

Chapter 22

Data Literacy and Citizenship: Understanding ‘Big Data’ to Boost Teaching and Learning in Science and Mathematics

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ABSTRACT

This chapter explores the challenges that emerge from a narrow understanding of the principles underpinning Big data, framed in the context of the teaching and learning of Science and Mathematics. This study considers the materiality of computerised data and examines how notions of data access, data sampling, data sense-making and data collection are nowadays contested by datafied public and private bodies, hindering the capacity of citizens to effectively understand and make better use of the data they generate or engage with. The study offers insights from secondary and documentary research and its results suggest that understanding data in less constraining terms, namely: a) as capable of secondary agency, b) as the vital fluid of societal institutions, c) as gathered or accessed by new data brokers and through new technologies and techniques, and d) as mediated by the constant interplay between public and corporate spheres and philosophies, could greatly enhance the teaching and learning of Science and Mathematics in the framework of current efforts to advance data literacy.

INTRODUCTION

Notorious events such as the Flash Crash of 2:45 (Treanor, 2015) or Facebook’s secret behavioural experiment on users (Meyer, 2014) have stirred global outcry. The first one, a 2010 stock market crash triggered by computerised algorithms, caused the largest intraday point decline in the entire history of the Dow Jones in a matter of minutes. The second one took place in 2012 and involved the manipulation of 689,003 users’ feeds by ranking algorithms for a week without any kind of user consent. Unprecedentedly, both events led to two realisations: firstly, our knowledge of the obscure data technologies and agents mediating our everyday life is limited. And secondly, we are powerless in holding datafied bodies and technologies to account for this kind of actions.

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As algorithms use data to make vital decisions about our lives in a domain free of public or civic scrutiny, practices such as surveillance, biometrics, automation, consumer profiling, algorithmic predictability, and machine learning tend to agitate public opinion. Simultaneously, in a dynamic indistinguishable to the public eye, mediated discourses of innovation extol Big data's messianic virtues as the cure to all societal illnesses, framing it as the ultimate panacea. Whilst reports on the marvels and failures of Big data populate the mainstream news agenda, citizens appear to be inadequately equipped to engage on equal terms with governments and corporations in the construction of a reality increasingly modelled by informational data. As numeracy tends to be rather limited across the board, a growing need for citizens to be able to understand the dynamics underpinning data is generally unfulfilled. Paradoxically, the idea of citizen empowerment through the use of ICTs remains a key objective in the era of Big data, primarily driven by expectations that new technologies and platforms will facilitate more responsive governments and provide people with access to information that will engender economic growth as well as creative and social fulfilment, especially after the launch of the Open Data Charter at the G8 summit in 2013.

Despite the efforts of the G8 governments to open up their data stores for public scrutiny, the techniques and strategies used to filter databases and datasets, identify and isolate noteworthy information from numerical data, and translate mathematical abstractions into insight that informs and reinforces decisions at the different levels of society, remain generally excluded from the education system. The teaching of Science and Mathematics appears to favour instrumental aspects of the discipline (Chevallard, 2013) to the detriment of the critical and fundamental approaches to Big data that are essential for the integral education of individuals living in this increasingly data-centric society.

This chapter thus aims to make a contribution to existing debates surrounding Science and Mathematics education by highlighting a set of challenges that emerge when Big data is not properly contextualised in the delivery of educational strategies for the enhancement of data literacy. In this vein, this study considers firstly the materiality of computerised data to examine its implications for data literacy. And secondly, it examines how notions of data access, data sampling, data sense-making and data collection are nowadays intermediated or contested by datafied governments and corporations, hindering the capacity of citizens to effectively understand and make better use of the data they generate or engage with. This article contributes to ongoing discussions on data literacy (Schield, 2004; Mandinach & Gummer, 2013; Stephenson & Schifter Caravello, 2007; Hunt, 2004; Qin & D'Ignazio, 2010; and Jacobs et al, 2009) and big/open data and algorithms as culture (Manovich, 2001; Pavlik, 2001; Howard, 2012; Hayles, 2012; boyd & Crawford, 2012; Mayer-Schonberger & Cukier, 2013; Manovich, 2013; O'Reilly, 2013; Crawford et al., 2014; Kitchin, 2014; Puschmann & Burgess, 2014; Struijs et al., 2014) in order to explore how data literacy is mediated by notions of Big data.

Quantifying the World

The superabundance of data in contemporary developed societies has produced a pressing necessity to understand the intricacies of Big data and harness its potential. boyd and Crawford (2012) remark that current efforts to conceptualise this socio-technical phenomenon elicit both utopic and dystopic rhetoric, whereby Big data is either constructed as a powerful solution to many societal issues, or a neoliberal force which threatens to constrain civic freedom by reducing citizens' right to privacy. More seriously, explain the authors, "the currents of hope and fear often obscure the more nuanced and subtle shifts that are underway" (boyd and Crawford, p. 663-4). With the salient emergence of Big data, the different social actors responsible for the categorisation of reality and the institution of knowledge have had

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