers, and evolved into a social media platform for schools (Williamson 2017b), targeting not only teachers, but also students, parents and school leaders/administrators. In basic terms, a platform in this context is an online digital infrastructure facilitating the interaction of different user groups (Davies 2017). ClassDojo in this sense acts as an intermediary bringing together its targeted user groups, including teachers, students, parents and schools. This is a key feature for the success of online platforms. Users participate in what is referred to as a value exchange process, in which the facilitation of user interactions and the management of user relationships is highly prioritised (Van Alstyne and Parker 2017). A suite of additional features facilitates this value exchange process in ClassDojo, each one designed for one particular user group while providing value for other user groups. ClassDojo, therefore, by design promotes a participatory culture. Users' participation then leads to the production and consumption of data, so that users become data subjects, data generators and data consumers (Langley and Leyshon 2016).

The behaviour component of ClassDojo operates by way of teachers issuing feedback to individual students, groups of students or the entire class for particular behaviours or skills performed. The behaviours and skills to be targeted are customisable, with default options such as working hard, on task, displaying grit, off task and unprepared. The datafication of this feedback is integral to ClassDojo's discipline approach. Two feedback categories are available: 'positive' and 'needs work'. Despite the obvious intention to apply a positive vocabulary, the visual and auditory cues accompanying each category expose a more traditional separation between 'positive' and 'negative' feedback. 'Positive' feedback is coloured green and arrives with a pleasant ding sounding auditory cue, while 'needs work' feedback is coloured red and arrives with an auditory cue to match, a harsh buzz sound. Furthermore, affixed to all feedback is a numerical value that transforms feedback to students from a qualitative form into feedback that is both qualitative and quantitative. This quantified aspect of feedback produces statistical data representations of behaviour, better known as 'Dojo points'. Dojo points accumulate and appear as an aggregated score above student avatars until they are reset by the teacher. The default value setting for 'positive' feedback is one positive point, and for 'needs work' feedback is one negative point. Teachers can alter the numerical values attached to behaviours and skills, including a value of zero. This function of situating feedback along a numerical scale allows teachers to datafy behaviours according to a hierarchy of importance.

ClassDojo automatically tracks and stores every piece of student feedback data, creating interpretations of individual student and whole-class behaviours that are constructed as objective representations of truth through the production of a report. Reports include data on each behaviour or skill awarded, the time and date at which it was awarded, the number of accumulated 'positive' points, the number of accumulated 'needs work' points, and a green and red donut chart representing all feedback received that includes the percentage of positive points awarded. The timeframe from which data is represented within student reports is adjustable, including options to display data accumulated over a day, week, month, year, all time, or over a customised date range. Teachers can print reports for students to take home, or share with registered parents and students over the platform. Furthermore, registered parents receive automatic weekly email notifications reminding them to check their child's latest report.

An uncritical uptake of ClassDojo

On the surface, it is not too difficult to recognise why ClassDojo appeals to many teachers as a convenient technological tool supporting their management of student behaviour and the classroom more generally. Managing student behaviour is an aspect of teaching in which many teachers encounter persistent challenging professional dilemmas (Evertson and Weinstein 2006a). Schools and teachers are subject to consistent pressures to ‘control’ student behaviour in order to maintain ‘good order’ (Johnson and Sullivan 2016). In fact, this incessant, often politicised issue has led to ‘an uncritical acceptance of discipline as a synonym, and ultimately a verb, for control’, rather than viewing school discipline as an educational endeavour (Slee 1995, 7). This contextual backdrop creates an environment in which teachers frequently adopt discipline approaches designed to control the conduct of students (Armstrong 2018), despite research associating this approach with student alienation (Hoy 1972). ClassDojo provides teachers with a disciplinary model based on the control-oriented paradigm of behaviourism (Slee 1995). Relying heavily on external positive reinforcement, or rewards, ClassDojo ultimately controls through seduction (Deci and Ryan 1985). This type of disciplinary approach provides teachers with the allure of a behavioural quick fix while appealing to a broadly accepted, uncritical, common-sense logic that rewards are an effective and efficient means to get children to do what they are told (Kohn 1993). This is despite a strong body of research demonstrating that rewards undermine intrinsic motivation and the development of self-regulation (Deci, Koestner, and Ryan 1999), questioning their use as a strategy to achieve long-lasting behaviour change. Such behaviour control strategies offer teachers practical means to produce obedient students, but ignore the lessons of educational research on effective approaches to discipline (Slee 2014).

Teachers continually report that managing student behaviour is difficult, that persistent minor behaviour problems are very prevalent and they are aware that they often do not use effective discipline strategies (Johnson, Oswald, and Adey 1993; Sullivan et al. 2014a). Contributing to this problematisation of school discipline is a preoccupation with student behaviour within the education, political and public spheres of life, often playing out in the media. Reports of ‘bad student behaviour’ stoke societal fears of chaos, crime and disorder, leading to unsubstantiated moral panics. The response to such pressures is enacted through school discipline approaches, the technology through which the institution of education imposes and maintains its view of order (Ball, Maguire, and Braun 2012) and the process by which relations of power are deployed (Slee 1995). This is evident when analysing school discipline strategies, many of which involve ‘controlling’ students to ensure their compliance (Slee 1995). In particular, schools often use behaviourist approaches to discipline that involve issuing rewards to promote compliant behaviour and sanctions to deter undesirable behaviour (Slee 1995; Kohn 2006; Maguire, Ball, and Braun 2010). ClassDojo’s variation on behaviourism integrates the datafication of behaviour into its approach, enhancing its disciplinary and organisational capabilities. Teachers have an increased capacity to organise, analyse and compile student behavioural information, invoking a pedagogical shift in discipline practice, and students can be subject to an increasing array of evaluations and representations directly related to their behaviour. Therefore, ClassDojo provides teachers with an attractive data-driven technology of control, constructing an image of itself as a convenient way in which to gain student compliance and maintain classroom order.

In contemporary educational discourse, technology is framed as a positive transformational agent (Watters 2017b) and data revered as the key to effective schooling (Pasi and Hasak 2017). These ideas do not confine themselves to the realm of policy makers or the ed-tech sector; rather they are pervasive, traversing through education systems all the way into schools, materialising as visions of progressive education and innovative teaching. In a sense, these ideas have emerged as modern values of education. The consequence of this, at the school and classroom levels, is that resistance by educators to the adoption of modern technology, particularly that which incorporates data-related processes, risks being perceived as an obstacle to beneficial change (Watters 2017b). Therefore, through this dominant tech- and data-positive narrative, schools and educators are encouraged to consider

how to incorporate technology and data processes into practices to improve performance. ClassDojo's self-representation and industry recognition as a novel education technology innovator position it as an attractive educational product within this context.

In the broader context of education, ClassDojo situates itself firmly within the current technological and data-inspired education transformation as a free high-tech datacentric tool. Its packaging and functionality embed it deep within an educational environment on the precipice of a technological and data-based transformation (Digital Education Advisory Group 2013; US Department of Education 2017; Spires 2017; European Commission 2018). Driven, in large part, by hegemonic techno-solution (Maturro 2014) policy and rhetoric, technology and data are often viewed uncritically as solutions to complex educational issues, including persistent concerns about student behaviour and classroom management (Evertson and Weinstein 2006b; Sullivan et al. 2014b). Subsequently, within the public conscious data has gained an axiomatic quality, a taken-for-granted acceptance as a representation of the truth (Lyotard 1984). ClassDojo capitalises on this nexus of contextual elements, emerging from the ed-tech sector as an attractive proposition for teachers and schools in search of an innovative technological datafication tool to support teaching practice and student learning (Barseghian 2011).

Not only does ClassDojo represent itself as a useful technological tool to support pedagogy and data-related practices, but it also transforms school discipline and classroom management into a game that is strategically targeted to engage students. The diffusion of games and game-like elements throughout the digital world is prolific. Digital video games are extremely popular, particularly with youth, and they have become a dominant cultural feature in society (Lee and Hammer 2011; Devers and Gurung 2015; Nacke and Deterding 2017). Over recent years this cultural immersion and popularity has led educators to explore how gaming may be utilised within educational contexts to support student learning and engagement (Devers and Gurung 2015). This application of game design elements in non-game contexts is known as gamification (Deterding et al. 2011). Media reports (Henebery 2015; Pinkerton 2017) and teacher testimonials (Haiken 2017) suggest that gamification is influencing the pedagogical decisions of educators and the way students are engaging with particular learning approaches. Gamification techniques abound within ClassDojo's design, most notably through its behaviour component features. These game elements include a points system, leader board, badges, personalisation and customisation, avatars and goal setting, many of which require the production, storage and analysis of data. Through these techniques, ClassDojo transforms school discipline into a game in which the datafication of student behaviour is a critical aspect. This occurs through the application of playful frames in what is traditionally a serious educational space, while simultaneously leveraging surveillance to evoke behaviour change in students (Whitson 2013). Prominent Silicon Valley edu-business leaders such as the CEO of the Silicon Valley Education Foundation have publicly credited ClassDojo's popularity to gamification, stating: 'gaming techniques succeeded in turning ClassDojo into the most widely used and respected behavioural-management app out there' (Chaykowski 2017). Additionally, reports of 250,000 students sending ClassDojo drawings of its monster mascots and students describing ClassDojo as fun (iCan Ipad in Third Grade blog 2015) suggest ClassDojo's playful gamified elements appeal to its student users. These factors also make ClassDojo appealing to teachers, particularly those who view it as an engaging approach to classroom discipline.

ClassDojo as a disciplinary system

ClassDojo's popular appeal has materialised in a rapid and widespread uncritical uptake of the technology by primary school teachers across the globe (Rodriguez 2016). We shift our discussion now to problematise this uncritical uptake, arguing that the implementation of ClassDojo as a disciplinary system may have profound implications for the educational trajectories of students. Working with conceptions of surveillance and performativity, we analyse ClassDojo from a critical standpoint, examining how it conceptualises and enacts discipline. We argue that ClassDojo operates as a

technology of power through which students are controlled via an intensification of surveillance, and that it functions via a process of datafication to produce an unjust behaviour-based performative culture. Moreover, it promotes a view of behaviour as emerging in isolation and unaffected by external influences (Sullivan et al. 2014b), situating responsibility for behaviour entirely with the student. Furthermore, it has the potential to produce decontextualised and possibly flawed behavioural data from which dossiers may be compiled with the potential of enduring on student records throughout their schooling.

Surveillance

Schools' digital data-gathering capabilities are extensive, typically including a multitude of instructional and assessment practices that by their nature function as mechanisms of surveillance (Boninger and Molnar 2016). Due to such conditions a culture of surveillance has become normalised in schools (Steeves and Jones 2010), creating a context in which the predilection of schools to adopt data-centric surveillance technologies in support of educational and institutionally designated objectives has carried on unchecked in recent times (Taylor 2017). ClassDojo exemplifies one such technology, one that promotes itself as a support for both school and institutional objectives relating to discipline. The effect of ClassDojo's datafied surveillance is an increased volume of behavioural data available to teachers and schools from which a wide range of decisions about students can be made. Therefore, ClassDojo can be understood as yet another data-gathering surveillance technology that is contributing to a culture of surveillance that has become normalised in schools.

ClassDojo requires teachers to monitor students constantly, catching students performing particular behaviours, generating, storing and analysing data through its software as this occurs. This approach, promoted on its website, describes the increased surveillance of students as a way for teachers to achieve behavioural success in the classroom. Exemplified by the following extract, ClassDojo's portability enables the constant surveillance of students and provides teachers with new ways in which to record that surveillance as data. "Lunch, recess, field trips, anything like that ClassDojo goes with us," ... [Mrs] Smith begins assigning points as soon as work starts' (Peak 2016). The idea is that, through increased surveillance, teacher feedback increases, and student data increases, which will lead to improved student behaviour and classroom culture. In effect, more surveillance equates to better behaviour and classroom culture. Foucault (1979, 170) describes this as 'coercion by means of observation'. He unmasks the disciplinary objective underpinning this simple mechanism, revealing the aim is to be able to supervise the conduct of each individual, to assess them, judge them and calculate their qualities or merits (1979, 143), producing in today's digitised educational landscape a controllable datafied student subject for whom being watched is a normal part of everyday school life.

The surveillance mechanisms embedded within ClassDojo are not confined to classroom observations but extend beyond the walls of the classroom. ClassDojo provides teachers with further new possibilities for practice in the domain of teacher-parent engagement. Through its digitised communication network ClassDojo provides teachers with the ability to deliver a child's behaviour data directly to parents, in real time, along with continual access to constantly updated behaviour profiles in the form of student reports. Registered parents are reminded every Friday via email to check their child's student report, a strategy deployed as a means to foster parental engagement. This feature effectively subjects students to a weekly report card of their behaviour delivered directly to a parents' inbox. This datafication of student discipline through surveillance and the digitised communication network servicing the school community combine to transform ClassDojo from a mechanism through which surveillance is datafied, into a dataveillance mechanism. Dataveillance in this context refers to the systematic use of a personal data system to monitor the actions of an individual (Clarke 1988). This capability enhances the reach and effect of surveillance. Prior to the digitisation of education, behavioural surveillance processes typically operated within the confines of the school, apart from exceptional cases. The arrival of technologies such as ClassDojo,

however, encourages an expansion of student surveillance that penetrates the family. Stanley Cohen, in his book *Visions of Social Control* (Cohen 1985), exposes how state disciplinary power utilised such a strategy to expand the reach of surveillance as a tool for controlling deviant youth. He argues that, when surveillance of the behaviour of children penetrates into the family, parents become correctional resources in service of the state. ClassDojo can be used in a similar manner. Teachers are able to recruit parents as correctional resources to reinforce classroom behaviours outside of school hours. Therefore, it is evident that if teachers modify their practice to implement ClassDojo according to company recommendations, students will be subject to an intensification of surveillance at school that encroaches into their homes, extending school-based disciplinary regimes further into the lives of young people.

ClassDojo's approach to behaviour can be understood as a technology of power, one in which coercive methods of control are deployed to make students visible. The visibility of students occurs by way of techniques associated with teacher observations and data generation, storage and analysis. These techniques function in response to a codified set of behaviours, and ClassDojo provides the digital framework on which to overlay the behaviour code. This enables the measurement of students in the form of data, producing a system in which the normalisation of particular behaviours occurs. Not only do these techniques make students visible; they also reveal the effects of power. The subjection of students to such techniques promotes the development of behaviour by way of value-laden measures and hierarchised rankings, creating what Foucault calls 'the constraint of a conformity' (Foucault 1979, 183). Conformity is the primary objective and facilitated through a system by which students are trained, separated, differentiated and analysed down to individual segments; they are objectified in a way that constrains autonomy and reduces them to visible data representations of behaviour (Foucault 1979). ClassDojo maintains the constant visibility of students via student accounts, the site at which students' can view their ClassDojo profile which includes behaviour reports that are constantly updated and evolving for as long as a student remains an active ClassDojo user.

In stark contradiction to the process by which students are individualised and made visible through an array of differentiating measures, ClassDojo simultaneously functions as a system for producing uniformity (Ball 2015). The visibility of differentiating measures in conjunction with a compliance mechanism of control manifest in conditions that encourage conformity. Such a system lends itself to a standards-based approach to discipline, in which the standards take the form of numerical targets or benchmarks that have been affixed to a range of predetermined behaviours. Reaching the standard becomes a measure of normality, and any student who fails to do this is at risk of being understood as non-conforming, below standard or abnormal. Normalising judgements in this context have a powerful effect in shaping human behaviour. Subsequently, normalising judgements act as an instrument of discipline and are reinforced by the visibility of student-differentiated measures (ClassDojo behaviour scores).

According to Foucault (1979), discipline operates through a coercive dual gratification–punishment system, deployed as a means by which to conduct training and correction. Foucault reveals that this mechanism creates the possibility of characterising behaviours as good or bad, and distributing them within a field delineated by an allocation of good and bad points. He explains that through such quantification an 'arithmetical economy' emerges, a behaviour economy in which individuals appear as balance sheets of behaviour (Foucault 1979, 180). ClassDojo utilises this method of behavioural quantification by affixing point values to all student feedback, driving the production of a classroom behaviour economy. According to the ClassDojo website, many teachers capitalise on this effect by converting 'Dojo points' into tangible classroom dollars that students can exchange for prizes (Greenberg 1980). In addition, ClassDojo recommends this idea as a way in which to 'keep students excited about ClassDojo', declaring that Dojo points need to mean something. Therefore, according to this logic, a tiered prize system from which to exchange Dojo points is imperative, and functions in conjunction with a dual gratification–punishment system to control student behaviour through coercion.

Quantifying discipline and behaviour in a performative culture

ClassDojo's production of a behaviour economy establishes for teachers a relatively new form of governing students, a governance by numbers (Ball 2015). The pronounced power of numbers in relation to governing is unmistakable (Rose 1991). Through ClassDojo, student behaviour is displayed in the form of numerical data which functions as a representation of the student. Students become behavioural data points from which decisions can be made about teaching and learning. Through ClassDojo, student behavioural data may function in a myriad of ways to govern students. Behavioural data may be used to create an economy from which student privileges and punishments are determined. Data may also be used to build behavioural dossiers of students, to make decisions about behavioural areas of focus, to determine time spent on particular learning areas or to incentivise students to achieve particular objectives. The power of numerical data to govern students in these ways arises, in large part, from their 'ordering capacity': numbers provide a means by which to order students in a range of ways that make them comparable, and enable the calculation of probabilities such as those related to success (Cohen 1999). However, this attractive organisational quality is also problematic, particularly when applied to the complex social features of behaviour, as it decontextualises and reduces its complexity through its transformation into a number (Alonso and Starr 1987). Numerical data may not be capable of adequately representing the social, as it tends to obscure ambiguities and limit the explanatory possibilities necessary to adequately represent the complexities of social life (Selwyn 2015). Therefore, ClassDojo's numerical representation of students through behavioural data is a form of reductionism, dismantling the complexity of behaviour in order to facilitate the governance of students via classification, rankings, comparison and the like. The implications of this may be profound, in particular those associated with the production of student behavioural reports, which are potentially based on flawed data. The potential for such reports to be compiled and reconstituted in the form of individualised behavioural dossiers is not implausible; rather, they may be viewed as a valuable source of data from which decisions about students' educational trajectories occur.

It is useful here to consider 'the examination', which is another method of governing students in schools. Drawing on Foucault, Ball reveals the effects of examinations on students and highlights the aspects that make it such an attractive tool for governance:

the learner is ... made visible and calculable, but power is rendered invisible, and the learner sees only the task ... which they must undertake and their 'result', position, ranking, category. They are made intelligible and manageable in these terms. (Ball 2015, 299)

This explanation of the effects of examinations on learners helps us to understand the ways in which ClassDojo can be used to govern students. According to Foucault, the examination 'is a normalising gaze, a surveillance that makes it possible to qualify, to classify and to punish' (1979, 184). Therefore, ClassDojo, through its datafication of behaviour and digitised organisation of students, can be understood as a continuous behavioural examination tool, unrelentingly evaluating the behavioural performance of students on a daily basis, providing an abundance of numerical data from which to conduct classroom decisions relating to behaviour. This evaluating process, along with test-scores shapes the way in which students understand themselves (Stobart 2008).

Numerical data is transformational, reconfiguring a complex social environment into statistical information, rendering it amenable to control and establishing the classifications by which people come to think of themselves and their choices (Hacking 1991). It thus generates the conditions from which a culture of performativity may arise. Performativity is synonymous with governance, measurement by numbers and control.

Performativity is a technology, a culture and a mode of regulation, or a system of 'terror' in Lyotard's words, that employs judgements, comparisons and displays as a means of control, attrition and change. The performances ... serve as measures of productivity or output, or displays of 'quality', or 'moments' of promotion ... or inspection. They stand for, encapsulate or represent the worth, quality or value of an individual or organisation within a field of judgement. (Ball 2000, 1)

We argue that the features through which ClassDojo shapes and controls student behaviour contribute to the creation of a classroom culture of performativity. Therefore, we now turn the focus to the ways in which ClassDojo uses numerical data to represent the behaviour performance of students, arguing that it concomitantly serves as a measure of student productivity, a comparative display of student quality, and a display through which students reconstruct their identities.

ClassDojo's performative approach is exemplified through its class list display, providing a modern digitised version of the traditional behaviour chart. Capable of being broadcast on large classroom screens to the entire class, visible to anybody who enters, a numbered ranking of students according to their behaviour fills the screen and invites a comparison of students. This public display of performance, even that which is sporadic, may serve as a behaviour-controlling mechanism (Sullivan 2016). The implementation of ClassDojo in this manner utilises the measurement of two student categories, output and quality, in effect transforming behaviour into a commodity and increasing the possibilities for control. High scores indicate high levels of student productivity and quality; conversely, low scores indicate low levels of student productivity and quality. Within such a system student compliance is traded for 'Dojo points', which represent outputs of productivity and quality. The audit-like nature of this approach promotes competition between students in a race to the top of the rankings while simultaneously creating a hierarchical ordering of students that may influence the way in which students understand themselves (Espeland and Sauder 2007). Thus, technologies such as ClassDojo, which rank students according to their performance, can be understood as contributing to the creation of a culture of performativity in the classroom (Jarke and Breiter 2015).

Student constructions of identity have been shown to be influenced by discourses of performativity that are produced and reinforced by calculations associated with student measures of success (Keddie 2016). The emergence of cultures of performativity in classrooms is linked to the infiltration of new managerialism in education, a mode of governance in which numbers and rankings are prioritised and framed as objective representations of value, creating an impression that what is of value can simply be counted (Lynch 2013). We argue that ClassDojo's datafication of student discipline and application as a behaviour governance tool demonstrably classifies it as a performative technology, transforming students and their behaviour into numerical data that is organised and ranked as a quantifiable measure of behavioural success. Through performative technologies such as ClassDojo, the path to student success is grounded in neoliberal notions of competitive individualism, and the enterprising individual, in which success is framed in individualistic terms and associated with merit and self-improvement (Nairn and Higgins 2007). Within such a climate, worth and value are framed against numbered parameters of behavioural success, from which students actively craft their identities (Nairn and Higgins 2007; Keddie 2016). Behaviours that are considered worth acquiring and performing are those embedded within the behaviour code applied to the ClassDojo framework, and subsequently are the only behaviours that count. Furthermore, ClassDojo's individualised psychological regime (Madsen and Brinkmann 2010) construes students as responsible for their own success, reinforcing notions of meritocracy that ignore structural and contextual barriers to success. This framing of ClassDojo as an objective measure of success establishes it as a self-validating vehicle for teachers and students to interpret a perceived 'true' behaviour performance of students. Subsequently, students are likely to associate their ClassDojo behaviour score and ranking with notions of worth, value and ideals of self-improvement (Lupton and Smith 2018). This means for students facing challenges associated with behavioural compliance, such as those bringing to school non-dominant cultural understandings of behaviour, forced failure becomes a possibility. Compelled to understand themselves through the calculation of performed behaviours that count, students may fail if they do not measure up to the narrow demands and expectations that are asked of them through such a performative behaviour system (Keddie 2016).

As a final contribution to this argument, there is a necessity to provide an alternative vision for school discipline. Therefore, we offer an approach to school discipline using ideas drawn from classroom ecology (Sullivan et al. 2014b) and democratic education (Pearl and Knight 1999), one that is

consistent with an educational discourse of discipline (Slee 1995). Such an approach would be underpinned by the values of respect, caring, and dignity, promoting practices that exhibit and develop such qualities in students (Johnson and Sullivan 2016). It would recognise the complexities of behaviour and consider the role of not only internal, but also external, influences on behaviour such as curriculum, pedagogy, relationships, student experiences and more. It would value a notion of connection, involving understandings linked to the why and how of learning. It would shift away from controlling discipline practices to practices that engage students with learning, and incorporate student voice and a more equal distribution of power between teacher and student (Sullivan 2009).

Conclusion

This paper has critically examined the ways in which ClassDojo is influencing the disciplinary landscape in schools and classrooms, in particular its datafication of school discipline and student behaviour. ClassDojo's popular appeal, and the relative scarcity of critical research investigating its influence on school discipline, was the motivation for this critical analysis. Moreover, this combination of factors indicates a necessity for further research into ClassDojo to uncover deeper understandings of its impact on teacher practice, student behaviour development and the education landscape more broadly. We have argued that within contemporary education's techno-friendly zeitgeist (Boninger and Molnar 2016) ClassDojo frames itself as a successful innovative educational technology (Williamson 2017a). However, despite representing itself in this way, closer inspection reveals a technological layering over older ideas and practices (Watters 2017b), resulting in a reconstitution of behaviouristic techniques that incorporate the datafication of student behaviour. However, ClassDojo's expanded surveillance techniques and datafying properties are producing new possibilities for teachers. These new possibilities expose ClassDojo's power-inducing effects as they promote controlling techniques of discipline and governance, rather than an educational approach to school discipline.

ClassDojo exists as an instrument of governance available to schools through which political objectives that prioritise state interests may be realised (Williamson 2017a). We argue that ClassDojo's datafying system of school discipline is intensifying and normalising the surveillance of students, and serving as a mechanism for behaviour control. This datafication and numerisation of students entices teachers with the prospect of a new and supposed efficient method of student organisation and decision-making, a governance by numbers. Furthermore, this form of psychologised discipline situates responsibility for behaviour entirely with the student, problematically decontextualising and erasing the complexities of behaviour, in particular those influenced by structural and contextual components of schooling (Sullivan et al. 2014a). It follows that representing and governing students in this manner produces the conditions from which a classroom culture of performativity can emerge. Putting students' behaviour performance under constant evaluation and on constant display objectifies and reconstructs students as statistical data representations of normalised culturally produced behaviours. Educating students through such performative mechanisms produces a school experience in which students are constantly subject to, and participate in, a calculation and organisation of their performance in response to evaluations, benchmarks, ratios and more (Rose 1999; Ball 2003). Furthermore, performative data-driven discourses of discipline, such as that which operates through ClassDojo, we argue force students to understand themselves through a process of calculation, constantly measuring themselves against narrow representations of ideal behaviours derived from dominant cultural understandings (Keddie 2016). Consequently, critically examining ClassDojo's datafication of discipline is important to building a comprehensive understanding of how ClassDojo is influencing school discipline practice and education more broadly.

Through the proliferation of ClassDojo, schools and classrooms across the globe participate in the process of increasingly normalising and promoting systems of student surveillance, and data-driven performative cultures of discipline. Such practices impede the enactment of school discipline through an educational, as opposed to a management discourse (Slee 1995). More must be

demanding of a disciplinary system than coercive compliance techniques associated with external regulation, and the taken for granted uncritical acceptance of discipline as a synonym for control. If it is not, schools risk failing to develop in students the skills and qualities necessary for their future success as ethical, successful twenty-first-century citizens – skills such as participation, critical thinking, creativity, inclusiveness and a sense of fairness (Taylor and Kearney 2018).

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4 The social value of anonymity on campus

A study of the decline of Yik Yak

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ABSTRACT

This paper considers the social value of anonymity in online university student communities, through the presentation of research which tracked the final year of life of the social media application Yik Yak. Yik Yak was an anonymous, geosocial mobile application launched in 2013 which, at its peak in 2014, was used by around two million students in the US and UK. The research we report here is significant as a mixed method study tracing the final year of the life of this app in a large UK university between 2016 and 2017. The paper uses computational and ethnographic methods to understand what might be at stake in the loss of anonymity within university student communities in a datafied society. Countering the most common argument made against online anonymity – its association with hate speech and victimisation – the paper draws on recent conceptual work on the social value of anonymity to argue that anonymity online in this context had significant value for the communities that use it. This study of a now-lost social network constitutes a valuable portrait by which we might better understand our current predicament in relation to anonymity, its perceived value and its growing impossibility.

Introduction: the death of a network

Anonymity has been under attack as the internet age has unfolded. Losing sight of the value of anonymity – a value based in ‘the possibility of acting or participating while remaining out of reach’ (Nissenbaum 1999) – online activity has become organised around the interests of a data capitalism in which the extraction, profiling, personalisation and accumulation of data on individuals is privileged, while the value of anonymity, privacy, secrecy and ephemerality is reduced. This is so much the case that calls for the ‘banning’ of anonymity online have recently been made at government level in the UK (Ball 2018). This paper counters such calls by asking a key question within the context of educational social media: what might be at stake in the loss of anonymity within student communities in a datafied society? In answering this question it draws on theory emphasising the social value of anonymity in order to better understand and argue for its place on campus, and for a broader conversation within universities and the wider society around the value of anonymity.

The paper approaches this question of value by presenting research tracking the death of an anonymous social network (Yik Yak) which, for a short period, was an important element of the social media ecologies of many higher education students. It uses the empirical study of this decline to theorise the ways in which anonymity can be *productively* engaged within university networks, and argues for an opening-up of discussion within higher education of the potential social value of anonymity in university online communities. This social value is well summarised by Bachmann, Knecht, and Wittel (2017) as residing in: anonymity as freedom from surveillance, accountability and social constraints; anonymity as a space apart from the ‘commodification of the social’; and anonymity as an egalitarian mode within which it is possible to experience ‘an unmaking of status inequality’ (244–245). It is the first two of these that are drawn on here as helping shape and theorise our analysis.

There is – despite what Bachmann et al. describe as a ‘small boom’ in anonymity studies across the disciplines (Bachmann, Knecht, and Wittel 2017, 242) relatively little research on anonymity and social networks in higher education. Research and commentary to date has tended to focus on the place and value of anonymity within assessment and evaluation practice (Li 2017; Raes, Vanderhoven, and Schellens 2015), peer review (Fresco-Santalla and Hernández-Pérez 2014; Bali 2015), research ethics (Moosa 2013; Kelly 2009), and sometimes on teaching methods (Bell 2001; Chester and Gwynne 1998), but rarely on online communities of students or its potential value for peer networks. While there is quite a significant body of literature looking at anonymity within computer-mediated communication and on social media (Scott and Orlikowski 2014; Ellison et al. 2016; Christopherson 2007), it is relatively rare to find such research specifically focusing on universities and student social networks. The general direction of anonymity studies in higher education has been to assume its value for some areas of activity (peer review, assessment and evaluation, research ethics, whistleblowing) while vilifying it for others (teaching, peer communication, social media). Such vilification is often on the basis of a commonly reported association with reduced social cues and ‘toxic’ disinhibition (Suler 2004) in anonymous online networks. However recent studies have emphasised the need to take a carefully nuanced approach to anonymity online in order to understand both its negative and positive effects (for example Kang, Brown, and Kiesler 2013; Correa et al. 2015; Christie and Dill 2016; Schlesinger et al. 2017; Wu and Atkin 2018), with some studies finding higher levels of toxicity and aggression from non-anonymous users when compared with those posting anonymously (Rost, Stahel, and Frey 2016).

Yik Yak was a social media application which was designed according to the three principles of anonymity, hyper-locality and community moderation, and focused specifically on user appeal on university campuses. Developed by two students (Brooks Buffington and Tyler Droll) at Furman University in the US, it launched toward the end of 2013 and quickly gained popularity across universities in the US and the UK. While firm usage figures are not available, by October 2014 it appears to have had around 2 million monthly active users (Constine 2016) almost entirely on-campus higher education students, and was the third most-downloaded iOS app in the US (McAlone 2016).

The app allowed students to use their smartphones to post short, anonymous messages to other users in close proximity (for example, our research showed it was used quite regularly as a back-channel in lecture theatres, and as a procrastination device in library study spaces). When the app was at its peak of popularity, its hyper-locality was more pronounced: users would see posts only within a 1.5 mile radius of their location. This would expand to a 10 mile radius if numbers of posts dropped (Stoler 2015). Importantly, the posts were community moderated: users could upvote or downvote other posts and if a post received four or more downvotes it was automatically deleted. Users could accumulate local social capital ('Yakarma') by receiving upvotes and by posting frequently. While user anonymity of a networked device is never total, anonymity as a principle was central to the design of the app when it was first launched: each message, or 'yak', would be accompanied by a temporary 'handle' which would persist only through a single thread of discussion and, for most of the life of the app, profiles, profile images and stable handles were neither enabled or required.

The figure below illustrates how yaks looked on user devices, with the original post at the top and the anonymous responses unfolding below, showing how each user is assigned a random, temporary avatar image by the app. Numbers of upvotes and downvotes are shown on the right of each yak. The content of the yaks in Figure 1 are generally illustrative of the kinds of yaks collected during this research, which tended to focus on issues surrounding campus life, peer support, mental health and the humour that was distinctive to this application in its heyday. These themes, their implications and the methodology used in the study are discussed in greater detail later in the paper.

The growth of the Yik Yak user base between early 2014 and 2015 was dramatic: figures reported by the company show an increase in numbers of upvotes and downvotes in the Los Angeles area, for example, as increasing by 822% between February 2014 and February 2015 (Shontell 2015). By that time 2.5% of all iPhone owners in the US were using Yik Yak on a regular basis, according to data published by *Forbes* (Olson 2015), outstripping other anonymous messaging apps popular at the time by a very considerable margin. Active marketing on university campuses brought the app to around 1600 US campuses by autumn 2014, with 50–80% of each student body using it (Shontell 2015). By early 2015 it was also being heavily used at UK universities: survey data from our own study suggests that at least 30% of undergraduates at our research site were active users of the app at that time. At the end of 2014, and after a \$61 million injection of venture capital funding the app was valued as being worth between \$300 and \$400 million (Russell 2014).

Figure 1. Screenshots of illustrative yaks from our study.

However, following adjustments made to the app which reduced its anonymity (discussed in full later in this paper), its decline was as dramatic as its rise. From 3rd most popular US iOS download in September 2014, it had dropped to 1067th by April 2016 (Constine 2016), and was widely reported as having lost its popularity and ‘cool’ on campus (McAlone 2016). Estimated numbers of active monthly users had dropped from a high of close to 2 million, to only 264,000 (Safronova 2017). In December 2016 Yik Yak laid off 60% of its staff (Soulas 2016) and the app finally closed in early May 2017. The research reported in this paper, which ran from July 2016 to May 2017, gathered data on student use at one large university over this period of decline and closure.

Methodology

Prior studies of Yik Yak focused on either qualitative or quantitative methods for analysing data sets captured solely from the app. For example West (2017) and Byrne (2017) developed analytic methods for understanding a Yik Yak dataset qualitatively, while Saveski, Chou, and Roy (2016) and Black, Mezzina, and Thompson (2016) described quantitative methods using topic modelling, sentiment analysis and content analysis. Our approach was one which interrogated the broader technosocial aspects of Yik Yak use within the context of a specific campus setting. For this reason, we wished to accompany analysis of data gathered from within the app with insights generated through ethnographic methods designed to understand its culture of use. The methodological mix we devised therefore incorporated ethnographic elements including participant observation, interview and survey, with computational methods including content analysis and topic modelling. We briefly describe these below.

The research site

Our research was conducted within a large, research-intensive university in the UK with close to 40,000 students. This is a university with campuses spread across the city, with wide variation in teaching methods and contact hours and large numbers of international students. It is also a university with competitive entry for most programmes, resulting in highly motivated students often uncomfortable with expressing concerns around academic or mental health issues that might have negative effects on ‘success’. Many students hold part-time jobs while studying. Our findings are therefore particular to this diverse, widely-spread, large community. It is likely that Yik Yak usage and experience would have been quite different in a smaller, more intimate institution with a single campus. We argue against the idea that app design determines behaviour, instead emphasising the importance of a critical, sociomaterial approach which accounts for such contextual factors.

Ethnographic methods

As Yik Yak was a social media application used primarily by undergraduates, we employed three undergraduate students to work with us as research assistants. These students conducted participant observation within the Yik Yak community, recording and coding posts to the app (‘yaks’) over four periods of seven days, between October 2016 and May 2017. Yaks were captured using smartphone screenshots, archived, transcribed and thematically coded according to a schema provided by the project team. The schema was refined between each round of data collection in discussion with the student research assistants who were mentored through the stages of analysis to ensure trustworthiness and robust documentation of data, including group sessions to refine the coding framework, and clear documentation of emergent and final themes and peer debriefing.

The research assistants wrote summary reflexive reports after each round of data collection, providing thick descriptive commentary and an overview of the data collected. We used findings from an annual social media survey conducted at the field site to gather baseline data on levels and type of social media usage among students. In 2016 this survey was sent to approximately 10,000 students,

and had 578 responses. Toward the end of the data collection period, we tested our emergent findings via interviews with ten undergraduate students who had identified as Yik Yak users in this survey. These interviews were conducted by the project team and the undergraduate research assistants.

Computational methods

Yik Yak presented some challenges in terms of data collection from the app itself: no official API or other machine to machine interface existed, and direct mining of Yik Yak data in bulk proved impossible. The daily volume of yaks varied substantially over the period of the study, and the rapidity with which offensive yaks tended to be downvoted and therefore automatically deleted means that it is possible some of these were not counted.

The value of Yik Yak lay both in its anonymity and in its geosociality: the community using the app was generally focused within a 1.5 mile radius, which mapped fairly well onto the central campus of our field site. However, when the volume of yaks being posted decreased, the radius expanded by several miles, making it difficult at times to be sure data was being generated within a single site. While several studies (West 2017; Saveski, Chou, and Roy 2016; Black, Mezzina, and Thompson 2016) have flagged these and similar issues, we are not aware of any other studies which have systematically addressed them by combining computational with ethnographic methods. Our approach enabled us to engage with rich data from the participant observation to contextualise and address some of the limitations of our computational data.

We adopted a convenience approach to this latter by manually gathering yaks from the central campus of our field site. The yaks were gathered from Mondays to Fridays between September 2016 to March 2017. In total we gathered 7497 original yaks and 39,140 replies over this period. These data were processed to extract the text of yaks along with their dates. Samples were merged and duplicates removed to produce the set used for topic modelling.

Topic modelling is a means to acquire a broad-brush overview of the content of large data collections and has been used to analyse Yik Yak data by Saveski, Chou, and Roy (2016) and Koratana et al. (2016) among others. We applied Latent Dirichlet Allocation (LDA) topic modelling to the yaks that we collected using the Mallet toolkit. LDA is a probabilistic method that models words and the documents in which they occur in order to cluster them into topics. Because topic modelling works better with longer documents we defined a document as an original yak concatenated with all of its replies.

In addition to topic modelling we explored our yak collection with other linguistic analysis tools. In order to assess the amount of offensive language in our data we followed Saveski, Chou, and Roy (2016) in matching the yaks to a list of offensive words, using a combination of pre-existing datasets.¹ Further, we developed a method aimed at uncovering name-calling by applying linguistic analysis and using regular expressions to pull out instances conforming to particular patterns. These methods revealed that usage of offensive language and name-calling were generally low across our field site, a finding discussed more fully below.

Ethical issues

Our approach to research ethics was one informed by the notion of ‘contextual integrity’ (Nissenbaum 2004) which emphasises that privacy violation occurs when ‘either contextual norms of appropriateness or norms of [information] flow have been breached’ and that ‘information revealed in a particular context is always tagged with that context and never “up for grabs”’ (125). Contextual factors in Yik Yak led us to conclude that the data collected through the app was largely perceived as public, and therefore ethically less sensitive than in some other social media contexts. User identity in Yik Yak was already anonymised at the level of the user interface. In addition, it was the norm for yaks to be gathered, aggregated and re-posted on other social media sites, by both the app developers and its users. Therefore while user expectations of privacy regarding their anonymity would have

been very high, their expectations of privacy regarding the content of their posts would have been low (a conclusion also reached by Byrne (2017)).

Further, Yik Yak was a volatile, ephemeral space in which constant disclosure of researcher presence would have been functionally extremely difficult, and also largely futile, making disclosure and consent from the user base impracticable. We addressed this problem by appointing active members of the Yik Yak community – undergraduate students – as our research associates, relying on these individuals as an ethical ‘check’ to help keep the project in line with what would be acceptable to the community more widely.

The wellbeing of the student researchers was an additional ethical issue for the project, in that there was a risk of them being exposed to negative or emotionally problematic content (for example there was one particularly difficult suicide-related thread during the period of the study). To address this, the undergraduate researchers were closely and responsively mentored by the project team, with regular de-briefs and clear responsibilities and guidelines set.

Ethical approval for the research was sought and confirmed by the relevant committee at the research site.

A history of the death of Yik Yak: hate and the social value of anonymity

We turn now to a discussion of our findings, presenting these within a wider analysis of the place of anonymity in the contemporary university. Why did Yik Yak fail? Perhaps the most commonly-cited cause in the popular media is that the app became a hotbed of hate speech, cyber-bullying and victimisation, making its demise not only inevitable but welcome. We suggest here that – while the controversy over hate and victimisation was one highly-publicised factor in its decline – there are others which are equally significant: the developers’ inability to recognise the value of anonymity to their users as evidenced by the design and development choices that were made toward the end of the life of the app, and their inability or unwillingness to ‘monetise’ the data the app collected and generated.

By analysis of these factors in relation to our field site, we attempt to answer our guiding question regarding what might be at stake in the loss of anonymity within student communities in a datafied society. In doing so we offer insight into the contemporary social and critical contexts of online anonymity within university communities, and lead into our concluding critical argument that the moral panic around anonymity evident in media responses to Yik Yak, and other similar apps, works not only as a failure to engage with these more intractable issues, but as a hegemonic moral blind for the normalisation of data extraction, profiling and the surveillance capitalism which depends on these.

Yik Yak and hate

There were several well-publicised incidents of hate and victimisation over the period of the life of Yik Yak. For example, in October 2014 a female student at Middlebury College in the United States published an open letter describing her distress following personal victimisation on the app (Seman 2014); in late 2015 there were reports that several arrests were made following threats posted at other US campuses including racist threats at The University of Missouri, mass shooting threats at Charleston Southern University, and terrorism threats at Emory University. On 5 May 2017 the *New York Times* reported that former students of the University of Mary Washington were bringing a federal complaint to court accusing the university of failing to protect its students from anti-feminist hate speech and threats of violence on Yik Yak. Commentators on these incidents were often quick to assume a strong causal link between these hateful incidents and the disinhibiting effects of online anonymity on Yik Yak (for example Li and Literat 2017). The campus arrests also prompted criticism around the limits to user anonymity that could be assured by the app (Xue et al. 2016).

In fact Yik Yak's privacy and legal policies were quite clear that anonymity for users was not total: it could be breached in response to emergency or in order to 'comply with the law, a judicial proceeding, court order, subpoena or other legal process' (Cox 2015), with date and time stamps, IP addresses, GPS coordinates and handles retained to this end. As Bachmann, Knecht, and Wittel (2017) remind us, 'there is hardly ever total anonymity, neither temporally, nor socially, nor technically' (249). Even without legal process, a certain level of hacker de-anonymisation of yaks was demonstrated as possible (for example Xue et al. (2016) and Moskowitz (2014)) (Figure 2).

Yik Yak was arguably more responsive than other social media platforms when it came to limiting its capacity for toxicity and bullying: over the period of its existence the developers implemented word filtering and warnings for violent and discriminatory language, succinct rules for engagement (Figure 3) and geo-fencing protocols for high schools (a way of 'locking out' particular locations) to prevent routine uses of the app by teenagers at school. With this last, they shut out a large proportion of their user-base at the time (as one commentator asked, 'What other social media company has attempted to physically block teenagers from using its product?' (Hess 2015)).

Criticism in the literature that Yik Yak was at the same time too anonymous (enabling disinhibition and victimisation) and not anonymous enough (in technical and legal terms) perhaps illustrates some of the complexity around the question of anonymity that this research attempts to unpick. Certainly victimisation and cyberbullying on university campuses is real and devastating, carrying serious consequences for the mental health of both victims and perpetrators (Selkie et al. 2015). Gahagan, Mitchell Vaterlaus, and Frost (2016) found that as many as 46% of higher education students have witnessed cyberbullying on social media, and Dishon and Ben-Porath (2018) have made a strong argument for the need to re-think the concept of 'civility' in online educational contexts. The argument we put forward in this paper does not attempt to minimise the negative effects of cyberbullying and online disinhibition on the mental health and wellbeing of students, and it

Figure 2. Yik Yak rules of engagement.

Figure 3. Topics in the 7497 Yik Yak conversations identified in this study.

does not uncritically seek to decontextualise or champion anonymous social media per se. It does, however, suggest that our discussion of anonymous social media within universities and beyond needs to be wider and more open than it has been to date.

While there clearly were instances of hate and victimisation enabled and amplified by Yik Yak, we suggest a need to move away from assuming that this was somehow *determined* by the app design to take on board a sociomaterial analysis which brings the institutional culture and context within which the app was used into the analysis. If hate speech was prevalent in a university's Yik Yak feed, this would likely indicate its parallel presence in clubs, bars, coffee shops and playing fields. It is important, as Bancroft and Scott Reid (2017) have argued, not to reduce political questions to technical ones in understanding how anonymity works online. For example, the dominant mode on the campus we researched was one in which Yik Yak was most often used for peer support, empathy and community building, with very limited evidence of toxicity. As one of the project undergraduate researchers reported:

YikYak was a platform where students shared all aspects of their university life. Since it was a truly anonymous platform, I had a feeling that people were sharing all their genuine thoughts and feelings as there was a shared general feeling that most people read and respond to posts not with judgment but with empathy and understanding. I had seen posts from people being excited over achieving 1sts in their degrees to people feeling depressed or overwhelmed by university to people just merely sharing their dailyness.

Other published research also indicates that Yik Yak was not for the most part a toxic environment. Black, Mezzina, and Thompson (2016) content analysis of 4000 yaks from 42 US campuses found that, while profanity in yaks was quite common, most exchanges were focused on commentary about campus life rather than victimisation or hate. Their research 'does not reveal bullying or insulting posts so inflammatory as to call for the demonizing of the entire application', or suggest that the

app posed ‘a significant threat to young adults’ (21). Saveski, Chou, and Roy (2016) study compared 1.9 million yaks with 1 million tweets, looking particularly at the effects of anonymity on user behaviour. They did not find a significant difference between Yik Yak (anonymous) and Twitter (less so), and in fact demonstrated that community moderation within Yik Yak designed to limit vulgarity or offensive speech was working effectively.

Findings from our research align well with those of previous studies: only 2% of our corpus of yaks contained offensive language – this using a wide definition of ‘offensive’ which included common everyday profanities often not considered taboo. Yaks which were directly abusive of other users were even less common. Of the 7497 conversations (yaks and replies) that we were able to categorise, the majority were general discussions and commentary on undergraduate student life (food, flatmates, clubs, TV, jobs, parents), with generally positive and supportive conversations about politics, sex and health making up the rest (Figure 3). Politics-related talk was for the most part focused on current or recent events: Brexit, the election of Trump, racism and terror attacks. Conversations on the theme of anonymity itself were also notable, primarily because over the last year of its life Yik Yak made several experiments with this aspect of its functionality, discussed in more detail below (Table 1).

The social value of anonymity

While the negative media frenzy around Yik Yak as a poisonous platform of hate was certainly part of the story of its failure, we move on now to suggest two other reasons why – despite its rapid early growth – it declined and died. The first, strongly indicated in our data, was the failure of the app developers to understand the social value of online anonymity to students; the second, more speculative issue, was their failure to find a way of monetising the data generated by the platform. Our argument here is that rather than responding to anonymous social media solely in terms of its ‘morality’ and the debate around disinhibition and victimisation, we need to include discussion around the value of anonymity as a sensibility, and to see its marginalisation as implicated within a broader social and techno-political context which normalises surveillance capitalism and ‘personalisation’ through data extraction.

To return to the story of the decline of Yik Yak, after its popularity high point around the end of 2014 and a venture capital investment of \$61 million² its growth halted and usage entered a decline (McAlone 2016). To try to address this, the developers introduced a series of app re-designs, focusing on incremental reductions in the feature which was in fact of most value to its users: anonymity. First they introduced optional ‘handles’ (stable user names) and then optional profiles. Finally, in a disastrous move in August 2016 they made handles and profiles compulsory for all users, justifying the move as working to enable better local community-building on campus, but likely driven by a need to build a more sustainable business model based on data extraction and personalisation. While users could still adopt pseudonyms if they wished, the sensibility of the app had radically shifted away from anonymous, hyper-local chat towards campus link-ups and persistent user identity. Verification via users’ mobile phone numbers was now required, and a ‘local yakkers’ function introduced to enable co-located students – for example in a library study area – to see who else was yakking nearby, making it far easier to identify who was posting at any given moment. The developers justified the change in the following terms:

Since day one, we were very focused on hyperlocal, and anonymity was just a mechanism we used to make the onboard easy. Right now we are focused on college campuses and really nailing what are these local interactions so we can power the best user experience. (Carson 2016)

The effect of these changes was disastrous for the app and for the student communities that used it. Yaks collected during September 2016, when students returned to the site of our study demonstrated an outrage and disappointment which was typical of the responses of Yik Yak users globally (Figure 4).

Table 1. Indicative conversations from the main topic groupings identified.

Student life	<p>'What portion of UG students actually works part time during the school year?'</p> <p>Selection of 27 replies:</p> <p>All my friends work part time during uni</p> <p>A good amount</p> <p>None of my friends did/do. I guess it depends on the degree/workload</p> <p>I worked part time in a shop from 1st–3rd year</p> <p>Depends if mummy and daddy will bankroll you</p> <p>I had one in first year and then stopped because I didn't really need it. I stay at home and get the student loan so I just save it all, I never really buy stuff.</p> <p>Living at home and getting a student loan is ridiculous, you know you have to pay it back?</p> <p>No it isn't ridiculous socks.⁴ It's the cheapest loan we will ever get, if you understand the terms of repayment it's also the safest loan</p>
Sex	<p>'Anyone else think they'll never have sex again?'</p> <p>Selection of 40 replies:</p> <p>No but I think I'll never be in a relationship again</p> <p>Why so boot?</p> <p>I don't think I function best in one, what about you?</p> <p>Just don't think I'll ever get the opportunity to have sex with someone I'm into.</p> <p>Into someone in what sense, actual connection or physical</p> <p>If it's just physical tinder will sort you out in no time</p>
Politics/gender	<p>'So Teresa plans to slash employment rights and reduce workers wages. Tell me right wing yik yak, why is she a good choice?'</p> <p>Selection of 36 replies:</p> <p>Best of a bad bunch? I want Tim Farron to get into power</p> <p>'Why should the government control what businesses do, it's taking away their freedom for economic success' is the argument</p> <p>Corbyn supports homeopathy. He's not a decent guy.</p> <p>Corbyn isn't perfect, or necessarily the right guy to lead the opposition, but it's refreshing to see a politician be legit and stick to their principles and keep their integrity.</p>
Academic issues	<p>'Exam tomorrow and 7 weeks of lectures revision to go!'</p> <p>Selection of 21 replies:</p> <p>I did 12 weeks of lectures in 1 day 🧑 you're fine</p> <p>Thanks for giving me hope 🧑</p> <p>My exam went well btw too 🧑</p> <p>The hope increasing</p> <p>Got nothing more to say but good luck OP! Also I'm doing a engineering degree for reference:)</p> <p>Exams always 'go well'. The grades are the problematic parts.</p> <p>Wee bit aye haha</p> <p>What exam?</p> <p>History of Christianity as a world religion</p> <p>Then have some faith in yourself</p> <p>Cheers!</p>
Anonymity	<p>'Profiles are a stupid idea that ruins the unique anonymity of Yik Yak.'</p> <p>No replies.</p>
Health	<p>'Do most people eat 3 times a day or less?'</p> <p>Selection of 17 replies:</p> <p>I eat 5–6 meals a day</p> <p>3–4. 6 if making GAINZZZZX BRAHHH</p> <p>At least 6</p> <p>Is it bad to get by with 2</p> <p>If you're having trouble with body image/flirting with an eating disorder please get help. I managed to overcome it and feel ashamed about how much I would hate myself for FUELLING my body</p> <p>Depends on what you're eating and your activity. There no one size fits all solution.</p> <p>Coffee makes it easier to eat less ... But yeah you're right boat</p> <p>Coffee is great but food is better, good luck OP x</p> <p>Thank you 🧡</p>

A few weeks later our undergraduate research associates reported a dramatic drop in usage of the app within the local community:

The decline of Yik Yak was clearly evident in the lack of use compared to a year or two ago. The number of posts could be as low as 5 a day, therefore it was difficult to collect data from this social media platform as it wasn't used. Posts were generally looking for interaction, asking questions or seeking relationships. The lack of response was notable, again with the same people tending to respond to all posts.

Figure 4. Example yaks posted in response to the removal of anonymity.

The introduction of a username and profile was a terrible decision by the app creators, it would be interesting to find out why they did this as the main appeal of Yik Yak was the anonymity it provided. The username made people less likely to post in general, repeat posts would be noticeable and any comments or responses would be clearly attributed to a profile.

Discussion within the small core group still using the app at this point confirms this conclusion, for example this exchange occurred in early September:

I wonder how much yikyaks popularity dipped after completely changing the app ... 🐼

Judging by the fact I can see last weeks post about a million people leave per day

50,000 people used to live here, now it's a ghost town.

When they changed it I literally died. I live in hell now.

I knew it was going down hill as soon as they added usernames even when it was optional to post with it

Yeah no one used the usernames anyway.

Anonymity was what yik Yak was about. Shame the devs thought otherwise:/

Ah well all hood things come to an end

Good*

Figure 5. Volume of yaks posted at field site over the period of the study, showing significant drop over the period in which anonymity was being 'designed out' of the app. Usage picked up immediately on the reintroduction of anonymity before falling away again as the academic year drew to an end, and the imminent closure of Yik Yak was announced.

Usage of the app over September–November 2016 dropped to the extent that in November 2016 Brooks Buffington and Tyler Droll released a video admitting that they had ‘messed this one up’, apologising and announcing a return to optional handles.³ Mapping usage at the field site for this study, the effect of the return of anonymity was immediate (Figure 5).

However, this reversal did not result in the regeneration of the community in the longer term: in December 2016 Yik Yak laid off 60% of its staff (Soulas 2016) and the app closed in early May 2017.

Conclusion: anonymity as a space apart

All our data – quantitative and topic analysis of yaks posted in our field site, content analysis of yak content, undergraduate researchers’ reflective reports and interviews – converges clearly on the finding that anonymity was a major source of value of the app to its users. Two of the characteristics of anonymity outlined by Bachmann, Knecht, and Wittel (2017) in their special issue dedicated to the theme of the social value of anonymity are particularly relevant here: anonymity as freedom from surveillance, accountability and social constraints; and anonymity as a space apart from the ‘commodification of the social’ (244–245).

In her classic paper ‘The Meaning of Anonymity in an Information Age’, Helen Nissenbaum (1999) argued that anonymity may encourage freedom of thought and expression by removing individuals from risk of ridicule, enable people to seek help particularly for ‘socially stigmatized problems’ such as sexual issues, suicidal thoughts or domestic violence, and provide space away from ‘commercial marketeers’ (142). These were all notable topics addressed in the yaks we gathered. Nissenbaum goes on to re-work the idea of anonymity in terms of the ability for individuals to be ‘unreachable’:

Being unreachable means that no one will come knocking on your door demanding explanations, apologies, answerability, punishment, or payment. Where society places high value on the types of expression and trans-action that anonymity protects ... , it must necessarily enable unreachable. (142)

In concluding, she states that:

If, as a society, we agree that what is importantly at stake in anonymity is the capacity to be unreachable in certain situations, then we must secure the means to achieve this. This will include a dramatic reversal of current trends in surveillance, as well as a relentless monitoring of the integrity of systems of opaque identifiers. Without at least these measures, even if we nominally secure a right to anonymity through norms and regulations, we will not have secured what is at stake in anonymity in a computerized world. (144)

It is debatable whether, despite recent regulatory changes such as the European General Data Protection Regulation and the Facebook/Cambridge Analytica scandal, the data societies of wealthy nations have genuinely learned to value this capacity for individuals to be sometimes unreachable. In fact, our data society is one in which surveillance and the routine plundering of personally-identifiable data has become normalised for most users of social media (Hargittai and Marwick 2016). As the Facebook/Cambridge Analytica scandal of 2018 revealed, the dominant business models of the new capitalism are highly dependent on data extraction, data profiling and still largely unregulated trading in the personal data of individually-identifiable users (Srnicek 2017; Zuboff 2015). Newer technologies currently touted as becoming mainstream in education (facial recognition, internet of things, neurotechnology) only promise an acute intensification and amplification of this lack of unreachability (Williamson 2018; D’Mello, Dieterle, and Duckworth 2017), and a growth in the sophistication of the architectures of surveillance we are subject to on campus (Ross and Macleod 2018; Hyslop-Margison and Rochester 2016). In this context, we might see the simplistic moral panic evident in media responses to anonymous social media like Yik Yak working not only as a refusal to engage with these more intractable issues, but as a hegemonic moral blind for the depredations of surveillance capitalism.

If, as our research shows, unreachability holds significant social value for students, there is a need for higher education to learn to value it in broader terms than its use-value for peer review,

anonymised assessment or teaching evaluation. There is a need to move away from the tendency to align anonymity within social media communities with deviance and secrecy, thinking in a more nuanced way about the social media ecologies of students and re-framing them in terms of what Haber (2017) has called ‘the complex desire for diverse temporalities of interaction – different speeds of communication at varying levels of intimacy and exposure’ (no page). Schlesinger et al. (2017) have helpfully described the social value of Yik Yak as lying in its bringing together of anonymity with ephemerality and hyper-locality, with the resulting ‘situated anonymity’ being key to its success and vibrancy as an online community.

To finish, we wish to focus on two ways in which universities might learn from the example of the failure of Yik Yak, and from the insight this failure gives us to the current state of anonymity, surveillance and community formation on university campuses. First, surveillance technologies which write out the possibility of anonymity, continue to be championed by corporate ‘ed-tech’ and its supporters in the education community. Adoption by universities of some of these has already become mainstream: plagiarism detection and lecture recording, for example. Others are still emergent: for example, facial and emotion recognition has already been posited as a means for measuring student attendance and engagement (D’Mello, Dieterle, and Duckworth 2017), sensor-based technologies are increasingly used for managing space and measuring movement around campus (Atif, Mathew, and Lakas 2015), and educational neurotechnologies are being developed aiming to scrape brain data from students in the interests of measuring and ‘enhancing’ student learning and engagement (Williamson 2018). The extent of this amplification of surveillant uses of individuals’ data has led human rights researchers to argue the need for new protections which go far beyond the protection of personal data: Ienca and Andorno (2017) argue for the right to cognitive liberty, the right to mental privacy, the right to mental integrity and the right to psychological continuity. The solutionist promises of surveillance ed-tech need to be countered by programmes within universities which directly address and counter their likely long-term effects on trust, reciprocity and academic freedom on campus.

Second, to work against these potentially dystopic trajectories of surveillance technology, universities need to re-visit anonymity, and put into place principles and frameworks which respect its social value. As Bachmann, Knecht, and Wittel (2017) have pointed out, the technical forces converging on the exclusion of anonymity have their base in some very muddy waters: in the politics of fear, in normative dreams of transparency, connectivity and justice-via-measurement, and in digital capitalism’s competition for more and more data (241). There is scope, as we move further into the data age, to normalise alternatives by recognising the value of the sensibilities of anonymity, ephemerality and unreachability.

Material examples of ephemeral community and anonymity as a ‘terrain of contestation’ (Rossiter and Zehle 2013) on campus are becoming alarmingly hard to find. Our research, which has interrogated the development, growth, decline and legacy of one such example, constitutes a valuable portrait by which we might better understand our current predicament in relation to anonymity, its perceived value and its growing impossibility.

Notes

1. <https://www.noswearing.com/dictionary> and <https://www.cs.cmu.edu/~biglou/resources/bad-words.txt>.
2. https://www.sec.gov/Archives/edgar/data/1612046/000161204614000003/xslFormDX01/primary_doc.xml.
3. Available: <https://www.facebook.com/yikyakapp/videos/1142915752424904/>.
4. Convention on Yik Yak was to refer to specific users by naming the temporary avatar assigned to their post (in this case a picture of some socks).

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5 Reconsidering data in learning analytics

Opportunities for critical research using a documentation studies framework

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ABSTRACT

In this article, we argue that the contributions of documentation studies can provide a useful framework for analyzing the datafication of students due to emerging learning analytics (LA) practices. Specifically, the concepts of individuals being ‘made into’ data and how that data is ‘considered as’ can help to frame vital questions concerning the use of student data in LA. More specifically, approaches informed by documentation studies will enable researchers to address the sociotechnical processes underlying how students are constructed into data, and ways data about students are considered and understood. We draw on these concepts to identify and describe three areas for future research in LA. With the description of each area, we provide a brief analysis of current practices in American higher education, highlighting how documentation studies enables deeper analytical digging.

1. Introduction

Data are not objective entities, nor can they fully represent an individual’s identity, interests, and values. However, in the era of Big Data, these qualities are often attributed to data (Frické 2015). Data create flawed representations of people based on their interactions with technologies, effectively reducing them into fragmentary representations. Moreover, flawed data are framed by social and political interests embedded into data structures by database designers, administrators, and stakeholders who seek to analyze and mine value from data. Given the resources and time being put into Big Data practices and the consequences they have for human life, this is problematic and worth targeted inquiry, especially in the context of education.

The datafication of student life has emerged as a result of learning analytics (LA). LA is the use of data mining and analytic methods to investigate and better understand how students learn, as well as to optimize institutions of learning, their environments, and administrative processes (Siemens 2012; van Barneveld, Arnold, and Campbell 2012). Outspoken advocates of LA argue that only by redirecting data flows to capture student life in granular detail will educational data mining reach its potential for improving learning outcomes among other things (Siemens 2013).

We argue that contributions from documentation studies can provide a useful framework for analyzing the datafication of students with LA. Specifically, the concepts of individuals being ‘made into’ data and how those data are ‘considered as’ (Buckland 2013, 2014) help frame vital questions concerning student data practices. We begin this article by describing documentation studies. Following, we argue that data should be considered as a type of document. Viewing data as documents and

applying the concepts of ‘made into’ and ‘considered as’ to data creation and use, we argue, provides scholars and practitioners a useful lens for understanding student data and critiquing LA practices. After unpacking these approaches, we pull concepts from documentation studies to identify and describe three areas for future research. With the description of each area, we provide a brief analysis of current practices in American higher education, highlighting how documentation studies enables deeper analytical digging.¹

2. Documentation studies and data

2.1. Documentation studies

Documentation studies challenge the traditional view that documents and documentation refer to text-based artifacts only, as well assumptions that documents exist outside of interpretation and the contexts that give them life. As Buckland (1997, 805, emphasis in original) writes, ‘there was (and is) no theoretical reason why documentation should be limited to *texts*, let alone *printed texts*.’ Early documentation theorists – like Otlet (1934), Briet (1951), and Schürmeyer (1935) – pivoted the conversation away from texts towards objects. ‘One understands as a document,’ began Schürmeyer (1935, 537), ‘any material basis for extending our knowledge which is available for study or comparison.’ Effectively, this new view established that any object is a document insofar that it has materiality, is intended to inform others as evidence of something, needs to be processed (i.e., documented), and others besides the documentarian view it as a document (Briet 1951).

Briet (1951) famously asked, ‘is an antelope a document?’ The answer: it depends. If the antelope is living in the wild, no. If the antelope is on display at a zoo, yes. The difference being that in a zoo, the antelope is ‘an object of study, it has been made into a document. It has become physical evidence being used by those who study it’ (Buckland 1997, 806). Combined, Briet’s insight and Buckland’s analysis support Lund’s (2009, 424) description of a document as a ‘physical, social, and mental phenomenon.’ That is to say that documents come into being through technical and technological means, they are shaped by a *mélange* of social factors, and creators and users develop a mental (cognitive, intellectual) relationship with documents.

Early documentation studies more often than not viewed documents through a technical lens (Buckland 2013; Lund 2009), one that focused on resource management processes, especially preservation, organization, representation, and dissemination practices (Buckland 1991, 1997). As a counterweight, modern documentation studies – such as those by Latour and Woolgar (1979) and Brown and Duguid (1996), among others – have focused on social contexts and political factors, arguing that purported evidence and facts within a document depend on the perceptions of those who both construct and use the document. Such an approach has broadly impacted the study of documents by (1) building from Briet’s liberal definition of a document and (2) expanding the range of problems associated with their creation and use.

2.2. Data as documents

Data are documents, too, as Buckland (2000, para. 15, emphasis added) writes: ‘any “thing” that is regarded as signifying [is a document]: Books, records, *data*, speech, signs, symbolic objects.’ And considering data as documents through a modern documentation studies perspective, provides a lens to explore the conditions that lead to the construction of data and, in turn, how they are perceived and understood. Data are commonly viewed as digital objects derived through the reduction and extraction of social and cultural phenomena from observations, computations, experiments, and record keeping (Kitchin 2014). In this sense, data are ‘anything recorded in a relational database in a semantically and pragmatically sound way’ (Frické 2015, 652). Data are then able to be searched, aggregated, cross-referenced, and examined (boyd and Crawford 2012). However, this technocentric view too often considers data as objective entities, while ignoring the social, cultural, and political

aspects of data and the consequences of their use (Bowker 2013; boyd and Crawford 2012; Kitchin and Lauriault 2014).

This paper draws on two views of documents to (1) conceptualize student data as documents and (2) to frame areas for critical research in LA. From a modern documentation studies perspective, the functional (or instrumental) view and the semiotic view enable new ways to study student data (Buckland 2013, 2014). In the functional view, *anything* can be considered as a document so long as it is 'held up as constituting evidence of some sort' (Buckland 2013, 7). This view is concerned with the process through which things are 'made into' documents. The semiotic view defines documents as anything that is evidence of something, regardless of a creator's intentions and its format (e.g., textual, non-textual), and explores how documents are 'considered as' (Buckland 2013).

Individuals are 'made into' plausibly infinite data representations that constitute evidence of something in relation to themselves and others through their technical interactions with information systems (Day 2015; Floridi 2012). And even though the technical avenues by which a person is 'made into' data have limitations, the incalculable amount of relations that can be made among datasets continues to add information to and redefine how humans are 'made into' data.

Through the semiotic view, data are 'considered as' being informative in that the perception of data and the meaning associated with them depends on their creator(s), users, and the context in which they are situated. As Buckland states, the phenomenological aspect of documents (including data) refers to 'objects perceived as something, the status of being a document is not inherent (essential) but attributed to an object' (Buckland 2013, 4). The individual that is 'made into' numerous and ever growing number of data are, therefore, embedded in social and political contexts that underlie how data are 'considered as.'

2.3. Documenting students in data

Documents about student life no longer consist of paper files locked away in the registrar's office. In fact, student life is increasingly documented in digital dossiers consisting of academic, social, behavioral, and even emotional markers. And these dossiers encompass the data against which institutions run their descriptive and predictive analytics to develop insights, which feed back into the dossiers to further inform an array of actors about a given student (Alblawi and Alhamed 2017).

Analyzing the documentation of students in data adds a new perspective to critique current and future educational data mining technologies, practices, and sociopolitical interests. Furthermore, it complements and extends the usefulness of a robust toolbox of applicable theories and approaches, including: infrastructure studies (see Williamson 2018), critical data studies (see Illiadis and Russo 2016; Selwyn 2015), sociology of quantification (Espeland and Stevens 2008; Hardy 2015), data and information ethics (see Floridi and Taddeo 2016; Rubel and Jones 2016), and others. Asking how students are 'made into' and 'considered as' data creates a new framework for addressing important critical questions. These questions along with relevant sub-questions in Table 1 can serve as a guide for approaching student data from a documentation studies perspective.

When we ask questions about making students into data, we begin to unpack the material aspects of data, the processes leading to that materiality, and the actors associated (or not) with those processes. When we ask questions about how students are considered as data, we uncover the purpose or role of the data in a social system, along with how data are used as means to various ends – and the potential and actual negative effects data surface. It is with this framework that we will address particular aspects of LA and the documentation of students in data in the following sections.

3. The fallibility of data

3.1. 'Cooking' data

In the current data climate, the breadth and scale of data being collected has led to the belief that 'digital traces' are, in fact, comprehensive pictures of human life (boyd and Crawford 2012). These traces,

Table 1. Documentation studies framework.

Made Into	Considered As
<p><i>Material</i></p> <ul style="list-style-type: none"> • Are the data a document or exist as part of a corpus, and how do we know? • What is the data source? • In what form(s) do the data exist? <p><i>Processes</i></p> <ul style="list-style-type: none"> • What visible and invisible documentation processes created the data? • Were the documentation processes purposefully created or ad hoc, were they responsive or forward-thinking? • How do uses of the data support other practices? <p><i>Human and Non-Human Actors</i></p> <ul style="list-style-type: none"> • Who directly and indirectly created the data? • Who directly and indirectly uses the data? • Who makes secondary uses of the data? • In what ways do algorithms and artificial intelligence affect the data's characteristics? 	<p><i>Purposes</i></p> <ul style="list-style-type: none"> • What evidence do these data provide, and can we verify their veracity? • What end(s) do these data serve? • What role(s) do these data play in a sociotechnical system? <p><i>Values</i></p> <ul style="list-style-type: none"> • What social value do the data have? • What cultural value do the data have? • What political value do the data have? <p><i>Issues</i></p> <ul style="list-style-type: none"> • Is the data morally justifiable? • Can the data be ethically accessed and used? • How do the data create or perpetuate unjust systems? • How does the existence/use of the data create harms?

argue Lazer et al. (2009, 721), hold ‘the potential to transform our understanding of our lives, organizations, and societies’ when aggregated, analyzed, and acted upon. Their argument assumes, however, that such traces are full, infallible representations of human life, and it extends the dangerous position that data ‘exist prior to interpretation or argument’ (Kitchin and Lauriault 2014, 3).

Data do not simply exist, rather they are generated (Manovich 2011). Social influences shape data artifacts and ensuing data-based decisions are subject to interpretive human judgement (Ekbja et al. 2015). Bowker (2013) refers to the process of data generation and shaping as data cooking. He argues that viewing data as ‘raw’ is an oxymoron, and that all data should be considered ‘cooked’ and ‘seasoned’ with the values of those doing the so-called cooking.

In summary, taking for granted data as objective documents and treating them as pure evidence of facts does not motivate some to consider the ‘made into’ and ‘considered as’ characteristics of data-as-documents (boyd and Crawford 2012). Specifically, such an approach to data (1) ignores the politics and values that drive the documentation creation processes and (2) fails to underscore the socio-technical mélange in which data exist. In the following subsection we highlight the emergence of advising analytics, pointing out as we write how the interests of higher education administrators are intertwined with making students into data.

3.2. Examples in practice: Advising analytics

To increase advising capacities and better inform students of their educational options, LA proponents have built descriptive and predictive advising technologies. When combined with analytic affordances, such tools may be able to help advisors diagnose students issues quicker and with exact information (Aguilar, Lonn, and Teasley 2014). Advisors can also use advising analytics to personalize student resources based on their educational and professional profiles (Kraft-Terry and Kau 2016). Three universities – Austin Peay State, Arizona State, and Georgia State – are known for their work with advising tools supported with analytics.

Austin Peay State University uses a recommender system, which identifies courses students should take by, first, determining if they are core and program-specific courses required for graduation and, second, if students are expected to achieve academic success in a given course (Denley 2013). Arizona State University’s advising tools calculate a student’s college readiness and predicted retention score (Phillips 2013). Georgia State University ‘analyzed two and a half million grades earned by students

over ten years to create a list of factors that predict which students are less likely to graduate,’ which the institution’s advising system combines with ‘past student performance data to predict how well each current student will do in all majors and most courses’ (Ekowo and Palmar 2016, 3).

Proponents of advising analytics argue that there are ‘no more excuses’ (Crow 2012, 21) not to analyze student data and implement predictive measures, especially for advising, but they often fail to carefully balance the potential harms with the benefits they proselytize. If administrators and other LA proponents continue to make students into and consider students as irrefutable, empirical, factual data, then it is plausible that predictive scores may consequently affect student autonomy (Jones 2018; Rubel and Jones 2016). A prediction that a student will do poorly in a given course could motivate an advisor to suggest easier courses for which a student has a higher rate of predicted success, even if that course does not align with a student’s professional or personal interests. At the extreme, if students are predicted to not be retained, administrators may push advisors to provide less of their time and resources, or to suggest to advisees that they pursue their degree elsewhere. This is not a hyperbolic example. Mount St. Mary University’s former president advocated for using predictive analytics to ‘weed out students unlikely to be retained’ (Johnson 2017, 1), or as he churlishly put it: ‘drown the bunnies ... put a Glock to their heads’ (Svrluga 2016). The president argued that dismissing students unlikely to be retained could improve the university’s retention data, which accreditors, prospective students, and national rankings (e.g., *U.S. News and World Report*) use to make judgements about an institution.

3.3. Critical questions for future work on LA and values

The documentation perspective enables an approach that examines advising analytics as an incomplete representation of student retention that is shaped by institutional values, not student interests. As the example in practice above highlights, institutions often pursue advising analytics based on administrative values (e.g., financial cost recoveries). In the Georgia State University example, many have exclaimed about the system more for the nearly \$5 million it saved taxpayers and less about how and to what degree students benefited (see University Innovation Alliance, n.d.). Using concepts from documentation studies, researchers can examine the consequences of students being ‘made into’ data when one institutional perspective is favored over others, such as the administrative perspective over the advisor or student perspectives, in the ‘considered as’ process. We can generate more critical questions using the ‘made into’ lens regarding the creation of data and the people who are both involved and excluded in the process. The ‘considered as’ concept then enables us to question the purpose and goals of LA, as well as address the emerging effects of these systems in practice. Some questions are in Table 2.

4. Apophenia and data

4.1. Seeing patterns where none exist

Much of the attention in LA research has focused on advancing analytic strategies. But Bowker (2013) cautions that those who deploy data science methods too often treat data objectively and

Table 2. Documentation studies questions on data fallibility.

Made Into	Considered As
<ul style="list-style-type: none"> • What is the source of the student data used in the predictive models? • What is the process by which data are determined to be included in analytic models? • Who makes decisions regarding analytic model development? 	<ul style="list-style-type: none"> • How do we know that the predictive scores measure what they purport to? • Whose interests do these analytics serve? • Are the actions the analytics inform justifiable, and what heuristics justify such actions?

fail to recognize the imperfections of statistical models. Critics argue that these actions lead to *apophenia*, which is ‘seeing patterns where none actually exist’ (boyd and Crawford 2012, 668). This is certainly problematic since one of the potentials of Big Data methods is the ability to spot patterns that were previously unidentifiable.

One of the causes of apophenic behavior is due to the fact that too often computer scientists identify and analyze data without the aid of individuals for whom the studied phenomena would be familiar (Bowker 2013; Ruppert 2013). Without the proper contextual lens through which to look at data patterns, the patterns themselves stand to become meaningless, if not harmful. If this is the case, how do researchers go about analyzing individuals through data while keeping in mind the potential creep of apophenia into their results? It depends on whose point of view is privileged when data patterns are considered as evidence. The following subsection presents a now infamous LA initiative, where those conducting an LA analysis of student retention failed to consult those who could have curbed the apophenia that emerged.

4.2. Examples in practice: Questioning Purdue University’s student retention claims

In 2007, Kim Arnold and Matthew Pistilli, two of Purdue’s assessment researchers at the time, developed and patented the predictive application Course Signals. Using a proprietary algorithm, the tool compares students’ earned grades in a course, interactions with course materials within a learning management system, and past academic history and personal information to predict their risk of earning an unsuccessful grade. Pistilli and Arnold (2010, 23) explained that the algorithm ‘was built from the ground up using empirical data at every stage to ensure the most predictive student success algorithm.’ The popularity around Course Signals stems from its substantial results.

Arnold and Pistilli (2012) reported that

students who began at Purdue in fall 2007, 2008, or 2009 and participated in at least one Course Signals course [were] retained at rates significantly higher than their peers who had no Course Signals classes but who started at Purdue during the same semester. (268)

For students who had taken two or more Course Signals-enabled courses, five-year graduation data showed that students graduated at a rate that was 24.36% *higher* than students who did not take a course with Course Signals technology (Tally 2013). *Desire2Learn* and *Blackboard*, two prominent learning management system developers, also took note of these findings and modeled their own predictive tools off of the work done by Arnold and Pistilli (Feldstein 2013a).

A single-digit increase in graduation rates is notable, but a double-digit increase is nearly unheard of – this fact alone raised suspicions. In particular, Caulfield (2013a) put forth serious criticisms. Pistilli claimed that taking Course Signals-enabled courses was *the* explanation behind the dramatic increases in retention, but Caulfield argued otherwise. He claimed that a reverse-causality effect was at play, which Essa (2013) was able to simulate. Essa explained:

[T]he direct causality attributed to Course Signals is erroneous. In fact, the causation is the reverse of what is claimed. Students who take Course Signals courses are not more likely to graduate than non-Course Signals students (at least not directly and at the rates suggested), rather students who graduate are more likely to take Course Signals courses. (para. 2)

Pistilli and Arnold fell victim to apophenia: they saw patterns where they did not exist.

The desire to identify and spread the retention claims was powerful given the sociopolitical pull retention metrics have in institutional conversations. Their claims gained popularity and even awards (Caulfield 2013b). But at what cost? The work arguably motivated other institutions to invest significant (but unknowable) amounts of money in systems like Course Signals, which now look like sales of ‘snake oil’ (Feldstein 2016). And Purdue’s reputational gains may have precipitously dropped among those in the LA community, especially since Pistilli inadequately defended his claims on behalf of the institution (Feldstein 2013b; Straumsheim 2013).

4.3. Critical questions for future work on LA informed by contextual factors

Auditing student data and algorithms through collaboration with those with an intimate knowledge of statistical methods for calculating retention is paramount for curbing apophenia. And as shown in the Purdue example, those familiar with the contextual factors that shape student retention were left out of the conversation but could have been useful collaborators. LA scholars have argued for the importance of considering institutional context in order to create effective data models because doing so ‘speaks to an in-depth understanding of the institution and how it functions’ (Prinsloo et al. 2015, 298). To this point, Feldstein’s (2016, para. 6) critique noted that the Purdue University situation would not ‘have happened had there been robust peer review of Purdue’s work in the first place’ and had different disciplines and higher education perspectives come together to evaluate the analytic processes.

When contextual factors are considered in relation to the data patterns that emerge as part of the documentation process, the ‘what’ found in the data patterns can be further explored to find the ‘why’ without falling victim to apophenia. We pose the following questions in Table 3 from a documentation studies perspective that could be used to study the consequences of similar LA practices.

5. Creating data doubles

5.1. Indexicality and data linking

Architects of data create systems of organization and representation to the end of linking indexical data and, by extension, an index’s attributes (Kitchin 2014). Effectively, indexical data enables a seemingly infinite array of data fusions, regardless of the context from which the data were born and the ends to which they were designed to serve. For proponents of data analytics, this characteristic amplifies the possible insights statistical work can bring about. For privacy advocates and LA critics, indexicality raises serious concerns about the increasing use of ‘data doubles’ to represent student life (Selwyn 2015).

Data and surveillance practices abstract an identifiable human body and its activities ‘into various data flows or streams’ and then reassemble ‘them into data doubles to be analyzed and targeted for intervention’ (Haggerty and Ericson 2000; Ruckenstein 2014, 69). An individual’s data double is configured, reconfigured, and reinterpreted with each recursion brought about by making new data linkages and grafting on new data attributes. As such, the documentation of life in data doubles ‘configure a certain representation of a person ... [and] have their own social lives and materiality, quite apart from the fleshy bodies from which they are developed’ (Lupton 2014, 82). We cannot assume, however, that each version of a data double is perfectly constructed. Data may be inaccurate, and similar flows of data that inform the double may conflict, which effectively embeds anomalies into the double. Moreover, the ‘rhizomatic,’ often opaque connection of complex assemblages of data makes it increasingly impossible for subjects to know what data their double includes and alter these digital records (Caluya 2010, 626; Tsesis 2014).

Taken together, these things highlight a need to understand not only the materiality of data doubles, especially given their role in LA, but also the decision-making criteria for including specific data in data doubles and the processes by which data doubles come to be. It is more often than not

Table 3. Documentation studies questions on apophenia.

Made Into	Considered As
<ul style="list-style-type: none"> Do the data analytics exist as visualizations or in tabular formats? Are the statistical modelling processes iteratively developed and vetted at each stage? Were non-data science actors consulted during the construction of the statistical models? 	<ul style="list-style-type: none"> Are the data analytics intelligible by those for whom they were design to be used? Will a diverse set of institutional actors see the usefulness of the data analytics in the same way? Do the data analytics accidentally target already disenfranchised student populations?

the case that data doubles are becoming a part of a student's official educational record. Bearing in mind how consequential student records are, it is also worth the effort to critically assess how these particular types of documents are defined, by whom, and how such definitions determine student privacy rights – all these things we highlight in the following subsection.

5.2. Examples in practice: the Fountain Hopper and student records

In January of 2015, a group of anonymous Stanford University students writing for the online newsletter the *Fountain Hopper* argued that the admissions process was unfair and possibly discriminatory. Students, they wrote, should have the right to review these records. To enable students to seek access, they built a record request template that exploited what they described as a 'tried and tested legal loophole that guarantees you access to your confidential, internal Stanford admissions file' (Fountain Hopper 2015a, para. 2). That loophole was title 20 section 1232g in the U.S. Code, which is more commonly known as the Family Educational Rights and Privacy Act, or FERPA for short. FERPA provides students the right to inspect, review, and request amendments to personally identifiable education records maintained by their institution. Nearly 3000 students and alumni requested access to their admissions records in a 3-month period (Fountain Hopper 2015b). Within 45 days of their request, students began to access their files. They found quantitative scores of 'intellectual vitality'; written evaluations by at least two admissions officers, and categories based on whether or not they were legacy students, 'VIPs,' athletes, or had other characteristics related to diversity; and logs of every time they used their ID card to enter doors (Pérez-Peña 2015).

In the wake of the press the *Fountain Hopper's* efforts received, students at other institutions attempted similar efforts to gain access to their records. In response, both Stanford and Yale changed their record retention practices. The former deleted the admissions records of students who had not requested access, and they no longer retain admission files post the admit decision (Gioia 2015); similarly, the latter expunged all admissions and career development records (Pomianowski 2015). Brown University, who was also hit with records requests, claims that 'the internal admission file ... is not considered part of the academic record and thus does not fall under FERPA' (Lifshits 2015, para. 9), arguing that 'each institution can constitute what determines a permanent record' (para. 6).

5.3. Critical questions for future work on LA and data doubles

A documentation studies approach homes in on the Kafkaesque nature of educational records, highlighting how such records have shifting materiality and are managed differently by institutions (the 'made into' lens). Furthermore, it surfaces how institutional decisions about what to include educational records affects students' legal privacy rights (the 'considered as' lens). As institutions continue to link their information systems to student identities, it will become even more unclear how these data doubles will develop and institutions will define an educational record. This is especially true as institutions enter into contracts with educational technology companies to provide services (Polonetsky and Tene 2015). But as these things continue to unfold, we can apply some of the

Table 4. Documentation studies questions on data doubles.

Made Into	Considered As
<ul style="list-style-type: none"> • How do we know data is or is not part of a student record? • Does a policy exist detailing what data to include into a student record? • Who, exactly, can access student records within an institution and what usage rights do they have? 	<ul style="list-style-type: none"> • What are the explanatory reasons for including certain data in a student record? • How does a student record and the data it includes represent a student's academic achievement and future potential? • How might leakage of data from a student record harm the reputation of a student, the institution, or specific institutional actors?

following critical questions (see Table 4) to unpack the ‘made into’ and ‘considered as’ aspects of those practices and their effects on educational records.

6. Conclusion

Students are ‘made into’ innumerable data representations through their interactions with technical artifacts. These data are considered to constitute some sort of evidence regarding students and their behavior. However, as has been shown, the evidence these data represent should be called into question given that data are not objective representations. Rather, they are generated, shaped, and cooked into some representational form to stand as evidence. Data are subject to manipulation, which shape how these data are ‘considered as’ regardless of how the data had been intended to be considered. While the plasticity of data has been acknowledged in critical data studies, more attention needs to be given to the social and political shaping of data in LA research with a documentation studies approach.

Using the ‘made into’ and ‘considered as’ views of data as a framework, we put forward three critical areas for future LA research in this article. LA research should begin to acknowledge and address the fact that data are not pre-factual; that *apophenic* behavior can lead to data misjudgments; and data doubling obfuscates students’ understanding of what constitutes their education records and how to access data about themselves. The critical areas we covered herein differ from previous critical research on LA (see Selwyn 2015) in that these areas illustrate the unintended consequences of LA when applied in practice. The practice orientation of these critical areas provides a variety of topics that researchers should begin to explore.

We do not deny that LA research has contributed to improvements in pedagogy, technological design, and learning outcomes. Furthermore, we recognize that LA scholars are reflective and critical of their own work. We argue, however, that LA research writ large would be further improved and more self-aware by considering a documentation studies perspective. Our analytical framework enables researchers and practitioners to examine the data they use in model design, algorithms, and data dashboards, along with practices informed by data analytics. LA holds potential to impact higher education – for the good and for the bad – and our documentation studies framework provides a way to ensure that bigger data become better data.

Note

1. While our focus is on American higher education, the framework we develop applies nicely to all levels of education where data mining and analytic practices are becoming common. For example, see Crooks (2017) whose work focuses on urban charter schools. Additionally, the framework would apply nicely to non-American contexts, especially the United Kingdom and Australia where higher education systems are facing neoliberal pressures like the United States. However, we recognize that any critique of a particular learning analytics practices needs to take into consideration its geographic location and related contextual factors, including relevant laws, societal norms, and community values (see Prinsloo and Slade 2017).

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6 Objectivity as standardization in data-scientific education policy, technology and governance

Ben Williamson and Nelli Piattoeva

ABSTRACT

New data-driven technologies appear to promise a new era of accuracy and objectivity in scientifically-informed educational policy and governance. The data-scientific objectivity sought by education policy, however, is the result of practices of standardization and quantification deployed to settle controversies about the definition and measurement of human qualities by rendering them as categories and numbers. Focusing on the emerging policy agenda of ‘social and emotional learning and skills,’ this paper examines the practices of ‘objectivity-making’ underpinning this new field. Objectivity-making depends on three translations of (1) scientific expertise into standardized and enumerable definitions, (2) standardization into measurement technologies, and (3) the data produced through measurement technologies into objective policy-relevant knowledge, which consolidates a market in SEL technologies. The paper sheds light on knowledge-making practices in the era of big data and policy science, and their enduring reliance on the precarious construction of objectivity as a key legitimator of policy-relevant scientific knowledge and ‘evidence-based’ education governance.

The rise of digital data analytics has catalyzed attempts to render ever-more ‘objective’ measures of education. New forms of data-driven analysis performed through education technologies appear to promise a new era of accuracy and objectivity in scientifically-informed educational policymaking. The production of data about students represent attempts to capture students in increasingly objective fidelity. In so doing, these scientifically-produced measures may become increasingly influential in directing policymakers toward problems for intervention, as they produce ‘policy-relevant knowledge’ with the ‘objectivity,’ neutrality and impartiality ascribed to the authority of pure science itself (Jasanoff 2011). While objectivity is at the center of scientific modes of data-driven ‘evidence-based policy’ (Webb and Gulson 2015), however, objectivity is itself produced through processes that involve networks of actors, technologies, policy activity, and scientific expertise – revealing how the objectivity of a data-scientific form of education policy is in fact a precarious achievement.

The paper analyzes how objectivity is ascribed to datafication in education through an analysis of emerging measurement technologies designed to capture data about students’ ‘social-emotional learning and skills’ (SEL). In recent years, SEL and related categories such as ‘soft skills’, ‘character education’, and ‘noncognitive learning’ have become the focus for governments, education technology vendors, think tanks, psychologists, economists, psychometricians, and influential international organizations (Bates 2017; Bull and Allen 2018; Duckworth and Yeager 2015). We focus primarily on

three organizations involved in promoting SEL: the Organisation of Economic Cooperation and Development (OECD), the Collaborative for Academic, Social and Emotional Learning (CASEL), and the World Economic Forum (WEF), plus related educational technology vendors and partners. Together, these organizations are creating a collective field, or a ‘policy community’, dedicated to a new psychological science of learning, practice, measurement, and policy influence (Allen and Bull 2018). As the co-founder of CASEL puts it:

we need new science, we need new training, we need new standards of implementation, new policies ... [and] new tools to measure its effectiveness. ... When you get all those things put together, that’s a field. That’s a new field with new programs and practices, new policies, and new ways of engaging the community. (Aspen Institute 2018, 17)

By tracing the creation of this new field of SEL science, implementation, measurement, and policy influence, we identify three key translations in the production of objectivity: (1) how SEL has been defined and standardized for enumeration through translating psychometrics and economics expertise into measurable categories; (2) how these standardized categories have then been translated into the design of particular measurement technologies which are intended to make SEL legible as objective data; and (3) how, through the production of ever-finer objective data, organizations that promote SEL are seeking to produce scientific knowledge that might be translated into policy influence, and that this is further opening up a marketplace for technology providers that can capture psychological attributes as quantitative data.

Analytically, we focus on standardization as a prerequisite to objectivity, and trace the production of standardization and objectivity in the emerging SEL field. As Jasanoff (2011) has detailed, ‘objectivity-making’ for policy takes hard work. It is procedurally produced, performed and reproduced in culturally situated settings by actors and institutions working within and in between the contested environments of science and policymaking. In other words, considerable practical work takes place in the translation of science into policy objectivity. In this paper we are interested in the knowledge work, quantitative practices, and technical developments involved in establishing the objectivity of policy-relevant scientific knowledge about SEL. It exemplifies problematic claims made about objectivity in relation to digital datafication in education, and reveals new ways in which data are being made as part of educational policy developments that focus on instrumentalist ‘what works’ programs and ‘evidence-based policymaking’. As such, our examination of SEL provides a critical perspective on the ‘objectivity’ of contemporary and emerging data-scientific modes of education policy, in particular by focusing on some key policy actors, forms of scientific expertise, metrics, and data-processing technologies through which objectivity is produced and circulated.

Methodologically, we examine materials produced to promote SEL technologies, analysing them for their scientific claims to objectivity, and relevant policy documentation and policy lobbying materials where these technologies are advocated, plus published scientific literature mobilized by advocates to support these technologies. Through analyses of how psychological data are produced as objective policy-relevant knowledge, our main claim is that SEL, as a contested science-in-the-making, embodies attempts by policy influencers to stabilize the field through the production of objectivity, while broadening and consolidating the uses of education technology.

Data-scientific policy objectivity

Data have become central to practices of educational policymaking at local, national and global scales (Anagnostopoulos, Rutledge, and Jacobsen 2013; Sellar and Lingard 2014). Research has begun to show how the collection, processing and dissemination of digital educational data relies on dynamic sociotechnical networks of people, policies and technologies which together produce new ways of measuring, evaluating, and governing education (Piattoeva 2015; Hartong 2016; Sellar 2017; Williamson 2017). As such, data-scientific practices that utilize advanced technologies and scientific methods of data collection and analysis are emerging as sources of policy-relevant knowledge and

policy objectivity (Sanders et al. 2017). At the same time, new ‘policy science’ approaches have developed whereby behavioral, psychological and neurological insights have been deployed in education (McGimpsey, Bradbury, and Santori 2016). Although science has long been integral to education policy, based on techno-rationalistic assumptions that policy problems can be resolved through specialist expertise and methods (Webb and Gulson 2015), the emerging field of social-emotional learning and skills exemplifies the combination of data science and psychological science as novel sources of policy knowledge, with objectivity ascribed to the datafication of students’ psychological traits, characteristics and attributes.

Translating science into policy objectivity is a complex practical accomplishment, not least since scientific objectivity itself is a social achievement (Jasanoff 2004). Critical studies of psychology, for example, have revealed how its disciplinary objectivity is produced through clinical examinations, experimental procedures, demonstrations, authoritative explanations, the production of texts, tables, diagrams and images, and the rhetorical deployment of evidence (Rose 1999). Psychometrics, or the field of psychological measurement, in particular, has been singled out as a field in which the central assumption that psychological attributes such as personality traits and cognitive abilities are quantitative and objectively measurable often remains unquestioned (Michell 2008). According to such studies, the objectivity of psycho-realist accounts of the quantitative ‘facts’ of human psychology is in fact a complex expert accomplishment involving concrete materials and practices, undertaken in particular settings, according to disciplinary conventions, agreements and decisions regarding psychological measurement.

The objectivity-making of science has long been the subject of Science and Technology Studies (STS), which we can only briefly touch on here. In particular, STS has focused on examining the practices that produce ‘objective’ representations of nature. It has emphasized the meticulous work invested into making ‘facts’ credible as a transcendent mirror of reality, the emergence and stabilization of new objects of inquiry as a precarious achievement, and the intelligibility and portability of the products of science (Jasanoff 2004). As noted by Daston (1992, 600), objectivity in its normative sense of abstaining from perspective emerged ‘when science came to consist in large part of communications that crossed boundaries of nationality, training and skill’. In the context of practical scaling up of both science makers and science audiences, objectivity started to function to bring disparate sites and actors into relations (Porter 1994), thereby creating ‘spaces of objectivity’ such as expert agencies, commissions, and forums for expert presentations (Fourcade 2018).

Particularly, quantification came to be allied with objectivity not because it mirrored reality more accurately, but because numbers were easily transportable (Desrosieres 2001). Numbers may be shared across disciplinary divides and cultural borderlines, enabling effective communication between parties whose goals, interests and beliefs may be otherwise different (Porter 1994). In the case of ‘regulatory science’ created to serve policy needs, the requirement of the communicability of knowledge is even more acute because such knowledge is vulnerable to criticism and unfolds under adversarial conditions (Jasanoff 2011). The demonstration of objectivity lends cognitive authority to and empowers those who can claim it (Megill 2007). In this process, not only is the science rendered truly objective as knowledge, but the potential interpretive flexibility of the available knowledge is temporarily resolved as policy influencers work to translate and fix it into policy.

Objectivity-making in this sense is underpinned by processes of standardization. Porter (1994) argues that tools of standardization enable something that started as local and situated to be made public and replicable across space and experience, thereby intensifying the production and diffusion of standardized recording and analytical instruments that are based on agreed upon scientific categories. The notion of *procedural* objectivity highlights the role of impersonal, standardized methods of investigation (Megill 1994). Procedural objectivity posits that human quality is problematic, and the solution to this problem rests on both the multiplication of measurements and points of view across different sites and the meticulous standardization and stabilization of the processes and environments of quantification (Daston 1992). An independent, standardized experimental apparatus that is detached from its user/observer needs to be created in order for it to render

identical results across spaces (Porter 1994). Standardized analytical categories are the precondition for building standardized measurement tools that help to render uniform results, thus proving the theory that underlies the endeavor in the first place.

Claims of the objectivity of science necessitate ‘arriving at criteria for judging claims to have represented things as they really are’ (Megill 1994, 2). This ambition represents the *disciplinary* aspect of objectivity, captured in the notions of trained eye, consensus, shared norms and control of self (Daston 1992; Jasanoff 2011; Porter 1995). As Megill (1994, 1) writes, a disciplinary sense of objectivity ‘takes consensus among the members of particular research communities as its standard of objectivity’. The calibration of instruments required for the replication of scientific facts leads to the centrality of standardized skill and vision achieved through meticulous socialization (Megill 2007). At the same time, non-scientists are equally in need of and become the targets of standardization and consensus-making, especially when science seeks to extend to policy decision-making and the commercial arena.

The above discussion illustrates how the practices of standardization are ingrained into and seem indispensable to objectivity-making. Standardization is thus equally a process of stabilization in which the object to be known, and the knower, get manufactured. As Megill (1994) expands, standardization as a practice of objectivity-making impacts both objects and subjects. The former is captured and standardized through the construction of rigid measurement tools, while rule making standardizes subjects by limiting their room for personal judgement. In the following we show how the hard work of objectivity-making unfolds through practices of standardization. These practices attempt to stabilize both the objects and subjects of SEL and prove to be extremely productive for further expansion of education technology markets. In the following sections we illuminate how objectivity-making in the new field of SEL is being accomplished through the three translations of (1) scientific expertise into standardized and enumerable definitions and categories, (2) standardization into measurement technologies, and (3) the data produced through measurement technologies into objective policy-relevant knowledge, which consolidates a market in SEL technologies. Through these overlapping practices, SEL has been made legible as categories and numbers, made amenable to calculation, and processed into objective data for use in a new policy science of student emotions.

Psychometric science and SEL standardization

The first way in which data about social-emotional learning and skills is produced as objective policy-relevant knowledge is the production of standardized SEL definitions from existing science expertise, in ways which make SEL amenable to enumeration as objects of measurement. This key process of translation of expertise into standards is exemplified by the OECD’s recent announcement of a new Study on Social and Emotional Skills (SSES, <http://www.oecd.org/education/ceri/thestudyonsocialandemotionalskills.htm>), part of the OECD’s growing portfolio of international large-scale assessment instruments (OECD 2017). SSES will consist of a computer-based test to be taken by 10 and 15 year-olds. Piloted in 2018, SSES will roll out in 2019 with first results due 2020. The purpose of the survey is to ‘provide participating cities and countries with robust and reliable information on the social and emotional skills of their students,’ and also to ‘have policy relevance’ by identifying ‘the policies, practices and other conditions that help or hinder the development of these critical skills.’ As a ‘policy-relevant project,’ the OECD claims, ‘study findings can also be used by policy makers to devise better policy instruments geared towards promoting these types of skills in students’ (<http://www.oecd.org/education/ceri/study-on-social-and-emotional-skills-faq.htm>).

Behind the OECD SSES survey and its objectivity and policy relevance lies a body of expert knowledge about the measurable qualities and characteristics of socio-emotional skills. The study is being administered by an international consortium led by the Center for Human Resource Research (CHRR) at The Ohio State University in Columbus, Ohio, USA (<https://chrr.osu.edu/>). The CHRR’s mission is to provide ‘substantive analyses of economic, social, and psychological aspects of individual labor market behavior to examining the impact of government programs

and policies.’ According to the CCHR, the SSES project will identify ‘those social and emotional skills that are cross-cultural, malleable, measurable, and that contribute to the success and well-being of both the youth and their society’ (<https://chrr.osu.edu/projects>). As such, the project is centrally concerned with defining and categorizing SEL skills, with the creation of a set of standards for their classification and categorization, and with making the noncognitive aspects of learning enumerable, measurable and calculable.

Importantly, from the perspective of the standardization practices required to produce policy-relevant objectivity, the OECD claims socio-emotional skills constructs can be classified into five broad categories – thereby further standardizing SEL as objects to be known and enumerated. It refers to a well-known framework called the ‘Big Five model’: emotional regulation (emotional stability); engaging with others (extraversion); collaboration (agreeableness); task performance (conscientiousness); open-mindedness (openness)’ (OECD 2017, 5). These Big Five categories derive from psychological theory and research conducted over the last three decades which has produced a five factor model of personality consisting of openness, conscientiousness, extraversion, agreeableness and neuroticism (OCEAN). Psychologists have developed standardized tests and assessments, including the Big Five Inventory (BFI), the Neuroticism-Extraversion-Openness Personality Inventory (NEO-PI) the International Personality Item Pool (IPIP) and Trait Descriptive Adjectives (TDA), to measure these personality traits (Soto and John 2017). Indeed, the original architect of the BFI, the psychologist Oliver John of the Berkeley University Personality Lab, was a key informant in the development of the OECD’s framework for SSES (OECD 2015). As a consequence, the OECD’s categories map exactly on to the five factor personality categories, assuming that these psychological traits are quantitative – an assumption Michell (2008) describes as the ‘pathology’ of psychometrics.

Indeed, as with most psychometrics, the OECD refers to a huge body of quantitative psychometrics literature to justify its approach to personality measurement. A 2017 working paper published by the OECD, entitled ‘Personality matters: Relevance and assessment of personality characteristics’, provided a scientific literature view on a range of personality characteristics and ways of measuring them. Its author noted that ‘personality characteristics have a demonstrable relevance for a wide range of policy issues and represent an important, although often neglected, subject of policy interest’ (Kankaraš 2017, 4). Crucially, the review notes strong correlations between high scores in the Big Five and other outcomes such as academic achievement, job performance, and standardized test scores, and details the Big Five inventories available to measure students’ socio-emotional skills in a standardized way. As this indicates, with SSES the OECD intends to apply the standardized OCEAN categories to the quantitative measurement of students’ socio-emotional skills in order to derive objective policy-relevant insights into effective interventions that improve these skills. Notably, the report emphasizes the ‘policy relevance’ of the insight that many personality characteristics – or socio-emotional skills as the SSES translates them – are malleable and can therefore become a ‘potential target for policy intervention’ (Kankaraš 2017, 82). Standardized psychometric categorization and quantification is therefore an essential step in translating personality science into a policy science.

However, the OECD’s categorization, standardization and enumeration of SEL relies not just on scientific expertise in psychometric quantification, but on the translation of personality theory into economic modes of calculation. As with its cognitive skills assessment PISA, in which test results are treated as surrogate measures of ‘human capital’ (Sellar and Lingard 2014), the OECD’s SSES instrument is invested with economic imperatives, not just psychological theories. In its previous Skills for Social Progress report, the OECD noted that ‘skills are broadly defined as individual characteristics that drive at least one dimension of individual well-being and socio-economic progress (productivity), that can be measured meaningfully (measurability), and that are malleable through environmental changes and investments (malleability)’ (OECD 2015, 34). It added that social and emotional skills are ‘a) individual capacities that are manifested in consistent patterns of thoughts feelings and behaviors; b) can be developed through formal and informal learning experiences and c) influence important socioeconomic outcomes throughout the individual’s life’ (OECD

2015, 34). Again, the OECD has worked hard to stabilize a series of slippery concepts into a standard vocabulary and set of explanations that make SEL appear commensurate with economic outcomes – thereby making it possible to calculate socio-emotional skills as measurable indicators and predictors of socio-economic outcomes, and ultimately translating students' social-emotional learning into performance metrics to compare different nations' production of human capital.

The accomplishment of the OECD in attaching emotional categorization to economic calculation has required significant external expertise and policy advice. The OECD's approach to the economics of SEL is directly informed by James Heckman, the Nobel Laureate in economics whose 'Heckman equation' has become a powerful way of calculating the economic gains to be returned from investment in childhood programs. Based on extensive econometric analysis applied to aspects of developmental psychology, personality theory, and 'human capability formation,' Heckman has argued that 'socioemotional skills, physical and mental health, perseverance, attention, motivation, and self confidence' are all 'important determinants of socioeconomic success, ... contribute to performance in society at large and even help determine scores on the tests that are used to monitor cognitive achievement' (Heckman 2008, 3–4). The analysis he presents leads to the conclusion that 'personality factors are also powerfully predictive of socioeconomic success and are as powerful as cognitive abilities in producing many adult outcomes' (Heckman 2008, 5).

Heckman's work is significant because it directly fuses policy and science, while showing how SEL objectivity borrows authority from earlier approved scientific claims. He claims that 'capabilities are produced by investment, environment and genes' and that 'capability formation process is governed by a multistage technology' whereby 'inputs or investments at each stage produce outputs at the next stage' (Heckman 2008, 33). Heckman's advocacy for 'personality investments' and the effects of non-cognitive skills on human capital and labor market outcomes have been influential in the OECD's Education and Social Progress program (of which SSES is a major instrument). Drawing on findings previously published in Heckman and Kautz (2013), Heckman co-authored the 2014 OECD paper *Fostering and Measuring Skills: Improving cognitive and non-cognitive skills to promote lifetime success* (Kautz et al. 2014). It highlighted that 'IQ tests and achievement tests do not adequately capture non-cognitive skills, personality traits, goals, character, motivations, and preferences that are valued in the labor market, in school, and in many other domains' (Kautz et al. 2014, 7). Strikingly, in reviewing programs to support noncognitive skills, the authors claimed that 'Some have annual rates of return that are comparable to those from investments in the stock market' (Kautz et al. 2014, 8). These arguments establish authority by criticizing the inability of earlier studies to capture the human being in her entirety, that is, to enable an objective representation of reality 'as it is'. Such claims also borrow credibility from and connect to economics theory, predictive economics modeling and statistical analyses based on reliable, objective measures of non-cognitive skills.

As these points illustrate, SSES comes preloaded with economic priorities around productivity maximization, with 'individual capacities' treated as influences on wider socioeconomic outcomes. The malleability of socio-emotional skills is presented as imperative to improving socio-economic progress. The policy relevance of this equation relies on the objectivity of standardized personality testing as claimed by psychologists and psychometricians, as well as standardized econometric methods for predicting productivity outcomes from personality measurement. However, the use of self-report surveys for capturing noncognitive skills has been questioned by psychologists within the field of educational assessment and measurement (Duckor 2017), while influential figures such as Duckworth have questioned the validity of instruments to capture adequate empirical measures of their constructs (Dahl 2016). Wilbrink (2016), moreover, argues that OECD reports based on fusing personality psychology with econometric analysis 'lack scientific grounding,' exemplifying ongoing contests over the objectivity ascribed to SEL science by its most active advocates. As with mainstream psychometrics, the SSES survey is underpinned by the assumption that psychological traits such as personality are quantitative (Michell 2008), twinned with the belief in mainstream economics that 'economic reality' can be known 'through measurement and measurement only' (Fourcade 2018). These forms of 'metric realism' (Desrosieres 2001) obscure all the hard work, disciplinary practices

and choices made in translating complex psychological traits and economic knowledge into standardized categories. These practices of objectivity-making depend on the formation of a disciplined consensus among practitioners who have converged upon agreed standards and procedures (Megill 2007). As such, the first stage in rendering SEL as an objective, quantitative science, as the OECD example demonstrates, is the consensual creation of standardized, enumerable categories for both psychological and economic measurement, which then provide the basis for the design of measurement technologies such as the SSES survey.

Designing measurement technologies

The second key translation of SEL into policy-relevant science knowledge is the mobilization of standards into concrete technologies of measurement. The OECD's computer-based SSES survey is one such example – as the Big 5 are put to the task of large-scale student assessment – but CASEL has also played a significant role in proceduralizing SEL knowledge through measurement technologies. CASEL has actively sought to shape how educational technologies are designed to promote SEL through a 'design challenge' on 'innovative direct assessments of social-emotional skills' (McKown, Read, and Bookman 2017), the aim of which is 'to shine a light on innovative and technically sound direct assessments of SE competencies that are also practical and feasible to use in schools, and in so doing to stimulate further development and adoption of these assessments' (McKown and Trejo 2018). Notably, the internal evaluation of the design challenge noted the need for more fully-defined 'design principles' 'to clarify which of those features is most important for an SEL assessment,' and clearly communicate 'what is being measured and how that thing is related to the reality of classroom life and the broader SEL movement' (McKown, Read, and Bookman 2017, 4). These ultimately represent standardized design principles for future SEL technologies, supported by appeals to the 'reality' of classrooms and a homogenized account of the SEL movement.

CASEL is an ideal illustration of the meticulous and hard work involved in translating science into consensus for objective measurement technologies. Scientific literature collected in meta-analyses by CASEL demonstrates how the objectivity of SEL technologies is promoted through the translation of science into standards and quantitative measures. CASEL's first meta-analysis was originally published in 2011 in the journal *Child Development* (Durlak et al. 2011) with a follow up in the same publication in 2017 (Taylor et al. 2017), both of them reporting findings as objective facts:

Current findings document that SEL programs yielded significant positive effects on targeted social-emotional competencies and attitudes about self, others, and school. They also enhanced students' behavioral adjustment in the form of increased prosocial behaviors and reduced conduct and internalizing problems, and improved academic performance on achievement tests and grades. (Durlak et al. 2011, 13)

It is notable that the 2017 meta-analysis mobilizes a standardized framework called 'Positive Youth Development' (PYD) which 'focuses on enhancing young people's strengths, establishing engaging and supportive contexts, and providing opportunities for bidirectional, constructive youth-context interactions' (Taylor et al. 2017, 1156). The empirical and theoretical bases for PYD, the authors note, are the '5Cs' framework developed by Lerner (2005, 2) in a white paper on the science of adolescent health and development:

[PYD] has arisen because of interest among developmental scientists in using developmental systems, or dynamic, models of human behavior and development for understanding the plasticity of human development and, as well, the importance of relations between individuals and their real world ecological settings as the bases of variation in the course of human development.

The standardized categories of the '5Cs' of PYD refer to 'Competence, Confidence, Connection, Character, and Caring' (Lerner 2005, 31). Although the 5Cs of PYD constitute part of the framework for CASEL's meta-analysis, CASEL itself has not straightforwardly adopted the 5Cs. Instead, CASEL emphasizes an alternative set of five competencies which constitute SEL: self-awareness; self-management; social awareness; relationship skills; and responsible decision-making. The meanings of

these categories overlap to some extent – ‘confidence’ in the 5Cs appears similar to ‘self-awareness’ in CASEL’s framework, while ‘connection’ and ‘caring’ link, respectively with ‘relationship skills’ and ‘responsible decision-making.’ CASEL emphasizes ‘skills’ more strongly than PYD. These definitional slippages and translations clearly reveal how SEL, as a science-in-the-making rather than a homogenous movement, remains a site in which competing categories are being put forward as standardized systems for measuring objectively the non-cognitive aspects of learning.

Based on these translations, CASEL has actively employed its categorical standards in quantitative technologies of SEL measurement. It has both produced a State Scan Scorecard (<https://casel.org/state-scan-scorecard-project/>) to measure different US states’ progress on developing students’ social-emotional learning – part of its proposal to use SEL as a school accountability measurement (West 2016) – and has used its Design Challenge to provide standardized rules for the production of SEL technologies. In two iterations of the Design Challenge, it has sought to refine its standardized guidance for SEL ‘competence assessment services’ (McKown and Trejo 2018). CASEL is seeking to subject SEL to standardization and datafication by imposing its framework and its guidance on the emerging field of SEL technology development. Like the OECD, CASEL has also committed to the production of glossy brochures and reports summarizing the scientific knowledge base on SEL. In these ways, these organizations are seeking to produce authoritative policy-relevant knowledge and standardized criteria for its production, performing what Jasanoff (2011, 4) terms ‘the added work of representation and persuasion that actors must do to project credibility, objectivity and truth to non-scientific audiences.’ In so doing, CASEL and the OECD are building consensus for the idea that SEL is quantitatively measurable as standardized categories which act as proxies for complex psychological traits, emotional states and characteristics, and are building or promoting technologies for their measurement. Furthermore they are catalyzing demand for SEL assessment services and other technologies to capture students’ socio-emotional learning as digital data.

Objective data-scientific policy & market-making

The third key translation of SEL into a policy science concerns the production of ever-finer precision and objectivity through technologies that can process ‘big data’, and the opening up of a market of innovative products to capture SEL data in classrooms. Such technologies fuse the objectivity ascribed to SEL to practice in classrooms, acting as sociotechnical diffusers of standardized psychological vocabularies and practical relays of economic metrics from the expert realm to spaces of enactment. As CASEL itself has noted, existing SEL ‘competence assessments currently offered in the commercial marketplace include self-report questionnaires, teacher rating scales, direct assessments, and peer nomination measures’, and notes that future iterations of its Design Challenge might focus on ‘soliciting ideas for how different sources of assessment data can be collected and combined to provide a richer picture of student strengths and needs than would be possible with a single source of data’ (McKown and Trejo 2018). A commercial marketplace of digital, data-processing technologies to support SEL has already emerged for ‘affective capture’ in classrooms (Hogan et al. 2018; Nemorin 2017). As such, the further translation of SEL from standards for quantitative measurement into specific technologies, and from there into policy and practice, depends on building a rich marketplace of providers of technologies that can capture increasing quantities of data and process it into objective policy-relevant knowledge that meets practitioners’ needs.

While the OECD exemplifies the use of psychometric survey techniques in the measurement of SEL, and CASEL exemplifies the expansion of datafication techniques, newer psychoinformatic innovations using ‘big data’ have also been developed and advocated for capturing SEL data. These technologies expand the enumerative capture of SEL data from the sample survey of SSES and the metadata of CASEL’s Design Challenge to automated real-time analytics, bringing with them the big data promise of impartial objectivity. The emerging field of psycho-informatics is based on the application of computer science techniques to psychological tracking, measurement, and analysis of behaviors, emotions, personality traits, attitudes, cognition, and abilities (Markowitz

et al. 2014). It employs a combination of behavioral data sources such as wearable sensors to track movements; smartphones to trace online activities; big data stores for psychological analysis; and analytics platforms that use techniques from data mining and machine learning to detect, characterize, and classify behavioral patterns (Markowetz et al. 2014).

Psycho-informatics stand poised for entry into education and the enhanced quantification of SEL through the advocacy of the World Economic Forum. The WEF promotes the ideal that digital technologies could be used to measure and build ‘character qualities’ and that SEL proficiency will equip students to succeed in a swiftly evolving digital economy (WEF 2016). In particular, it emphasizes the use of wearable biometric devices and facial vision systems as technologies to capture indicators of social-emotional learning from the bodies and faces of students in real time. As such, WEF’s endorsement of psycho-informatic and biometric technologies represents a shift from the more conventional computer-based psychometric testing of the OECD’s SSES or CASEL’s data-processing SEL technologies, to a real-time, automated, psycho-informatic approach to measuring SEL – and requires the involvement of commercial vendors claiming highly standardized data-scientific ways of producing objective results.

Two biometric examples are provided in the WEF report: the wearable wristband Empatica, and the facial vision system Affectiva (both originating in the MIT Media Lab but spun out as commercial enterprises), both claimed by WEF to promote SEL. It suggests these ‘affective computing’ innovations will allow systems to recognize, interpret and simulate human emotions, using wearable biometric devices, webcams, eye-tracking, databases of expressions and algorithms to capture, identify and analyse human emotions and reactions to external stimuli, and to differentiate between emotions such as happiness, fear, surprise and confusion (WEF 2016). Empatica is a wrist-worn device designed to measure emotionally aroused responses such as stress and anxiety, and then vibrate to nudge its user ‘to switch to a more positive response’ (<https://www.empatica.com/>). These biometric bracelets run an electric current across the skin to measure changes in electric charge as the sympathetic nervous system responds to stimuli, and detect emotional responses such as excitement, stress, fear, engagement, boredom and relaxation through the skin. Affectiva claims it ‘pioneers in emotion recognition software’ and ‘Emotion AI,’ having developed a ‘science platform using deep learning and the world’s largest emotion database’ (<https://www.affectiva.com/>). Its database includes nearly 6 million images and videos of human faces scraped from the web, which Affectiva has analysed and tagged using its Affdex ‘emotion classifier’ service to produce ‘emotion metrics’ on each image (Affdex n.d.). The service then compares each pixel of facial data from new users with its tagged dataset to classify the precise emotional response associated with their facial movements. Data scientists working at Affectiva itself have claimed that ‘as distance learning becomes more popular automated measurement of learners’ emotional states becomes more critical’ (McDuff et al. 2016).

The WEF’s endorsement of biometric and affective technologies relies on the production of objective, standardized scientific knowledge pertaining to the measurement of emotions from embodied signals. Rather than relying on student self-reporting at long periodic intervals, as in the OECD SSES, in the WEF vision, the body is treated as quantifiable through emotion metrics that track signals in real time. The emotion analytics performed by Affectiva has been described by D’Mello (2017) as ‘affect detection from bodily signals’, whereby embodied affects are understood to be ‘machine-readable’ as observable signals. The automated detection of affect from embodied signals is enabled by video recordings, ‘computer vision programs’ and ‘motion filtering algorithms’ which can identify ‘facial action units,’ head pose and body movement and correlate these observable signals to an underlying emotion classification model, using machine learning methods to ‘build detectors of each affective state’ (D’Mello 2017, 118).

Significant effort has been invested to produce the standardized categories and measurement instruments that derive objective knowledge about human emotions from bodily signals. Systems for affect detection from bodily signals such as Empatica and Affectiva rely on standardized emotional classification scales such as PANAS (Positive and Negative Affect Scale), twinned with

Facial Action Coding Systems (FACS) that correlate facial movements with emotional categories, and psychophysiological analytics that match biological signals to affective states. These classifications of the emotions crucially need to be understood as part of the hard work of objectivity-making through the creation of standardized classification systems. First originating in the 1970s through psychological efforts to classify human emotion into distinct categories, PANAS and FACS have evolved from paper-based self-report surveys and observation schedules for use in laboratory settings to automated systems that correlate biological signals to their emotional explanation (Rose, Aicardi, and Reinsborough 2015). Some of the key work in this area by the psychologist Paul Ekman posits that particular facial behaviors and micro-expressions are universally associated with particular emotions of happiness, sadness, disgust, surprise, anger, and fear (Ekman 2016; Ekman and Friesen 1976). The Affdex emotion classifier service underpinning Affectiva is directly built on Ekman's FACS, which its data scientists describe as 'the most comprehensive and widely used objective taxonomy for coding facial behavior' (McDuff et al. 2016). Based on this 'objective taxonomy' it uses an automated version of FACS 'trained' on millions of labeled and tagged facial images to identify emotional valence, attention and expressiveness. Through the development of these specific scientific practices, facial actions and emotions have been standardized for capture as data, enabling the subjective aspects of human experience to be rendered as machine-readable, objective, quantitative measures. The numbers so produced then serve as detached realist metrics of emotional arousal.

All psychometric and psycho-informatic instruments for objective quantitative measurement of emotion depend on specific standardized psychological theories, categories and scales, which possess their own procedural and disciplinary objectivity as products of specific practices undertaken through the consensus of expert communities of practice. The efforts of organizations such as the OECD, CASEL, and WEF to stabilize SEL for objective measurement and accurate intervention is now stimulating increased user demand from practitioners, and catalyzing a fast-growing market of providers of SEL apps, data analytics, and assessment platforms (Hogan et al. 2018; Nemorin 2017). Body-worn analytics and biometrics, informed by the psycho-informatic turn to real-time data in psychometrics, represent an attempt to ascribe objectivity to automated systems that can read the body directly for signals without the subjective 'noise' associated with self-report surveys. These technological innovations, as their endorsement by the WEF demonstrates, are being positioned as ideal instruments for data-scientific policies which depend on objective knowledge about the psychological correlates of education and learning. Their uptake in a market of SEL products and services is essential to the formation of the social-emotional 'big data' required by authorities to understand the emotional aspects of student learning, and to build momentum for further policy intervention (Aspen Institute 2018). As such, the translation of psychological and economic expertise into a new 'policy science' of SEL unfolds in parallel with, and is dependent upon, an expanding market of SEL measurement technologies.

Conclusion

In this paper we have explored how the objectivity ascribed to datafication is actively produced through processes of standardization, enumeration, and technical innovation in big data technologies, through the particular example of social-emotional learning and skills. As a new field of science, measurement, and technical development, SEL advocacy organizations are seeking to secure consensus for the key claim that the noncognitive aspects of education are quantitative and measurable, as well as malleable and open to being improved through policy intervention. The objects of SEL, in the shape of psychological traits and characteristics, are stabilized as standardized and enumerable categories that can be transported to new sites of practice and coded into new assessment services, metrics, and technology products. The procedural objectivity of SEL has been accomplished through impartial modes of investigation based on agreed scientific categories. At the same time the subjects of SEL – its scientific supporters, practitioners, and policymakers – are also standardized as disciplinary consensus across the field closes down room for subjective personal judgment.

The processes of standardization documented in this article reveal how different knowledges and practices – such as personality theory, positive youth development, and facial action coding – are being made public and replicable by organizations such as the OECD, CASEL and WEF, and thereby driving demand and stimulating a new market in SEL-based educational technologies, while also producing policy-relevant knowledge. As an emerging global policy community, these organizations are establishing a new frontier for data-scientific education policy, while empowering themselves as key sources in the procedural production of objective policy knowledge, and positioning themselves as expert spaces of objectivity. Objectivity is especially powerful to education policy because it represents a claim to authority that seems to ‘mirror reality without distortion and hence is not contestable’, though, while it is ‘easy to claim,’ it is ‘hard to accomplish “in practice”’:

Policy objectivity, like all social norms, is painstakingly constructed, contested, reaffirmed and performed in the routine practices of social actors and institutions. ... [T]hese modes of construction and affirmation become most visible at moments of controversy, when opposing actors challenge each other’s assumptions and so reveal the interpretive flexibility of concepts such as objectivity. (Jasanoff 2011, 21)

The claims to objectivity focus on expelling or subordinating subjectivity. Specifically, objectivity is employed as a controversy-settling mechanism as it is established through processes of standardization and quantification. The ongoing discussions on SEL, however, reveal still-emerging competing definitions and conceptualizations as an unsettled and thus subjectively contested science-in-the-making. SEL remains subject to a significant degree of practical objectivity-making and ongoing standardization, as each of the participating organizations in this emerging policy field is seeking to settle disputes about SEL through the production of quantitative objectivity. These contestations reveal how policy-influencing organizations are all seeking to resolve the interpretive flexibility of SEL science in order to standardize and fix it into policy – though it remains, as yet, a precarious achievement.

The data-scientific methods explored here importantly need to be seen in the context of increasing policy emphasis on objective evidence, the discourse of ‘what works’ and the advance of data-scientific policy approaches which mobilize psychological knowledge alongside data-processing technologies as ways to inform and shape education policy and practice. As the OECD (2015: xx) notes, ‘While everyone acknowledges the importance of social and emotional skills, there is insufficient awareness of ‘what works’ to enhance these skills and efforts to measure and foster them.’ Yet as we have seen, the objectivity of ‘what works’ according to science is itself an accomplishment of complex ‘set ups’ and devices such as classification schemes and standardized scales. As a policy focus, SEL is the social achievement of micro-practices which extend from psychological laboratories, theory and measurement, through econometric analyses, morally-laden categories such as grit, character and ‘positive development,’ and are then mediated and transformed through the glossy brochures, websites and presentations of international policy influencers and technology vendors as policy-relevant knowledge. At each stage, policy objectivity is achieved through the translation of science into standardized scales, classifiers, frameworks, diagrams, and memorable words and phrases, which resolve the interpretive flexibility of SEL into objective measures that can be captured as quantitative data using digital technologies. In this sense, ‘what works’ as policy-relevant objectivity and data-scientific policy knowledge is the contingent outcome of disciplinary, practical, technical, procedural and material processes that remain hard to accomplish in practice, yet continue to exert considerable power and influence in education policy.

Disclosure statement

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7 Datafication, testing events and the outside of thought

Greg Thompson and Sam Sellar

ABSTRACT

Education is undergoing various transformations due to new data-driven educational technologies and the management of educational data through data infrastructures. These technologies are frequently promoted to parents and the profession as being ‘revolutionary’ because they represent a new generation of learning. While computer adaptive tests may arguably improve various efficiencies, the argument that they will revolutionise education requires evaluation. In this paper we draw on the philosophy of Gilles Deleuze and Felix Guattari to theorise (a) the desire for data amongst policymakers and (b) the effects of data infrastructures as systems that coordinate educational thought. We argue that, rather than revolutionising learning as promised, datafication in computer-based modes merely offers more intense expressions of longstanding possibilities for learning. We describe three types of events—breaks, cracks and ruptures—and argue that data-events translate cracks (imperceptible changes that constitute learning) into breaks (information), but either cannot generate rupture (difference) or represent rupture as error. However, the intensification of learning through datafication may, we suggest, rupture educational thought more broadly.

... and the skeptics, a species of nomads, despising all settled modes of life, broke up from time to time all civil society.

(Kant, *The Critique of Pure Reason*, Preface to the First Edition).

Introduction

Education institutions, and the people who work and learn in them, are constantly generating and using more and more data. Much of this data is in digital form, either in collection, production or analysis. These data are fuelling increasingly complex forms of software, including digital learning environments, computer adaptive tests (CATs) and student information systems. The development of these different platforms has driven the development of interoperability standards in education. Interoperability is an essential feature of data infrastructures that are designed to facilitate the integration and coordination of data across multiple systems, and this integration creates opportunities to employ ‘big data’ techniques such as predictive analytics, machine learning and education data-mining. For example, the next generation of computer-based standardised testing will generate greater volumes of data, more frequently, and these data are being integrated into emerging data infrastructures (e.g., business intelligence platforms) to add new force, or intensity, to datafication in schooling (Sellar and Thompson 2016). However, the conceptual tools that we have for thinking through these new technologies in assessment and learning, particularly in relation to implications

for politics, policy and practice, remain caught between dystopian visions of technology undermining human values, culture and subjectivity, or utopian fantasies about continual improvements to the efficiency and effectiveness of learning.

We are particularly interested in CATs because of the expectation in reports and advertising focusing on educational technology, and among certain actors within education policy contexts, that CATs can solve many of the ‘wicked problems’ confronting assessment, learners, educators and education systems (Mayer-Schönberger and Cukier, 2013). For example, in an interview in 2016, Albert Hitchcock, CIO of the edu-business Pearson, unveiled plans to ‘create a global digital platform for education’ that would ‘*revolutionise* the education industry through a flexible, API-driven, cloud-based platform’ (Ismail 2016, Emphasis added). CATs represent an important part of this platform that have become desirable because they promise greater efficiency, precision, timeliness and a more enjoyable and motivating test experience for students (Frey and Seitz 2011; Martin and Lazendic 2018). CATs are technical objects that represent broader, and deeper, educational and social desires to measure learning and to use quantitative data to inform policy and pedagogical decisions. For example, Australia’s national literacy and numeracy testing programme (NAPLAN) has been trialling CAT across selected populations since 2013 (ACARA 2016). The motivations for establishing this testing regime are complex and multifaceted, rooted in desires for education systems that better manifest economic efficiencies, twenty-first century skills, improved quality, and greater equity. Increasingly, efforts are being made to develop data infrastructures across which national and international databases link to enable faster and more precise analysis with the aim of eradicating educational underachievement (Thompson 2017). While many of these developments have been scrutinised by researchers in psychology, sociology and policy studies, the claim that has escaped scrutiny is that digital solutions such as CATs will revolutionise educational assessment and, in turn, educational thought more generally.

Critical scholarship continues to ask questions about the effects of datafication in education (cf. Enyon 2015), with particular emphasis on: the rise of data surveillance (Roberts-Holmes and Bradbury 2016); concerns regarding children’s rights (Lupton and Williamson 2017); new forms of digital governance (Williamson 2015); the impact of the technologies on education policy and practice (Roberts-Holmes 2015); and concern regarding the role of technology companies within education (Reckhow and Snyder 2014). While this recent work has adopted what might be called a ‘digital sociology’ approach (Selwyn 2015), we will take a different approach here. We consider datafication and its implications for educational thought from a philosophical perspective, drawing on the writings of Gilles Deleuze and Felix Guattari. We pursue Deleuze and Guattari’s theoretical approach to this problem for three reasons: first, because claims to revolution, or the creation of new possibilities, are essentially claims to the introduction of difference or the untimely, which are key concerns of Deleuze’s philosophy. Second, Deleuze and Guattari offer us conceptual tools for analysing how thought is changing, or undergoing a revolution, as a result of technological advances such as datafication, CATs and machine learning. Third, there is much to be gained through engaging with an almost forgotten line of inquiry in poststructural theory that considers the coordinates of thought and its untimeliness, or its ‘outside’.

Deleuze, Guattari and thought as untimely

Deleuze (1994), and Deleuze and Guattari (2005) writing together, argue that revolutions in any social institutions such as education only proceed through challenges to the orthodox or representational *image of thought*, which ‘determine[s] what it means to think and what the ultimate goals of thought are’ (Voss 2013, 13). Revolutions in and of education must alter the orthodox image of educational thinking—the set of implicit presuppositions about what it means to think—and only through this can it create new possibilities for thought that can bring about new activities, behaviours, organisations and connections. Deleuze and Guattari (2005) discuss the problem of thinking the outside, which is a thought that cannot result in achieved knowledge.¹ This distinction is

critically important in educational contexts where ‘disruptive innovation’ has become a fairly common claim in education policy interventions. With the emergence of new educational technologies such as CATs, we are often promised a revolution in education by certain sections of the education technology community and their supporters in education policy networks, but as Deleuze and Guattari (1994) observed two decades ago, the concepts offered by information and technology companies are just more products for sale, not new tools for thought.

Deleuze and Guattari (1994) argue that thought in its philosophical mode ‘creates concepts’ for the express purpose of extracting ‘an event from things and beings, to set up the new event from things and beings’ (Deleuze and Guattari 1994, 33). Datafication also has a relation to events, insofar as each programmatic data-machine produces effects through events of different kinds. Theorising the form and function of these events is necessary in order to consider whether the relation between data and thought provides conditions for thinking otherwise: what we will call the *thought of the outside*. Importantly, we do not claim that thinking the outside is in any way better than educational orthodoxies or that it will lead to an improvement in learning. Rather, we want to hold the *desire* for data-driven innovation that is *expressed* in the development and promotion of new infrastructures and technologies up to scrutiny. We argue that there can be nothing revolutionary about CATs, in contrast to desire for the outside.

We begin by introducing the theoretical framework of the paper. A brief discussion of data and information is then undertaken, with the aim of illustrating how thought that is *formed* in digital learning environments such as CATs ultimately *conforms* to a model: an information ontology (Sellar and Thompson 2016). This is followed by an overview of standardised testing and an argument for why the information that it generates reinforces the orthodox image of educational thought. Drawing from Deleuze and Guattari, we then develop a typology of data events to argue that CATs, and standardised testing in general, cannot produce events that expose thought to the outside.

Datafication and information

Large-scale testing is an obvious example where a new and efficient data assemblage has been constructed over time and shapes how school systems operate (Lingard and Sellar 2013), how pedagogical decisions are made (Lingard, Thompson, and Sellar 2015), how teaching is evaluated (Ball 2003) and how learning is defined (Biesta 2010). These testing assemblages utilise increased computational and digital power in various ways such as the incorporation of test data into broader platforms and learning systems. The selling point remains that we are on the cusp of a data revolution in education, whereby ‘inferred student data’ produced through online, normed assessments such as CATs will:

impact education in a big way. It is inevitable. It has already begun. If you’re part of an education organization, you need to have a vision for how you will take advantage of big data. Wait too long and you’ll wake up to find that your competitors (and the instructors that use them) have left you behind with new capabilities and insights that seem almost magical. (Ferreira 2013)

This claim to the ‘almost magical’ revolution begs the question as to how we might define what constitutes revolution in educational contexts. Furthermore, understanding the desire for ‘revolution’ through datafication in education requires analysis of the types of events produced by testing, which is now a key site of data production in schooling. We argue that the production of more and more data through digitised, integrated and adaptive forms of testing is unable to produce a new image of thought that could sufficiently disrupt the current orthodoxy. Thought is not so easily tricked by fashion and word-play. As we shall demonstrate, standardised testing, both in its design and application, and the subsequent advocacy/opposition divide, is produced within a dogmatic or orthodox image of thought and thus limits the conditions for thinking about learning, which is also a matter of learning to think.

Data have always been produced in schooling, from attendance records and inspection reports to matriculation results and standardised testing at national and international scales. As Selwyn (2015, 65) argues, digital data can be produced from a variety of sources including deliberate production (e.g., standardised assessments, student information systems) or volunteered through the use of digital technologies and more covert forms of monitoring and surveillance. Technological innovation and development has meant that public systems like education are increasingly 'the target for a host of governmental interventions and reforms augmented by software' (Williamson 2015, 84). Williamson (2015, 84) suggests that in English school systems a new form of digital governance is emerging that uses 'network-based communication and database-driven analytics software' that mediates educational conduct and promotes new organisations into privileged positions within these systems. The software driving these interventions have rarely been interrogated and our focus in this paper is on the production of the data upon which these programmes operate and from which they inherit particular limitations.

It is necessary to begin by distinguishing between data and information. Following Rosenberg (2013) and Galloway (2011), we define data as 'givens' or, more specifically, what is given for argument. Data are not necessarily numerical, although the term now commonly refers to numerical data in digital form. Rosenberg (2013) argues that, during the eighteenth century, there was a shift in how the term was understood, from what is given in principle or through revelation to what is given through experience or experiment. Moreover, Rosenberg distinguishes data from facts and evidence, arguing that the latter emerge from meaning-making processes.

Data has no truth. Even today, when we speak of data, we make no assumptions at all about veracity. Electronic data, like the data of the early modern period, is given. It may be that the data we collect and transmit has no relation to truth or reality whatsoever beyond the reality that data helps us to construct. (2013, 37)

Data are the givens from which sense is made, rather than having inherent meaning or truth. This distinction is clearly illustrated by Rosenberg's suggestion that false data are still data, whereas a false fact ceases to be fact.

Importantly, what is given is not 'raw', because 'to enter into presence means to enter into form' (Galloway 2011, 77). Data enter into form as information. Another way to frame this is to argue that 'data are characterized as phenomena in the universal domain, and knowledge is characterized as phenomena in the subjective domain' (Zins 2007, 488). Knowledge is dependent upon the form that models or organises the data. As Derrida (1983, 14) writes, '[i]nformation does not inform merely by delivering information content, it gives form'. It is thus impossible to separate data from information in actuality, but distinguishing between the two concepts draws attention to the process of formation. The context in which data is given has important effects on its formation and these contexts are changed by computer-based processes that both radically increase the volume of information captured and give it form according to models determined by the architecture of both software and hardware (Kittler 1992). This aligns with the General Definition of Information (GDI), which 'has become an operational standard' in fields such as Information Science and Information Systems Theory (Floridi 2004, 42). The GDI is 'semantic content in terms of *data + meaning*'.

The etymology of the term information is instructive when thinking about how information, understood according to the General Definition, enters into discursive form within educational contexts. In its earliest usages, information can be understood as (a) a synonym for education (the idea that to educate and to inform are the same activities) and (b) as the moral or religious training of the body and the soul. From these early usages we can see how information connotes a sense of purpose, or rendering data fit-for-purpose, always within a pre-existing schema. If we think about testing as an example, the desire for testing is a desire for organisation (think here of the spiritual sense of monastic organisation).

We have previously argued that CAT necessarily limits learning to the model that facilitates the production of information from test data (Sellar and Thompson 2016). Information ontologies are used to model a world for the operations of computer code and to enable interoperability between

systems. Here we want to extend this argument to an inquiry into why people desire the organisation and limitation produced by datafication. When Ball (2003) wrote about the terrors of performativity in schooling, which can be understood as an effect of specific kind of datafication, he identified a problem at the level of the subject that still requires examination: how is the desire for data produced?

Florida (2010, 8) argues that the information revolution, which he dates to the middle of the twentieth century, shifts not only our 'understanding of the world and of our interactions with it, but also in our self-assessment and identity'. The desire for data emerges with a shift in the centrality of information and information systems in contemporary life. For Deleuze, desire is not a property of a pre-existing subject ('my desire'), but produces subjectivities. New subjective desires arise with changes in the production of desire (Holland 2005). As Buchanan (2014, 11) reminds us, Deleuze and Guattari argue that what 'exists' needs to be accounted for affirmatively as a product of desire. Using Nazism as their example, Deleuze and Guattari (1983, 29) write that the German 'masses were not innocent dupes; at a certain point, under a certain set of conditions, they *wanted* fascism, and it is this perversion of desire of the masses that needs to be accounted for'. From this perspective, datafication in education must exist because it is desired. This, of course, is not to be mistaken as an endorsement of the desired object. Rather, what is produced or desired is a form of social production, because 'if something exists, it exists because it is desired; if a state of affairs exists, it exists because it is desired; if a certain behaviour exists, it exists because it is desired' and so on (Buchanan 2014, 11). The analytical work to be done, then, is to consider where the desire for datafication in education, for a data-driven 'revolution' in education, might lead.

The desire for data produces the 'actuality of the objects of those representations' (Kant 1911, 16). Data and its educational forms (tests, visualisations and rankings, to name a few) based on those data are in effect manifestations of a particular desires. The need for data expressed by many teachers, principals and education systems is a powerful dimension of this new subjectivity. Groups and individuals come to believe that they need *something* to solve their problems and this lack is felt as a lack of data. 'Desire is not bolstered by needs, but rather the contrary; needs are derived from desire: they are counterproducts within the real that desire produces' (Deleuze and Guattari 1983, 27). Desiring-production and social production 'are identical in nature, but always operate under different regimes' (Holland 2005, 55). To understand desire we have to determine 'the essence or nature of desire, no longer in relation to objects, aims or even sources (territories) but as an abstract subjective essence' (Deleuze and Guattari 1983, 270). So the question is: what is the abstract essence of this desire?

This need for data derives from a very particular concern to know, or to be certain, in order to manage education in risky modernity. This 'bargain with modernity', as Giddens (1990) names it, creates a social desire in individuals to be or become operational or commensurable as a marker of their trust. For Lyotard (1984), 'operational' and 'commensurable' are significant terms that derive from computer-based knowledge systems that he felt would increasingly ground epistemology. Commensurability is particularly important as it encompasses the transformation of qualities to quantities (measurement), which standardises the meaning derived from data (interoperability). As Lyotard (1984, 4) argues, with computerisation

the nature of knowledge cannot survive unchanged ... [it can] become operational, only if learning is translated into quantities of information. We can predict that anything in the constituted body of knowledge that is not translatable in this way will be abandoned and that the direction of new research will be dictated by the possibility of its eventual results being translatable into computer language.

The desire to be operational requires the production of, and belief in, data, grounded as it is by a knowledge system based on computation. For Lyotard, as this desire for computational data grows, the desirability of other forms of knowledge and lines of research diminishes. What cannot be computed is forced to disappear and 'the legitimization of that power is based on its optimising the systems performance ... be operational (that is, commensurable) or disappear' (Lyotard 1984, xxiv).

One interesting aspect of the desire for knowledge in this form is that it has a positive feedback effect, always producing the need for more and better information. It is this ‘coming to information’ that seems particularly evocative. Why is it that this sense is made of data in schools rather than ‘other possibilities ... such as the teacher who becomes indifferent to the database, who neither tries to ignore the changing expectations of the teacher nor manipulate the data by saying; “So, you’ve created some data-points. So what!”’ (Thompson and Cook 2014, 140). To analyse the desire for operability we need to discuss standardised testing in more detail, including its relation to the orthodox image of educational thought.

Standardised testing and the orthodox image of thought

Standardised testing has been driven by a view that better data necessarily creates the conditions for social progress and thus technical expertise ought to be devoted to this task. Standardised tests are administered ‘uniformly’ to a large number of students and ‘scored in a predetermined manner’ (Popham 2001, 39). There are two types of standardised tests: sample tests—where a representative sample of students sit the test—and census tests—where all students within the designated population sit the test. Those who are critical of standardised testing rarely pay sufficient attention to the creation of these tests, while those who support the tests rarely pay sufficient attention to their potential misuse and perverse consequences (Sellar, Thompson, and Rutkowski 2017). One problematic line of argument found in much academic literature is that standardised tests are inherently an instrument of neoliberal education policy, ignoring of course that standardised testing pre-exists neoliberalism by many decades.

A test is an arrangement of material to be tested that occurs in three distinct stages. The first stage is the **domain**. The domain is the specific area of interest that is being measured, whether it is a body of knowledge, skills, abilities or attributes. Essentially, domains constitute the sum of knowledge of a particular field that has sedimented over time. Domains are made up of **sub-domains** that have a specific relationship to each other. It is important to note that most tests are developed to report on ‘more abstract traits called *constructs*’ (Madaus, Russell, and Higgins 2009, 40). A **construct** is (usually) the statistical creation of a theoretical idea that is not directly observable, but is assumed to have observable behaviours that can be measured. Examples include intelligence, self-esteem, engagement, literacy, numeracy and so on. Ultimately, observable behaviours (such as answering questions correctly) become proxies that are used to infer the relative attainment of these constructs—what is ultimately measured is test performance (Dohn 2007).

Standardised testing captures what can quantified and it is impossible for any test to measure a domain completely in the time allocated for test administration. Thus, the second stage is that of sampling – all standardised tests are effectively **samples** of domains and sub-domains. A test of 40–50 questions is sampled in such a way that a meaningful prediction can be made of attainment within the domain of interest. The sample of items is guided by a **test specification plan**, which includes the number of items in the test, which sub-domains will be included, the proportion of items in each sub-domain, and the specific characteristics of individual items such as their difficulty and question style (Madaus, Russell, and Higgins 2009, 41).

The third stage is that of **inference**, or how test scores can be used to infer achievement within the domain. In other words, ‘*domain performance, not test performance, is really the interest in any testing situation*’ (Madaus, Russell, and Higgins 2009, 47). This can occur at the level of the individual (for example, how well a Year 4 student understands arithmetic) or can be aggregated into larger groups to enable comparisons between classes, schools, systems and nations. While inferences from tests appear to be almost limitless, and apparently easy to make, the real question is how to make *valid* inferences. This is notoriously difficult (Newton and Shaw 2014). Ultimately, ‘test performance on a sample of items drawn from the domain is used to make an inference about a student’s or a group’s performance relative to either the domain or to an entirely different domain of interest’ (Madaus, Russell, and Higgins 2009, 49–50).

Recent technical and computational developments require the addition of another stage to this schematic. With test developers no doubt stung by frequent criticism of tests being ‘snapshots’ that fail to capture learning, and driven by the desire to make tests better, new forms of standardised testing such as CATs are being used in school systems. CATs apply ‘prediction methodologies to reduce the length of the test without sacrificing accuracy’ (Hwang 2003, 218). While traditional pen and pencil standardised tests provide the same schedule of questions to students, often moving from easier to more difficult questions, CATs ‘adapt to a student’s ability level’ through offering branches or pathways (Shapiro and Gebhardt 2012, 296). These are known as **testlets**. At each stage of standardised testing there is **selection**.

While standardised assessments have not generated data with the volume, variety or velocity characteristic of big data, CATs promise to capture greater volumes of data (e.g., log file data) in real-time and they dramatically reduce the time between data generation, analysis and action. For example, CATs add an extra dimension to selection, beyond domain samples and inferences, which cuts across each of the preceding stages. What distinguishes CATs from paper and pencil tests is that selection, previously understood as a force applied externally to the test, is now internalised within the activity of test-taking itself. While students have always selected answers to questions, external agents choose the design of the tests (domains, sub-domains, items) and how to represent the tests (cut-off scores that indicate bands, levels or grades). However, selection in CATs also occurs during the tests because, at predetermined points, students are streamed or branched into different ‘testlets’ based on attainment in preceding questions. These selections are made by algorithms embedded in the tests.

Each act of selection is an event. These events range from the selection of the items in the domain to the selection of the student who answers the questions and from the teacher who uses the data to make decisions about curriculum and pedagogy to the policymaker who makes decisions about the effectiveness of educational provision and directions for education reform. The test cycle is a collection of *selection events*, but the question remains: What *kinds* of events are these? And how do these events capture people’s attention and desire? Our answer, which the rest of the paper develops, is that testing produces desire for data because it promises both operability and optimisation.

We are promised that new technologies such as CAT will revolutionise learning, but so often the intensification of standardised testing and its computerisation close thought in upon itself. No doubt this is one form of the social production of what is desired: while some claim that testing will ‘revolutionise’ education, in most cases it simply represents an optimised version of the image of education that we already have. We suggest that there remain other (either troubling or invigorating, depending upon your orientation) possibilities for thought, as a result of the development of new kinds of human-machine relations that we can begin to articulate using Deleuze’s concept of the event.

Thought, events and testing

So what kind of events does the production of data through testing generate? An event is an occurrence, something that happens. But clearly everything that happens does not qualify as an event; this term is generally reserved for remarkable occurrences that stand out from the background of everything that happens. For Deleuze, the event is a decisive technical term that needs to be carefully understood. Events are turning points, singularities: ‘bottlenecks, knots, foyers and centres; points of fusion, condensation and boiling; points of tears and joy, sickness and health, hope and anxiety, ‘sensitive’ points’ (Deleuze 1990, 52). Sense *is* an event and so we might also ask: What sense is made of testing? In asking this question we extract the problem of the testing event from the presuppositions of the tests themselves.

In a discussion of the novella, Deleuze and Guattari (2005) outline three kinds of events: breaks, cracks and ruptures. Breaks and cracks are of a different quality to rupture events, ‘which [are] like a line of rupture or a “clean break” and [mark] the exploding of the other two, their shake-up’ (Deleuze

and Guattari 2005, 199). To understand what happened, what is happening, or whether anything happened is the sense of the event. In Table 1 we associate these three events with different concepts, processes and expressions that demarcate the territory, and possibility, of sense-events in education. We then outline each type of event and discuss how it is or is not manifest in standardised testing, and particularly CATs.

Break-events

The multitude of selections involved in any form of standardised testing are break-events. The break is an occurrence of change from one structural position or identity to another. It occurs within a logic of representation and the change produced is always communicable and predictable. Quoting F. Scott Fitzgerald, Deleuze and Guattari (2005, 198) describe such events as proceeding ‘by oversignificant breaks, moving us from one term to the other according to successive binary “choices”’. Testing is premised on events of the break type that allocate test takers into limited sets of pre-existing categories (recognition) and, with CATs, this entails a form of ‘machinic enslavement’ (Lazzarato 2014) that partially disassembles the subject into human-machine processes (information). Break-events overcode and segment by allocating particular categories and qualities to bodies: “Even when change runs in the other direction, there is nothing to compensate for the rigidification, the aging that overcodes everything that occurs” (Deleuze and Guattari 2005, 198). Break-events are thus macropolitical events, but as Deleuze and Guattari (2005) emphasise, these events communicate with micropolitical events: ‘every politics is simultaneously a macropolitics and micropolitics’ (213). Break-events thus communicate with crack-events, which occur in the domain of the micropolitical.

Consider an example. The determination of a student as ‘passing’ or ‘failing’ is an event that involves a ‘choice’ that occurs as an incorporeal transformation: the determination of pass or fail changes the capacities of the student who is assessed (e.g., the student may no longer be able to access a particular educational or vocational pathway). This event inheres in language, is actualised in the depths of the body and reworks its capacities. Break-events are actual; that is, they represent potentiality in concrete forms. Individual scores, rankings and judgements about achievement and/or ability express changes in position or perceived identity. Labelling a student as above-average, a school as failing, or a system as excellent based on aggregated data, are all examples of break-events that express potentiality as information. This process is one of recognition: the break-event is (supposedly) the recognition of the capacities and attributes of a given body, but this recognition also changes the perception of that body. Thus, an excellent school may have always conducted itself the same way, with the same effects, but it may require the ranking of ‘excellent’ based on recognition of testing data (or other data) for the transformation to occur. Of course, these events are limited in that they merely confirm the image of thought that is presupposed in education.

Crack-events

The crack-event involves more imperceptible forms of change. Instead of blows from the outside—seismic shifts that change the qualities or emergent properties of things in noticeable ways—these events involve ‘micro-cracks, as in a dish; they are much more subtle and supple, and occur when things are going well on the other side’ (Deleuze and Guattari 2005, 198). The self is constituted

Table 1. Three kinds of event.

Event	Concept	Process	Expression
Break	Actual	Recognition	Information
Crack	Virtual	Learning	Signs
Rupture	Line of flight	Difference	Thought

through multiple crack-events that are only recognised as change after the event (e.g., learning as expressed in the surprise of a new perspective on the world), and this recognition necessarily fails to account for the multiplicity of forces that constituted, nourished and sustained the crack. The crack-event is of a different order to the break-event because it does not contain the conditions of recognition. We argue that learning can be understood as proceeding via crack-events because it is a process of virtual transformation that may or may not be incarnated in the depths of the body: 'it is so difficult to say how someone learns' (Deleuze 1994, 23). Learning proceeds initially on the surface, through crack-events that 'conjugate the distinctive points of our bodies with the singular points of the Objective Idea in order to form a problematic field' (Deleuze 1994, 165). Consider, for example, the way in which the body must conjugate with the forces or signs present in a body of water as it learns to swim (Bogue 2004).

The crack-event involves a micropolitics of subjectivity, because it occurs when

you reach a degree, a quantum, an intensity beyond which you cannot go ... But what exactly happened? In truth, nothing assignable or perceptible: molecular changes, redistributions of desire such that when something occurs, the self that awaited it is already dead, or the one that would await it has not yet arrived. (Deleuze and Guattari 2005, 198–199)

Deleuze and Guattari argue that there is a limit-point to the crack-event, a point at which if the line of travel continues something New can emerge. When cracks become ruptures, thought is produced by a different process of desire. At this limit point, learning can become recognisable (the crack becomes a break) or thought itself can become radically disoriented (rupture).

For Deleuze (1994, 165), the latter is the condition for true learning: 'we never know in advance how someone will learn' because learning does not proceed according to a method or model. Learning is a violent *paideia* and truly creative thought emerges from 'the destruction of an image of thought which presupposes itself and the genesis of the act of thinking in thought itself' (Deleuze 1994, 139).

Importantly, crack- and break-events presuppose each other. Crack-events are imperceptible changes that occur continually in schools (such as feelings of bewilderment, anxiety or elation when sitting a test) that produce, to some extent, the self as a process rather than an identity. Break-events produced by testing overcode these molecular changes and incarnate them as durable attributions of performance (the high performing student or school). Break events realise the desire for data in achieved knowledge that produces a sense of certainty. Thus, testing events may produce learning through which a learner struggles, and emerges anew, but these will only become evident after the fact, if at all. Digital technology that enables crack events to be better coordinated, more quickly processed and more insightfully arranged as personalisation hardly seems the stuff of revolution at the level of thought.

Rupture-events

Rupture-events involve change along 'a third line, which is like a line of rupture or a "clean break" and marks the exploding of the other two, their shake-up ... in favour of something else?' (199). The 'something else' that occurs in rupture is radical passivity: 'Nothing can happen, or can have happened, any longer' (199). Rupture-events involve absolute deterritorialization (line of flight): 'a type of movement qualitatively different from the relative movement' (509) of reterritorialization through breaks and deterritorialization through cracks. Rupture involves an encounter with the outside, with 'the impossibility of thinking that is thought' (Deleuze 1994, 199). In rupture, thought searches blindly for new coordinates and we are forced to think in absence of a model and without orientation towards an end. The active desire for data can be understood as desire for information that gives coordinates to thought. This desire is frustrated in rupture-events and potentially becomes transmuted into a problematic thought that wrestles with what cannot be grasped as knowledge (difference).

As absolute deterritorialization, rupture involves the creation of a 'new earth'. If breaks are incarnated in the body and cracks stay at the surface, then rupture is about the constitution of a new terrain: 'My territories are out of grasp, not because they are imaginary, but the opposite: because I am in the process of drawing them' (Deleuze and Guattari 2005, 199). Deleuze and Guattari (2005) write that 'Fitzgerald contrasts rupture with structural pseudobreaks in so-called signifying chains. But he also distinguishes it from more supple, subterranean links or stems of the 'voyage' type, or even from molecular conveyances' (199). In contrast to molar breaks and molecular cracks, rupture produces new lines of thought and are the only events which can be legitimately characterised, from Deleuze's point of view, as 'revolutionary' in the sense of producing new thought. If any test, or form of datafication, is to be revolutionary, it must produce rupture-events. The claim implied by many promoters of CATs and other forms of digital, integrative assessment is that they create the conditions for rupture-events. However, as it currently stands, these tests proceed along the familiar line of educational thought, whereby information is assembled, students are tested, data is aggregated, ranking follows along with the subsequent material effects of these rankings. There is nothing new here and thought looks unlikely to be ruffled by this aspect of a digital 'revolution' in education.

Conclusion

In this paper, we have argued that 'next generation' CATs, data-driven learning environments and algorithmic personalisation are promoted as rupturing with what has come before. Drawing from Deleuze and Guattari, we have sought to describe three types of event: breaks, cracks and ruptures. This typology of events provides us with a way of thinking about learning and its limits. We argue that standardised testing generates break-events when it reorganises thinking about learning on the basis of new information, new comparisons and new predictions. But testing cannot disrupt the orthodox image of educational thought or produce learning in Deleuze's more radical sense. Testing may generate breaks and cracks, but it is unable to produce rupture.

Every standardised test is essentially the Same. This statement seems obvious; after all, standardised tests are designed to be the same. However, what we mean by 'Same' is somewhat different to the common usage of this term. The claim is that all tests are created according to an image of thought that limits (a) what tests should be and (b) what the purposes of schooling are (as this necessarily influences how tests are conceptualised, created and administered). The desire for operability that manifests as a need for data is oriented toward conformity with a model rather than creative differentiation. Testing can only repeat the Same: it can only ever produce structural pseudobreaks.

Testing is an artefact of the selections made throughout the test cycle, which themselves are produced within the socialised world of education. Domains, sub-domains, constructs, specification plans and branching are all conceptualised, constructed and put to work according to an image of educational thought. Standardised testing assumes that acts of recognition are precisely what ought to be measured as the desired outcome of education. Educational thought based on the information generated by testing is thus inherently limited to the recognition of correct answers and a simple concept of error. Standardised tests cannot break with the past, therefore no test can deliver on the promise of a revolutionary educational future. CATs automate and intensify this representation, acting as a catalyst in the feedback loop between cracks and breaks.

We concede that rupture-events may occur while a student is engaged in a CAT, but they may also occur in any other situation. As Deleuze argues, we cannot say when or how such events will provoke thought. But, the occurrence of a rupture-event during testing is incidental to the form and function of the test, and CATs, by intensifying the desire for breaks, help to reduce the conditions in which ruptures can occur. Why is it a problem if educational thought is not exposed to rupture?

Following Deleuze, we have defined rupture as an event in which the desire that produces thought is transmuted through an encounter with the outside. The rupture event does not open thought to a

different way of learning (understood as recognition and the achievement of knowledge); instead, it constitutes a different movement of thought, one that is no longer relative. Rupture-events invert the relationship between thought and learning and thus are better categorised as learning to think. This is a process without defined end or any certainties that provide a sure guide for thought. Our argument is not that rupture offers a 'better' type of learning, but rather that it constitutes different possibilities for thought. Such possibilities have a much more substantive claim to the 'new' or 'revolution' than hyped developments at the intersection of educational testing and technology.

While speculating about the future is a risky business, we do think that CATs, particularly with their integration into data-driven environments that are designed to optimise pedagogy and assessment, may have 'revolutionary' consequences, but of a different sort than is generally promised. The optimisation of learning through algorithms is just one element in a much broader and rapidly intensifying trend toward the automation of cognition as machine learning. As machines increasingly provide cognitive augmentation to thought, what it means 'to think' will become parasitic upon a much more powerful yet narrow model of cognition. A new image of thought may not be human at all. Perhaps the revolution that CATs will contribute to, as part of the broader computerisation of education, will be one in which the potential for thought to be confronted by the outside, in an attitude of radical passivity, is diminished in favour of more active colonisation by an inhuman logic of information processing.

Ultimately, the desire for data that drives the production of CATs and related technologies is a desire that puts pressure on orthodox image of educational thought. The philosopher Nick Land, who drew on Deleuze and Guattari's concepts to think speculatively about techno-capitalist dynamics, observes that '[t]raditional schemas which oppose technics to nature ... are all dominated by a phobic resistance to the sidelining of human intelligence by the coming *techno sapiens*' (Land 2011, 294). Educational thought is clearly structured by this resistance, this could break down as thought becomes integrated with information processing. When human thought becomes parasitic on inhuman cognition there is no longer a 'dialectic between social and technical relations, but only a machinism that dissolves society into the machines' (Land 2011, 294). This would be rupture and revolution of a very different kind.

Note

1. Deleuze and Guattari's reference to the thought of the outside echoes a longer engagement with this idea by thinkers such as Georges Bataille, Maurice Blanchot, Michel Foucault and Pierre Klossowski. Blanchot's writings are particularly influential in this regard, and his concept of the outside can be defined as: 'a power that wants to be a power even in the region of the ungraspable, where the domain of goals ends' (Blanchot, 1982, 106). Deleuze (1994) makes reference to

that point of which Maurice Blanchot speaks endlessly: that blind, acephalic, aphasic and aleatory original point which designates 'the impossibility of thinking that is thought', that point at which 'powerlessness' is transmuted into power, that point which develops in the work in the form of a problem. (199)

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8 Cruel optimism in edtech

When the digital data practices of educational technology providers inadvertently hinder educational equity

Felicitas Macgilchrist

ABSTRACT

As digital data become increasingly central to education, hopes for educational equity are pinned more strongly on educational technology providers. This paper examines the data practices of edtech providers who are not simply making token gestures towards justice and equality. Drawing on ethnographic interviews and Berlant's notion of cruel optimism, it presents three data stories. The paper suggests that datafication in education provides a showcase of cruel optimism, i.e., when the object of desire is blocking one's flourishing. The conclusion considers the constitutive paradoxes of datafied education, and implications for the current phase of edu-technical transformation.

'[E]veryone needs enhanced digital skills to participate fully in society' (European Commission 2014, 3; see also Working Group 2017, 15). Governments and philanthropists worldwide strive to provide access to technology in the belief that overcoming what has been called the 'digital divide' will ameliorate disadvantage and increase educational equity. Yet it is evident that the way digital technology is used today is (perhaps inadvertently) strengthening existing socio-economic inequalities. Studies on technological change and social inequality have identified correlations between differential access, usage, attitudes, skills, discourses, structures, and infrastructures and a range of individual and societal domains, including life chances, civic engagement, health care, political activism, health behaviour, entrepreneurship, social capital, age, education, disability, gender, 'race' and class (ITU 2017a, 2017b; Robinson et al. 2015; van Deursen and van Dijk 2013).

Simply providing fast broadband or high-quality hardware and software has not created a 'pipeline to prosperity' (Eynon and Huw in press). Instead, it has exacerbated entrenched inequalities and created new challenges (DiMaggio and Garip 2012; Eynon and Geniets 2016; Warschauer 2003).

Today, these new challenges include the inequalities enacted by 'data practices'. Algorithmic security assessments target specific subgroups, whose applications are systematically denied (Leurs and Shepherd 2017). When statistical models predict which children are at risk of abuse, human experts defer to these computerised risk assessments (Eubanks 2018). Venture capitalists push algorithmic decision-making as the basis for personalised learning; predictive analytics are being proposed that could help to discourage lower-income students 'at risk' of dropping out of university from going in the first place (Watters 2017). 'Digital redlining', i.e., the categorisation of students into classed bodies with differential access to information through regulation, tracking and filtering, actively limits the opportunities of some (mainly working class) students (Gilliard and Culik 2016).

A growing body of work on data activism explores ways that existing power relations are being challenged by mobilising data to enhance social justice (Fritsch 2018; Gutiérrez 2018; Kennedy 2018).

In between algorithmic control mechanisms and data justice, an open question remains how those working ‘on the ground’, developing the personalised learning technologies or advocating for better data practices, describe their data practices. This paper draws on extended ethnographic interviews to ask how actors in educational technology talk about data practices. Although many clearly make token gestures towards equity and social justice, the focus in this paper is specifically on those who voice a deep commitment to data ethics and to increasing equality. How do they express this commitment? How does this aid our understanding of the hopes pinned on technology in the datafied present?

Concepts and methods

‘Datafication’ is understood here as the rendering of myriad forms of information about education, in particular about learning, into ‘machine-readable digital data, which can then be subjected to sophisticated forms of processing, calculation, analysis, interpretation, visualisation and circulation’ (Williamson 2018, xv).

An ethnographic approach was adopted to explore how edtech organisations working at describe their own approach to digital data. This paper emerges from a study in which open-ended, ethnographic interviews were conducted with twelve stakeholders in data-based educational technology for schools (K-12) in the USA in 2017, including CEOs and CTOs of successful start-ups, managers at major educational publishing houses (now rebranded as ‘learning companies’), and advocates for a better understanding and use of student data. The goal of this paper is not a systematic typology of different data practices, but an in-depth look at three ‘rich points’. Rich points, drawing on Agar (2006), are those moments which surprise, confuse or intrigue the ethnographer. As noted above, previous studies have observed the cynicism and market orientation of edtech providers. A similar stance was observed among some interviewees (see Macgilchrist 2017). Rich points emerged as it became clear that three interviewees’ references to pedagogical care, ethics and equity were *not* being made as tokenistic gestures.

However, the goal of this paper is also not to identify straightforward ‘good practices’ among educational technology providers. Instead, taking an ethnographic sensibility means assuming that data practices will be ‘messy’ (Lather 2010). The goal is to identify tensions which point to broader issues in contemporary society; to complexify understandings of data practices and the potential effects of datafication by taking a close look at specific cases and engaging with the stories told by the people involved. Although, for instance, digital data ‘*can*’ be subjected to sophisticated forms of processing, etc (as Williamson 2018 writes), in practice, the use of data is often relatively *unsophisticated* (Selwyn 2016). The descriptive question for this paper is thus how these individuals express a commitment to ethics and equity. The analytical question is how this complexifies our understanding of the hopes pinned on technology to enable educational equity.

To analyse the interviews, the concept of ‘cruel optimism’ became relevant. Berlant describes ‘cruel optimism’ as those moments in which something we desire is actually hindering our ability to attain it (Berlant 2011, 1): *Optimistic* is the animating, sustaining, energising belief in ‘the good life’, and in the struggles and change required to reach this good life: in the case of educational technology, the good life would be the equity and social justice enabled through the use of digital technology. This optimism is *cruel* when it is tied to fraying fantasies of the good life, e.g., when people remain attached to the fantasies of romantic love, upward mobility or the solidarity of political systems despite their fragility (Berlant 2011, 21).

Berlant traces the conditions under which affective attachments to fantasies of the good life remain powerfully attractive, even as they block the satisfactions they seem to offer to individuals and collectives (2011, 13). Cruel optimism is a concept for thinking about the ‘chaos of the present moment’ (2011, 260) of ordinary lives ‘disorganized’ by capitalism in its many contemporary

enactments (2011, 8) but when catch-all concepts like ‘neoliberalism’ do not offer enough complexity, nuance or ambivalence (for analyses of cruel optimism in education, see, e.g., Moore and Clarke 2016; Rasmussen 2013; Zembylas 2016).

The following section presents three data stories to illustrate three enactments of cruel optimism in educational data practices: (i) *generating data* to close the achievement gap, (ii) *protecting data* to ensure privacy, and (iii) *using data* to expose inequity. The conclusion reflects on what these stories mean for education in the current phase of edu-technical transformation.

Data stories

Data story 1: generating data to close the achievement gap

The first data story concerns a for-profit data-driven literacy platform. It describes itself as being built around collaborative and self-paced learning, enabling teachers to truly personalize instruction for individuals and small groups; lessons are differentiated for each learner’s readiness level so teachers can challenge and inspire students with “just right” tasks and texts.¹ The website cites several independent reports and case studies from schools which demonstrate that students using the platform outperformed students using other literacy approaches: The platform helped students achieve ‘an extra year’s worth of growth’ in one school year, achieve 1.5–2.5 average years of grade-level growth compared to NWEA² grade-level norms, and gain over 6 test-score points above the control group on a standardised test. This latter finding is presented as the equivalent of closing the ‘achievement growth gap’ by: almost 300% for low-income students, over 450% for Black students and over 700% for Hispanic students.

During an interview, the CEO, Nancy (pseudonym), a former teacher and then Director of Curriculum and Instruction for approx. 115 schools, refers not to the ‘achievement gap’ but to the ‘opportunity gap’.

B: But the most innovative things are still those very tactical things. Like a teacher being able to give feedback during class time. Most English teachers have never done that because it’s really hard to do. Because you’ve got all these little munchkins running around. You know? So/

I: Yeah. But it’s something that’s always wanted?

B: But it has tremendous outcomes on the other hand. It’s the number one way to close the opportunity gap is to give rapid feedback. It’s the number one thing we can do. Doing it during class time is the only way we can actually do it. But it’s literally never conceived of as a thing you should be doing during your class time. (interview 2017-03-28_US06_83).

Nancy prioritises pedagogical practices which provide opportunities. Core practices for fostering student success are everyday tactical innovations like giving rapid feedback during class time. This practice is integrated into the platform’s design: The colour-coded data dashboard gives teachers a quick overview. It makes grading faster by automating the reading assessment and by giving a standards-aligned rubric for teachers to assess writing within the platform so that students see the feedback within the class.

Asked how the platform uses data about individual students, Nancy responds: ‘I think that that picture not only of what performance levels you’ve attained, but your growth over time and quite honestly the topics you’ve been exposed to, that’s the real richness’ (interview 2017-03-28_US06_49):

Because, you know, if I said to you what’s a main idea, you would be able to tell me the definition as an educated person. If I asked you to read a paragraph on baroque music, you would be able to tell me the main idea of that paragraph. If you know nothing about baroque music you won’t be able to tell me what you’ve read. You’ll be able to point out the feature that was the main idea, that would be clear to you. But what those words mean, you may or may not understand. And that’s where topical knowledge is actually one of the things that is very uneven. Our assessments [in the USA] are supposed to be generic, but they’re not. [...] If you’re a student who just got here from Mexico and never heard of the Civil War, it doesn’t mean you can’t read, it doesn’t mean you can’t think. It means you’ve never heard of Abraham Lincoln, you have no idea who the Confederates

are. You don't know who won, you don't know/ Like it's just, it's lack of exposure to actual content knowledge that is usually the biggest source of inequity in knowledge. (Interview 2017-03-28_US06_49-51)

Since assessments in the USA assume a shared nationally specific knowledge base, this content plays a large role in 'inequity in knowledge'. The platform aims to teach students how to identify a text's 'main idea' even if they have not been exposed to the topic, and it aims to expose students to the central topics that are likely to be assessed. In this way, it aims to support students who are often marginalised by the school system to achieve as well as their mainstreamed peers. Overall, by offering tools to enact tactical innovations, the platform is designed to function as a 'scaled-up' version of continuous professional development (CPD) for the teachers who use it (interview 2017-03-28_US06_5).

Reflection 1: the cruel optimism of generating data to close the achievement gap

The optimism seems clear here: the numeric data generated through empirical research show the benefit of using this literacy platform, especially for disadvantaged students; data dashboards support teachers; individual students engage with assessment-relevant content knowledge. The optimism becomes 'cruel' when it involves attachment to the belief that closing an 'achievement gap', and equalising or levelling the school system, will lead to greater equality across society.

Understanding 'educational equity' as closing the gap on test achievements among subgroups of students (generally minority and nonminority students) has been sharply critiqued by a range of scholars (Carter and Welner 2013; Ladson-Billings 2006; Milner 2013; Noguera and Rios 2012). The metaphor of the achievement gap is often associated with a discourse of individual or community deficit, since it presupposes that it is the student who achieves or does not. The metaphor 'disguises the accumulation of societal and educational exclusions of and prejudices toward historically marginalized students, their families, and their communities that leads to the so-called gaps' (Scheurich et al. 2017, 508f.).

Nancy does not reproduce this deficit discourse. Although the website taps into the discourse of closing the 'achievement growth gap', she consistently refers to opportunities and the 'opportunity gap' (interview 2017-03-28_US06_31, 55, 85). This concept shifts attention from educational outputs (performance) to inputs (resources). It shifts responsibility from the individual to the structural opportunities made available to students who have historically been excluded or disadvantaged by the school system. Nancy prioritises several systemic 'gaps' which undergird differences in individual test achievement: She talks about teacher quality, teacher training and a challenging curriculum (see Irvine 2010, xii, cited in Scheurich et al. 2017). These factors are internal to the educational system. However, further entrenched inequalities arguably remain outwith the remit of any edtech company: 'the school funding gap; [...] the wealth and income gap; the employment opportunity gap; the affordable housing gap; the health care gap; the nutrition gap; the school integration gap; and the quality childcare gap' (ibid.).

A relation of cruel optimism appears in the fantasies projected onto personalised learning technologies like this literacy platform. Governments, philanthropists and parents worldwide are channelling hopes and finances into hardware and software which aim to redress the achievement gap. Advocates for a more effective use of educational data aim to give policymakers 'the evidence they need to direct scarce resources in ways that truly work for students' (Data Quality Campaign 2017). When enthusiasm for data-driven technology focuses attention on unachievable fantasies of an equitable good life within contemporary regimes of capital, it diverts attention from other ethical, social, political and economic questions about contemporary education (Rasmussen 2013). Instead, the fantasy of equality is projected onto socio-technical mediators that enable minor interruptions in unjust practices but arguably disable major political or economic transformation (Berlant 2011, 25).

Data story 2: protecting data to ensure privacy

The second data story draws from an interview with Amelia (pseudonym), the CEO of a not-for-profit learning platform for mathematics. It describes itself as a comprehensive curriculum for maths, designed to cover the whole school year, replacing the textbook.

I asked whether parents of teachers have raised privacy concerns, given the amount of data required to personalise the individual digital lessons and give teachers an overview of students' learning. The question was met with a passionate response highlighting ethics and values.

So, you know, I'm a mom, and, you know, I think about if there was like some app out there collecting information on my children, I would find the server firm and burn it to the ground. So, like, I think the people who are vigilantly protecting children and focused on potentially crazy views on data, I largely agree with them. Right? So, I'm coming with that mind-set of do not touch children's data. Do not profile children. I mean selling children's information is like revolting to consider. But even developing a full profile of an actual child where you can attribute any personal information to that child is/ that's revolting to think about. So I start there, which is that I agree with what might be the kind of left-wing nut jobs who don't want student data pulled together. My head of product lab also agrees. So, she and I just start with that mind-set. (Interview 2017-04-07_US10_79)

Later in the interview as we continued to speak about data and privacy, she critiques her peers in the edtech community who 'whine' about the challenges of encoding privacy into the technology. For her, 'this whole contortion people make around student data privacy interfering with edtech is like just total bullshit' (interview 2017-04-07_US10_85).

That would be like a toy manufacturer being like, "It's so hard not to put chemicals on these toys that we make. This is so hard! We're so upset about these rules." That's disgusting, that's a disgusting mind-set. Your mind-set should be, "My own baby could put this in their mouth. And so I will do my absolute best with like the best intentions in my heart to make this safe." And that is a value, right? (Interview 2017-04-07_US10_87)

The language and specificity here break with the smooth responses of some other interviews, where the interviewees assured me that they of course take data privacy very seriously, and then swiftly moved on to other topics or waited for the next question. Amelia's responses indicates a level of annoyance with this debate (and perhaps with the interviewer's naïve questions) that speaks to a deep commitment to protecting the data generated by the platform to ensure the young users' privacy.

This ethical commitment translates into the company's business, technical and legal practices. Amelia emphasises several times that complying with legislation and safeguarding data is simply 'the cost of doing business with children' (interview 2017-04-07_US10_85). Her company has no problem showing academic outcomes and personalising learning 'but it is much more tricky and complex'. Problems require more complex solutions, partnering with apps is more complex. 'And we just take that complexity as a cost of doing business' (interview 2017-04-07_US10_85). 'We just take a lot of extra steps. We spend money and effort and we take a lot of extra steps' (interview 2017-04-07_US10_89). The task of edtech companies is, in her view, to take this cost and 'lead on it' (interview 2017-04-07_US10_85).

Leading on it means engaging with the legislation. In other interviews I had heard about instances of company lawyers negotiating with schools or districts to make clear that a data privacy agreement would hinder their ability to work. Occasionally, the lawyers manage to effect changes to the agreements to make them more workable (interview 2017-03-17_US01_102). Amelia agreed with these other interviewees that many current privacy laws are not practicable but distanced herself from this practice.

So, we have no interest in like skirting student data, doing the bare minimum, pushing the laws, framing them/ Like a lot of laws make no sense. And clearly the people who wrote them have never even looked at an Excel database. And so what you're sharing when people talk about, "Well, we need to baselines to figure out gains and we need to profile to be able to personalize," that's fair. And a lot of this, a lot of the laws kind of don't make sense. But the thing that we put on top of that is that's fine that the laws don't make sense, but like actually, we

agree with where they're trying to get to. Their ultimate goal is dead right. So, basically, we do back bends to follow it and to lead on it. (Interview 2017-04-07_US10_79)

Key to this data story are ownership rights. 'So, here's the big idea, here's the most important idea: We don't own that data. It's not ours. It belongs to the school' (interview 2017-04-07_US10_97). Almost two million students were using the product at the time of the interview. Apart from the case studies on the website, the company releases no information about the schools, districts or states that they are working with (interview 2017-04-07_US10_83). Amelia tells me of funders who say things like: 'Hey we're interested in Michigan. Will you send us all the schools that use your product in Michigan?'. And this edtech provider will say no (interview 2017-04-07_US10_83).

This also means schools maintain control over the future of the data. If a school asks them to delete the entire account, the company will check back: We do a hard delete, nothing will be retrievable, please confirm before we proceed. And if the school confirms, Amelia considers this their 'business obligation' to delete the data. Compare this, she says, to a credit card company, which will certainly not delete your data if you cancel your credit card, because the company owns the data, not the customer. In this sense, and while acknowledging its flaws, she praises the Californian SOPIPA legislation because the 'most important' thing now is moving forward towards school-centred ownership (interview 2017-04-07_US10_10).

Leading on privacy also includes finding technical solutions. Asked about whether certain things are not possible if privacy is engineered into the software in a serious way, which is a view I had heard in previous interviews, she answers, 'I mean you can do anything, right? So, I think it's all about doing things smartly' (interview 2017-04-07_US10_97). She describes, for instance, how they double-blind anonymise the data so that even she herself cannot find the names of individual students. And she disputes those in the edtech field who claim that student data privacy interferes with learning: These are not 'real' scenarios. It does increase the complexity, but: 'If you're really trying to solve that problem, you can solve it' (interview 2017-04-07_US10_99).

Reflection 2: the cruel optimism of protecting data to ensure privacy

Four dimensions of society's optimism meet in this data story. First, that values can be translated into ethical socio-technical practice. Second, that other edtech providers (including for-profit firms) can also see data privacy as a cost of business. Third, that legislation is moving forward in the right direction, and can safeguard future data practices. Finally, that technical solutions can be found to data-relevant problems. These four together should ensure that the student data generated through edtech are not exploited, that education remains a public good, and that students are not treated primarily as revenue-generating data servants. This optimism becomes cruel precisely because of the sense of possibility it creates for the wider world: that student data not be exploited, and young people not seen as sources of profitable data.

In this story, the school, where young people spend much of their waking lives, is a protected space. However, young people also live, first, within the everyday *commercial* space of global technology firms whose revenue stems primarily from the legitimated exploitation of user data for advertising. They live, second, within the *political* space of illicit data-mining and data analysis, flagged by, for instance, the Cambridge Analytica case in which a political consulting firm used profile data from 50 million Facebook users to target users with political campaign messages during the 2016 presidential election in the USA. And, third, young people attend schools within an *educational policy space* in which 'digital redlining' limits their opportunities to participate actively in public life (Gilliard and Culik 2016).

An optimism which focuses on the use of technology in classrooms, or in schools, neglects how these broader spaces in which public education unfolds are intimately interwoven with technology. This optimism hints at a new dimension of post-democracy (Crouch 2004; Stalder 2015). Crouch

(2004) argued that professional politicians, business elites and capitalist economic interests are now making decisions behind closed doors that were previously made with the active participation of ordinary people. The content of history curricula and textbooks, for instance, has been a frequent site of public debate and political contestation (Fuchs and Bock 2018). Today, alongside the political and business elite, the technological elite also increasingly makes decisions that shape public life. In education, no matter how good the motives, and how pedagogically well-founded the decisions, it is a post-democratic moment when the ability to make these decisions has shifted from publicly accountable government officials, policy-makers or educators, to developers, programmers, designers and other staff in private edtech organisations.³

As I noted above, this is not to criticise the not-for-profit company which designs a far better and more just privacy policy, embedded in a thoughtful pedagogical approach, than many other technology providers. It is, however, to reflect on the cruelty of society's optimism that focussing attention on protecting young people's data (in schools) can repair or resist the commercially-oriented 'datavaillance' (Clarke 1988) in their everyday data-saturated lives. In this data story, ethical data policy and practice may help us survive the constant monitoring of our lives through mainstream technology. Amelia's passion for privacy marks a respite offered in this educational space; but it also unfolds within a broader sociotechnical move towards post-democracy (see Berlant 2011, 117, 122; Stalder 2015).

Data story 3: using data to expose inequity

The third data story begins with the ethical challenges of data practices which are not illegal but seem inappropriate. Sena (pseudonym), a staff member of a national non-profit organisation which advocates for effective data use, said that in these situations, her organisation tries to 'get people more involved in decision-making and understanding why data is being used for different purposes' (interview 2017-03-21_US03_156). The goal is for people to be more informed, to appreciate the uses that benefit them, and to have a platform to disagree with those uses that seem detrimental. When I ask who tends to get involved in these discussions, assuming it may be higher income families who have more time and financial resources to spare, she replies:

Sometimes the biggest champions are actually lower income families, because they know that they've been receiving inequitable educational opportunities. So they can/ If they are sure that the data's being used appropriately, not to sort of punish their child, but/ they can often be real champions. Because they see it as a way to expose inequities. (Interview 2017-03-21_US03_158)

To my question about whether data are actually being used to address entrenched inequalities, Sena says 'Hopefully': She sees good data practices being developed at state level that uncover inequities, but there are few systems in place that lead to significant changes in situated practice. In one example she mentions, the school system in Washington, D.C., analysed its data to create an equity report card for each school. They found that schools were giving harsher discipline to African American students than to white students. Those in charge looked at the data, formed a task force and are working to make a change. 'But', she added, 'that's more of an outlier than it hopefully will be' (interview 2017-03-21_US03_162). Reacting to my comment that 'there could be a lot of use of data for that [sort of change], but it has to be pushed by somebody, right?', she reflected:

Yeah. Yeah, it's always hard when the data shows something bad or difficult. That's where it's really hard to take action. Because/ And I think that's why sometimes people are hesitant to use data, because if you don't see something, it's not a problem. But once you see it, you might have to do something about it. (Interview 2017-03-21_US03_170)

In this data story, people hesitate to use data, not because it is *impossible* to address structural inequalities, but because it is *too* possible, albeit incredibly difficult, to take action.

Reflection 3: the cruel optimism of using data to expose inequity

In this data story, the visibility of data has an ontological function: it brings problems into existence. As Žižek (2014) argues in another context, we ‘didn’t really learn anything from WikiLeaks we didn’t already presume to be true – but it is one thing to know it in general and another to get concrete data’. The data make something a problem that requires action. They become toxic (Berlant 2011, 24). Optimistic is the belief that data can be used to expose inequality and bring about change. The story identifies ‘forms of data, data tools and data techniques’ that are being used ‘to possibly empower otherwise subordinated groups’ (Selwyn 2016, 66). But this optimism can seem cruel when the responsibility is placed on ‘otherwise subordinated groups’ or individuals to do the exposing.

It is widely recognised that some students are treated more harshly than others. The apparent objectivity and indisputability of quantification now produces inequality and racism as problems for observers and stakeholders who did not previously feel an obligation to act (see Prinsloo and Slade 2017). At the same time, these are human stories. It takes families or individuals in government offices to use data in ways which expose inequalities. This equality aspect of rendering data actionable is not encoded into the software. Human decision-making is overlaid on the machine-readable data. Using data becomes an act that ‘create[s] new modes of sense perception and induce[s] novel forms of political subjectivity’ (Rancière 2004, 9; see also Williamson 2015).

In this data story, using data to expose inequity extends participation in the governing of education. Families are armed with politicised data visualisations of their experience of inequitable educational opportunities. However, this individualises the responsibility to become informed and expose injustice. Given the volumes of investor capital that flow towards the design and implementation of data technologies compared to the resources for interventions – even those that are only amelioratory – at ground level, this becomes a relation of cruel optimism. The visibility of data implies an obligation for officials to act. It operates as a technology of subjectivation of individual actors, creating activist citizens. But it also establishes new norms (of individual responsibility) against which parents or staff can evaluate themselves, and potentially find themselves failing, worn out and frustrated.

Concluding thoughts

Overall, the paper aimed to illustrate the workings of optimistic attachments in education, as the ‘sustaining inclination to return to the scene of the fantasy that enables you to think that *this* time, nearness to *this* thing, will help you or a world to become different in just the right way’ (Berlant 2011, 2, italics in original). The data stories point to the constitutive paradoxes of education which are ‘sticky’ and cannot be cleaned away. The stories of generating data, protecting data and using data show hope for change. They also show how the fantasy of equality is projected onto a socio-technical mediator (a personalised literacy platform, data privacy practices, an active parent armed with data visualisations) which enables a small interruption in inequality, but also blocks attention to the weakening of the fantasy of an equitable life in today’s increasingly post-democratic world.

The three stories reflect on the relations of cruel optimism across education today. The stories highlight a selection of actors that are not only paying lip service to goals of equality, justice, participation. At the same time, their optimism for a better future through edu-technical interventions (whether for-profit or non-profit) is intimately entangled with today’s predominant global economic structure. The optimism is shared by many of those making policy decisions on what to fund, who to support, which kinds of data infrastructures, technologies and practices to push forward. When hardware and software are being financed as the means to close the achievement gap, protect privacy and expose inequalities, this often passionate attachment to technological solutions blocks interventions in historically rooted, structural inequalities.

But at the same time, these stories highlight spaces in which pedagogical relationships, care and solidarity *are* made more relevant than in many other spaces dominated by data technologies. The belief that education (or edtech) can change socio-economic inequalities is an ‘animating, sustaining fantasy’, indicative of the ‘exhausting pragmatics’ of the messy, hyperconnected, always-on world of today (Berlant 2011, 261). Even if justice is impossible through education (see Rasmussen 2013), a cruelly optimistic education which values equality as a utopian goal makes school more bearable for its users than educational technology that place profitability before all other values. This suggests that optimism is necessary to survive the impasse of educating in the world today, even if it cannot fix the problems of inequality. The concept of ‘cruel optimism’ helps us – at least, that is the optimism of this article – to think about the fragile fantasies involved in ‘thinking otherwise’ about the datafied present, while also remembering that cruel optimism ‘is better than no optimism at all’ (Berlant 2011, 16).

Notes

1. To retain the relative anonymity of the interviewees, the sources of descriptions are not provided. All information is from the websites and/or interviews conducted in 2017.
2. This refers to standardised assessment tools available from the not-for-profit organisation NWEA.
3. Projects such as the Schulbuch-O-Mat propose open source alternatives which prioritise public participation, collective deliberation and community control over the algorithms for adaptive processes (www.schulbuch-o-mat.de).

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