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Chapter 18

Blurring boundaries: Exploring the potential for 'big data' to address inequalities in lifewide learning engagement

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Abstract

This chapter explores inequalities in the modern urban 'learning city' of Glasgow, specifically assessing inclusion in lifelong learning activities and 'lifewide literacy' engagement. We define the context, the definitions of lifelong learning and lifewide literacies within the framework of UNESCO's Learning City model, alongside social theories of educational inclusion and participation. We then offer a case study of how existing accessible 'open' data can be used to inform, explore and improve learning engagement in increasingly complex, demanding and evolving urban contexts. In this sense, the chapter seeks to blur methodological boundaries, as well as widen notions of literacy and lifelong learning engagement, thereby offering a holistic view of learning engagement in a modern UK context.

[H1]Context

Despite longstanding worldwide government initiatives to support and promote inclusion into post-compulsory education, inequalities persist in access, retention, attainment and subsequent economic outcomes (Schofer and Meyer 2005; Varghese and Püttmann 2011; Osborne, Rimmer and Houston 2015) and continue to be of primary political concern in the UK. As recently as 2016, the Social Mobility Advisory Group of Universities UK has reported that 'socio-economic disadvantage continues to be the most significant driver of inequality in terms of access to and outcomes from higher education' (UUK 2016, p. 4). In particular, 'eighteen year-olds from the most advantaged groups remain 2.4 times more likely to enter university than their disadvantaged peers, and 6.3 times more likely to attend one of the most selective institutions in the UK' (ibid.). Those from lower socio-economic status backgrounds are less likely to acquire professional jobs, of equivalent salaries, even when entering skilled employment after University (ibid.).

Therefore, this chapter explores an example of urban educational inclusion in the UK, of Glasgow in Scotland, where the government echoes a global issue that 'current approaches to widening access to higher education in universities have not produced the step change in participation that we would have liked' (Scottish Government 2011, p. 13). This statement concurs with wider international resonances concerning equity issues in the sector (see for example, Asian Development Bank 2012). In this chapter, we consider the range of work in tackling educational inequalities, not just within formal learning settings, but also those that capture the range of informal learning engagements as individuals interact with the city and its learning resources. We introduce the concept of 'big data' within a learning city framework and present a case study (integrated Multimedia City Data, iMCD) project as an illustration of the ways in which more diverse technologies, big open datasets and novel visualisations can offer higher education institutions novel approaches to inform the design and delivery of effective educational inclusion interventions, specific to regional environs and marginalised groups. We offer this chapter in an attempt to blur the lines between formal higher education institutions offering classroom-based learning to community-facing, publicly engaged facilitators of knowledge **and** data co-created with citizens. Whilst doing this, we also blur boundaries regarding methodologies for assessing learning engagement across all forms of learning, highlighting the less formal modes of

learning with which universities engage. We conclude by calling for more novel methods to better capture the role of higher education institutions in learning cities, societies and regions.

We begin by exploring the concept of UNESCO's 'Learning City', particularly its emphasis on inclusion in lifelong learning. In particular, we embed our discussions with reference to specific 'lifewide literacies', and how these may be potentially operationalised for measurement and onward comparison purposes. Secondly, we approach definitions of big data and novel methodology. Thirdly, we present the iMCD project as case study of how higher education institutions can better explore educational inclusion for marginalised groups from a position of 'open data' usage. Finally, we illustrate impact upon citizens within their cities through engagement in meaningful discourses around lifelong and lifewide learning, thus closing the research feedback loop. Thus, we offer Glasgow as a case study for how 'open' data can be used to inform, explore and improve learning engagement in modern urban contexts. Data, big data, and open data are terms which have been firmly aligned within wider discourses of empirical, evidence-based research, particularly in educational inclusion. Ultimately, we present innovations and associated challenges in using big and novel data in a mixed-methods context, to explore educational inclusion in the city using the framework of a learning city, arguing the case for universities to be a full and active player in such a framework.

[H1] Learning Cities and lifewide learning engagement

The concept of 'Learning City/Region' provides a framework for placing higher education institutions within place and purpose. Interestingly, we recognised that within this framework higher education institutions are not positioned as stand-alone providers of valued and trusted knowledge. Instead, they are defined in terms of their potential to promote and support novel, cross-disciplinary methods to address both local and global challenges with a variety of stakeholders. Longworth (2006) and Longworth and Osborne (2010) provide a historical and political overview of learning regions, societies and cities, and how these concepts have developed in many countries to become cornerstones of lifelong policy. The concept of a learning society was originally conceptualised as the necessity to create conditions to promote continuous learning, including into and beyond formal education systems (Hutchins 1968). It has become a contested idea not least since it has been interpreted by critics as a tool for governments and inter-governmental agencies, such as the OECD, to invoke continuous lifelong learning as a necessity rather than a choice to ensure individual competitiveness in the knowledge society (see Husén 1986, Edwards 1997 and Ranson 1998, amongst others). This perhaps is well illustrated in an influential OECD (2001) report, which considers how individual and organisational learning contribute to regional development. Although the social dimension is currently most prominent, such an economic imperative remains core within ideas of the learning city (or region) and can be traced back to early proponents such as Florida (1995) and Anheim (2012) who focused not only on individual learning, but also on learning within and between organisations based on regionally-based networking. This, they argued, would lead to continuous innovation and competitiveness within a given place.

The current Global Learning Cities Network (GLCN) initiative on learning cities developed by the UNESCO's Institute for Lifelong Learning acknowledges the workplace, but provides a much wider definition of a UNESCO Learning City as one which:

promotes inclusive learning (from 'basic' to higher education); re-vitalises learning in families and communities; facilitates learning for and in the workplace; extends the use of modern learning technologies; and fosters a culture of learning throughout life. (UNESCO 2013, p. 2-3)

Osborne (2014) further addresses the importance of lifelong learning and the development of 'Learning City' agenda at both the national and international level, and equally for social and economic benefits of citizens and their nations. Osborne adds that 'in order that such aspirations are achieved, it is cities themselves who should take the lead, and exchange their practices, working alongside their stakeholders and academics' (2014, p. 1075). However, at the heart of any learning city movement is governmental and political will, most often occurring in times of economic prosperity, albeit perhaps most urgently needed in times of economic precarity.

The UNESCO model outlining key features of learning cities was created in Beijing in 2013 as a response to the need for objective criteria to define, and potentially evaluate, cities' successes. It embedded learning at the heart of urban success and argued that wider benefits of a Learning City are three-fold: 1) individual empowerment and social cohesion; 2) economic development; and 3) cultural prosperity and sustainable development. The Learning City indicators consist of 42 features in total, open to diverse methods of measurement, and at multiple levels (individual, city and national; see UNESCO 2013). For instance, UNESCO proposes that inclusion in learning could be measured using existing baseline statistics, drawn from local or national government data. We operationalized and measured many of these factors within the iMCD survey, as discussed later in this chapter.

It should be noted that UNESCO's objectives were not to make distinctions between cities, acknowledging that 'Each city is different and its progress towards a learning city can only be measured within the context of its own cultural, economic and social history and traditions' (UNESCO 2013, p. 5). Therefore, the key features of UNESCO Learning Cities in a lifelong learning context had not been specifically operationalised in terms of methods of measurement, allowing flexibility, autonomy and cultural ownership in the cities' self-evaluation. However, this inherent individualisation of the indicators has limited the potential of standardised knowledge exchange and international, cross-cultural comparisons. The Educational Disadvantage and Place team at the University of Glasgow seeks to address this gap and provide recommendations of how UNESCO Learning City metrics might provide much-needed evidence-based insights into societal challenges, such as attainment gaps in schools, higher education and lifelong learning engagement.

Higher education institutions play a key role in the development of a learning society and of the learning city – although in contemporary times, in the pursuit of global income, Universities have in some instances been posited to neglect their locality. Laurillard (1999) argued for an ideal learning society, where:

the university's role in society is precisely to learn and understand itself and its environment...The more it addresses the concerns of society in its research, and the more it widens access to all members of society to benefit from the fruits of the research, the more it supports a genuine 'learning society'. (Rotimi 2014, Section 3)

It is the learning city that can be the vehicle through which universities actualise their contribution to the development of the learning society, along with the ever-increasing pressure upon UK universities to be accountable for public money spent – by challenging them inter alia to widen participation and to demonstrate impact of their research.

What we see in the UK, and specifically in Scotland, in terms of equity in educational attainment is in many cases comparable throughout the world. In many countries, despite decades of intervention, the challenges seem intractable to close the attainment gap and engage the learning potential of all citizens, particularly as outcomes for some specific groups of learners have worsened. These include mature adult learners and those from areas of socio-economic deprivation, as well as other non-traditional learner groups (Moore, Sanders and Higham 2013; Stuart, Lido and Morgan 2011). Rasak (2015), President of the International Association of Universities, points out that to achieve the goals

of equitable access as promoted in the Incheon World Education Forum of 2015, we must consider the connectedness of all parts of the formal and non-formal education. He argues for a ‘lifewide’ perspective, which as the European Commission’s *Memorandum on Lifelong Learning* stated, ‘enriches the picture by drawing attention to the spread of learning, which can take place across the full range of our lives at any one stage in our lives’ (European Commission 2000, p. 8).

UNESCO (2004, p. 13) defines literacy as the ‘ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts’. It derives from learning in formal, non-formal and informal settings and may be self-directed. Lifewide learning acknowledges that much of our learning life happens outside a formal classroom setting. Core to the notion of Lifewide Literacies then, is not just skills or achievement, but active knowledge and competencies which enable citizens to participate fully within their society, enabling individuals to self-actualise their potential (ibid). The concept of the UNESCO’s Learning City gives functional literacy a spatial dimension, moving the conversation beyond a simplistic notion of reading or numeracy, and towards a model of full participation, empowerment of the individual (or citizen) rooted within place. We argue therefore that lifewide learning engagement and lifewide literacies may be seen as indicators for the ‘success’ of the learning city in terms of empowerment and participation of its population. But how can such engagement best be captured in modern urban environs?

To break this impasse apparently facing equitable access, we argue that more triangulated, multi-method, evidence-based research is needed to better understand the complexity of learner engagement across the lifespan, particularly with transitions into higher education, and beyond into lifewide learning. Such research needs to capture substantial factors beyond those contained within administrative datasets, and to explore what is not typically captured in conventional research through the integration of multi-modal data.

[H1]Research Context: Educational Disadvantage and Place Agenda @UBDC

The context of the worldwide reform of higher education institutions offers an opportunity to address the increasing emphasis on demonstrating social impact imposed by government funders of research. One such example at a national level is UK’s Global Challenges Research Fund, which seeks to harness the expertise of researchers to tackle the major issues faced by developing countries and in so doing strengthen local capability (Research Councils UK [RCUK] 2016). More widely, the European Commission (2014) has acknowledged that political steering of the research and innovation system has not delivered the expected rewards in the form of marketable or practicable innovations addressing large societal challenges, such as sustainability and health and well-being. They clearly assert ‘The grand societal challenges that lie before us will have a far better chance of being tackled if all societal stakeholders are fully engaged in the co-construction of innovative solutions, products and services’ (European Commission 2014, p. 2). Responsible Research and Innovation (RRI) thus refers to the capacity of the institution to work in networks with multiple, diverse actors providing solutions for the grand challenges. Our input contributes to debates concerning the role of higher education institutions and their partners in social inclusion (Benneworth 2013; Benneworth and Osborne 2014), and our approach encompasses the engagement of citizen-users in knowledge exchange. Such work fits well within frameworks for transparent ‘open science’, and the push to see behind the walls of academic research, with and in communities for more embedded higher education institutions.

One such initiative is the Urban Big Data Centre (UBDC),¹ offering an opportunity to frame and

¹ Located at The University of Glasgow, supported by the Economic and Social Research Council under Grant [number 651920/1]

form more collaborative efforts and engage a variety of stakeholders in utilising both new and existing data to respond to wide urban challenges. Launched in 2013, UBDC is a strategic investment to improve the use, and re-use, of existing data, in order to contribute to solutions for current social, economic, and environmental challenges faced by the cities. UBDC's mission is to improve urban citizens' lives and, unlike other centres, it has placed learning at the heart of this mission, working collaboratively with and within higher education institutions to engage non-academic partners in its interdisciplinary remit. It prioritises research on transport, housing, technology, civic and cultural participation and educational inclusion, and offers networking and training opportunities both within and across these domains. By opening the use of data to researchers and the public, supported through its own training for data usage and linkage, the centre offers users the opportunity to work with real-time, naturalistic data, bypassing the need for costly and often unnecessary primary data collection.

Considering international agendas on widening participation in all forms of learning, the Educational Place and Disadvantage team at UBDC was formed to conduct mixed-methods, multi-level research into educational transitions, exploring age and place-based differences in participation in all forms of learning in the Greater Glasgow area. Participation in lifelong and lifewide learning is associated with improved health and well-being, and our research suggests that as well as social mobility, physical 'spatial' mobility plays a role in positive life outcomes, including degree of learning engagement (Geddes et al. 2010; Marmot Review 2010). Therefore, a better understanding of options to become more mobile through, for example, flexible and sustainable transport options, may be an important component of how we engage older learners (Lido et al. 2016). The team are in the process of amassing, linking and indexing (improving metadata for) a host of education-related datasets, for instance, related to secondary schools' exams and transition data, as well as further and higher education applications and educational outcomes, and finally on employment destinations.

An example of a quantitative exploration of educational disadvantage embedded within place in Glasgow, summarised by Mason (2018), utilizes secondary school data from 2006-7 to 2014-5 for the Greater Glasgow area, where we can look at period trends and cohort effects of pupils' personal characteristics, backgrounds, locational data (area deprivation, urban versus rural location, distance travelled to school, etc.) and school characteristics' impact on educational outcomes and subsequent educational and employment destinations. In this project, we have the opportunity to examine such effects simultaneously and over time using multivariate, multilevel statistical modelling methods. This project illustrates not only the usefulness of linking and visualising novel datasets to better address the attainment gap, but also the role of the university in exploring educational attainment embedded within place (areas of deprivation within the city, urban-rural local authorities), so that issues such as accessibility of schools and the relationship to transport services can better be examined. In such ways we can broaden the parameters used to understand the widening of access, particularly for those in the most deprived neighbourhoods.

We now offer definitions of what constitutes big data and novel methodology, and then present the iMCD project as case study of how higher education institutions can better explore educational inclusion, and gauge impact upon citizens within their cities through engaging them in meaningful discourses around lifelong and lifewide learning.

[H1]Big Data and Novel Methodological Approaches

Given UBDC's goals of addressing urban challenges, we have accessed innovative data collected using novel methods, to explore, for example, educational inclusion across diverse forms of learning, including learning leading up to further and higher education, and extending beyond into the full lifespan. Many educationalists rely primarily on qualitative, constructionist and/or phenomenological approaches, viewing quantitative approaches as an over-simplification of experiences in favour of

nomothetic ‘positivist’ focus on trends and outcomes (Panhwar, Ansari and Shah 2017). However, more recently, there have been calls at the policy level to utilise existing, rich research data resources more effectively and to critically inform the evidence base using ‘more objective’ indices relevant to adult inclusion and educational equality (Moore, Sanders and Higham 2013). We argue neither emphasis is suitable when attempting to ‘level the playing field’ of education and promote engagement in lifelong learning (formal and otherwise), as the picture is complex. This chapter instead calls for moving the discussion beyond that of whether or not to use quantitative or qualitative methods in exploring access to educational opportunity. We advocate greater use of existing data, whilst arguing for triangulating as many data sources as necessary to yield a more naturalistic and holistic approach to inclusion in learning. We acknowledge that these opportunities in making use of novel data methods, including greater use of open source data, GPS monitoring and visually derived data such as lifelogging methods, require recognition of potential ethical sensitivities including privacy issues. However, this synthesis of epistemologies allows the researcher to consider ‘big-data’ place-based factors, such as deprivation and neighbourhood characteristics, whilst also retaining opportunities to preserve individual, local and spatially relevant information which affects individual inclusion and participation.

Big Data usually refers to the vast amounts of information created and routinely stored by organisations. According to Lynch (2008), there are various ways in which data can be ‘big’. Therefore, there is no specific size or shape to such data, although such datasets are likely to be beyond the capacity of most traditional database systems to manage, and can require complex analytical approaches, inviting a range of methodological specialism. Most significant is the potential complexity of the data, particularly in its format, rapidity of development and change, and requirements for capture, standardisation, analysis and visualisation of patterns within the data. The true potential of Big Data approaches lies in the methods by which existing data (administrative and otherwise) can be harnessed through traditional databases (such as performance indicators in formal education, population and census data) and linked with technologically diverse sources of data such as social media, geographical ‘spatial’ mapping data and weather (see Lido et al. 2018 for review of diverse data resources at UBDC).

There is growing consensus that the concept of Big Data is best understood and applied when it is considered beyond its potential for quantitative power, and more for its explanatory effectiveness – namely: is it useful, reliable and valid for the question at hand? For instance, Big Data may be large numerically, or it may be beyond the capacity of existing database/management systems where it is housed, or both, or neither. Perhaps the most interesting aspect of Big Data is that it can be collected continuously in ‘real-time’; therefore, it will likely be complex, thus needing novel methodologies for capturing, analysing and visualising (Osborne and Lido 2015). The data may be numerical (e.g. large administrative data on benefits or student demographics), textual (e.g. tweets, news media) or pictorial (e.g. surveillance images, GPS trails). Interestingly, Big Data can display a combination of these properties due to the integration of mixed-methodologies at the design stage. Using UBDC’s data, we will now illustrate one example of this approach – the integrated Multimedia City Data Project (iMCD) and other Educational (and non-educational) archives it holds. We will discuss how these types of data reveal a multi-faceted picture of educational inclusion in the city, whilst acknowledging the limits and challenges of secondary data usage. The UBDC’s approach to addressing social challenges is perhaps best illustrated by the iMCD project (and associated data housed and hosted within their data archive), allowing higher education institutions to explore education-related datasets through novel methods, to blur the lines between formal and non-formal/ informal learning, engaging communities and citizens in co-created data/ knowledge exchange. Such an open science and knowledge sharing approach is perhaps a key role for higher education institutions that often represent the most diverse of knowledge producers within a Learning City framework.

[H1]Case study for big, novel, open data addressing educational inclusion: The integrated Multimedia City Data Project

UBDC's integrated Multimedia City Data (iMCD) project developed an open-use dataset accessible (by application) to academics, policy practitioners and the public alike. It offers an evidence base for addressing a range of urban challenges. The iMCD data is housed alongside other large publicly available datasets within UBDC's data archive and consists of four strands of data: 1) Large-scale, representative survey 'Understanding Glasgow' of 1500 households in the Greater Glasgow area; 2) GPS trails for one week's worth of travel; 3) 'Lifelogging' camera images of 48 hours of travels; and 4) 12-month large-scale social media capture (textual and visual, some geolocated within the city). The iMCD data complements other administrative data for the city, in domains that include education and a range of urban indicator data, as well as cycling app (STRAVA) and mobile phone data.

Exploring only a single strand of the iMCD data, the 'Understanding Glasgow' representative household survey (of every eligible adult in the household), we can see that it holds a host of usable data of interest to educationalists and social scientists more widely. This includes measuring attitudes, behaviours and literacies, operationalised as 'knowledge', in the domains of education, transport, sustainability, health, technology, and cultural and civic engagement, as well as a travel diary assessing adults' spatial patterns of travel activity and daily tasks. Developing a survey for 'open data use' by academic and non-academic stakeholders alike was a significant challenge. Although we designed the survey with specific research domains in mind, we did not adopt a traditional scientific model of research enquiry, which would be hypothesis-led or situated within a specific theoretical domain of knowledge. Instead, we sought to collect data that could be used by a variety of potential users, from academics to citizen hacktivists. Following widespread scoping and knowledge exchange activities with potential users and future stakeholders, we developed the survey iteratively, with a review of national survey questions (largely for the UK) in the domains of interest. Content validity was assessed by a team of eight subject matter experts from inter-disciplinary backgrounds. The draft survey content was compared against the 42 UNESCO (2013) features of Learning Cities to ensure we could link to key concepts for social inclusion and learning participation.

The survey collected a rich variety of demographic information including age, ethnicity, nationality and religion, as well as household demographic information such as children, housing and employment (full income and benefits information). The survey assessed learner engagement in the past (educational qualifications obtained) and present (within the last 12 months) across formal, non-formal and informal learning (in line with the European adult education surveys). In this way, we assessed those in formal programmes leading to formal qualifications, those with past formal qualifications, as well as those engaged in non-formal and informal learning environments within the last year. Thus, we sought to capture structured and organised learning undertaken outside the confines of the formal sector, as well as informal or 'self-initiated' learning, which typically is unstructured and a component of an individual's everyday learning, for instance learning in the pursuit of leisure or 'bettering oneself'.

In addition, we collected information on literacies, or informal competencies, through quiz-type knowledge questions and self-reported skills in specific scenarios. Barriers to participation and access to information regarding future learning opportunities were also assessed. Finally, general attitudes toward the value of education and learning, as well as satisfaction with local school systems were also gathered. We defined and operationalised the main lifewide literacy domains of interest, such as: financial literacy, political literacy, health literacy, data literacy, foreign language skills, numeracy (in everyday life), and Maths and English in the workplace. A detailed explanation of the full operationalisation of Learning City indicators is beyond the scope of this paper (see Lido et al. 2016). Every attempt was made to operationalise indicators with individual (survey) and city-level metrics. For instance, the 'Pediment' of the UNESCO (2013) model of a successful Learning City focuses on

the wider benefits of the modern learning city, with the first measurable set of indicators being associated with ‘individual empowerment and social cohesion’ of which adult literacy rates have been proposed as one of the possible components. One of the major ‘Building Blocks’ of the UNESCO model is enrolment rates in various stages of formal education. Through our work we were able to measure levels of lifewide literacy, as well as participation in all forms of education. We also captured voting, volunteering and other civic behaviours related to community activity, and included social mobility and social support, which are components of other building blocks of learning cities as suggested by UNESCO.

[H1]Situating our work back in ‘place’: Engaging the public

Our statistical work with the literacies above found that all ‘lifewide literacies’ we measured, including health literacy, correlated negatively with area deprivation of household (according to the Scottish Index of Multiple Deprivation rankings), as well as with proxy measures of household precarity. These measures included number of people divided by number of bedrooms, paid employment versus receipt of state benefits, and access to the internet, and all yielded negative literacy correlations (t-tests all $p < .05$). Precarity differences were also found, with higher lifewide literacies for those who were Scottish (versus non-Scottish), home-owners (versus those who rent or have other status) and/or employed (versus those seeking work or with a zero hours contract; t-tests all $p < .05$).

The research team decided that such findings, held by academics within an institutional setting and delivered solely via academic outputs (peer reviewed journals), would be of little benefit to those who needed to be included in the ‘literacies conversation’, in line with the Learning City Empowerment indicators. We therefore sought to reach out to precarious groups in order to use our data to support dialogue within families and between different citizens about the role of lifewide literacies in promoting engagement in city life. We focused on literacy ‘friendliness’ of various settings and built environments in which people work, live and play (a lifewide perspective) with the aim of supporting effective citizen conversations and, more ambitiously, community action, to address lifewide literacy inequalities, particularly in areas of deprivation and households facing precarity.

We secured further funding to engage members of the public focused on these statistical iMCD survey findings by creating touchable, interactive, colourful 3D models made using a Laser cutting and 3D printing techniques. After thorough engagement with two social enterprises specialising in design, Maklab and Creative Stirling, we were able to collaboratively develop public-facing objects in a way that aimed to promote meaningful, accessible dialogue with a range of audiences of all ages, at public events such as Glasgow Science Sunday and the Festival of Social Science event at IKEA. For a more detailed commentary about how we fused big data and design together for public consumption, please see Reid and Lido (2017).

The final objects created included a moving map of Glasgow, which visualised the relative mean scores of Health, Ecological and Financial literacies in eight Greater Glasgow local authorities. The second object was a digital and static quiz, with participants receiving a token for the correct answer. Finally, participants were invited to create their own literacy persona by attaching limbs to a central badge to represent the literacy skills they see as their strengths (e.g. reading/writing, maths, science, artistic/creative, cultural, digital, foreign language, and geo-literacy). At our first event (Glasgow Science Sunday), over 150 badges were created, coloured and taken away, and our second event at IKEA saw over 300 badges created (as part of the Economic and Social Research Council, Festival of Social Sciences).

Creating tangible objects to visualise inequalities in lifewide learning, and developing hands-on activities for the general public, gave us the opportunity to discuss the University of Glasgow, and within this discussion, the role of educational data, and how our research can better serve community

needs. We presented participants with GPS visualisations of men and women's physical mobility in the city centre, offering families the opportunity to win a school visit from our team, thus directly engaging with kids and learning practitioners about the role of lifewide literacies within early years' education. We were invited to share this work at a series of knowledge exchange awards and learning and teaching conferences. Our public engagement project has been picked up and promoted through various academic channels such as the Royal Society Edinburgh #LifeinData network, ESRC, and the British Psychological Society. We see our research and public engagement activities as symbiotic to the success and sustainability of educational research. We are confident that the public and practitioners who shared this experience with us are now better able to engage in family discussions surrounding educational inequalities in Glasgow and can embed some of these discussions in the context of lifewide domains including health, financial, environmental and digital literacies.

[H1]Sustainability in developing 'big data' educational strands

The iMCD project described above illustrates one way in which the University of Glasgow has engaged its community in responding to current citywide challenges. Not only through providing data resources, but also including community voices to inform survey design and data collection, to view educational engagement in the city from a 'bird's eye view'.

Our research focus continues to evolve and respond to the learning challenges faced by a wide range of learners. For instance, we have conducted research in exploring how older adults engage in formal, non-formal and informal learning, revealing that the Greater Glasgow population was less engaged than their younger age counterparts in Glasgow, as well as national UK and Scotland averages (Lido et al. 2016). Yet, those who do engage in any form of learning are more likely to be engaged also in online, cultural and civic activity, as well as being more physically mobile across the city, and across Scotland. Another example features work that we are undertaking in partnership with ESRC-funded Centre for Population Change, exploring Polish populations, both nationally and locally in Glasgow, revealing the ways in which this sub-population are more physically and socially mobile due to the precarity of their working lives. Such hyper-mobility affects ability to fully participate in learning (formally and informally), despite many individuals arriving in Scotland with prior qualifications. Such learning engagement is also linked to social belonging and relationship to one's area. Thus, our work explores educational access from a traditional 'widening access' educational inclusion lens, as well as the wider learning engagement advocated by lifelong and lifewide approaches. We must therefore continue to explore the continued marginalisation of older adults, as well as learners from areas of deprivation, from formal and non-formal learning opportunities in our cities. We must harness the drive from higher education institutions for greater community engagement and 'real-world' impact, as providing impetus to reverse the tide against older adult learner engagement, and the widening attainment gap.

These two pieces of work, exploring older adult and Polish migrant populations within the city of Glasgow, illustrate how 'big data' can assist higher education institutions in interpreting trends of engagement around their city, and develop programmes to bring learning to precarious and hyper-mobile populations, such as older adults and Eastern European migrant groups in Glasgow. Preliminary findings also reveal that lifewide literacies are indeed related to formal educational engagement in higher education institutions, and follow the same educational exclusion pattern of deprivation and precarity, such as benefits received, and housing tenure factors. We can see that lifewide literacies also follow the same pattern as the formal educational 'attainment gaps', indicating that less tangible, implicit forms of 'knowing' may play a role in educational participation, as well as successful life outcomes, such as general health and social inclusion. Thus, this data informs us that for certain demographic groups, it is those that are less physically and socially mobile (e.g. non-engaged older adults), who would most benefit from outreach/ community-engagement from higher education

institutions. However, there is complexity in this data-driven picture of mobility, where other populations that are more physically and socially mobile are in fact less likely to engage (e.g. Polish migrant groups with precarious work situations), and therefore might benefit from more flexible, distance and part-time provision, as well as specifically designed community outreach.

[H1]Situating our work within and out with higher education institutions: Engaging new networks

UBDC and our research team are also contributing partners in the Life in Data research network (funded by the Royal Society Edinburgh), bringing together academic, private and third-party stakeholders to exchange knowledge around ‘literacy, openness, education policy and creative data innovation’ in Scotland (Borges Rey 2018). We have found this network useful to disseminate our own iMCD project findings to a multidisciplinary network of scholars, creative and social entrepreneurs, policy makers, industry, educators and civic, public, and voluntary sectors. This network has opened up new discursive spaces for us, as social scientists, to explore creative as well as pedagogical challenges promoting data literacy. The network was developed in response to the Open Data Charter (UK Cabinet Office 2013), intended to facilitate citizens’ access to information, but to date citizens have not made enough use of open data, and certainly not using academic-non-academic partnerships and multidisciplinary working groups. Our knowledge exchange workshops have dealt mainly with operationalising data literacy, exploring why it matters (from different stakeholder views), the current state of data literacy in Scotland, and how can it be fostered by universities and non-academic partners alike to better meet the needs of future employers in Scotland. We have actively participated in the #Lifeindata network as a way to operationalise data literacies, and to engage with non-academic partners such as Wikimedia, Data Lab and the Scottish Cities Alliance, to determine the skills needed for the next generation of learners, as well as how we might go about assessing what a ‘data literate’ or empowered citizen might ‘look like’.

The Learning City framework provides access to networks beyond the UK, such as UNESCO’s Learning Cities Network and the PASCAL International Observatory’s Learning Cities Networks. These provide shared language around which higher education institutions may embed learning at the heart of their regions and reach outside their physical walls to research with and for citizens, particularly those previously marginalised from education participation (e.g. older learners from deprived areas of Glasgow). Many higher education institutions have already embedded long-term commitments to enable the next generation of social science researchers to be ‘big data’ literate, and for them to move more freely within and between epistemological boundaries which have traditionally separated qualitative ‘social science’ approaches from quantitative ‘science’ methods.

The Q-Step Programme is one such cross-institutional initiative with which we have engaged (supported by the Nuffield Foundation), embedded across higher education institutions into postgraduate and employability programmes. Q-step is designed to address a notable absence of quantitative skills amongst UK social science graduates, to develop a new approach to embed data skills early in the careers of social scientists, making such data skills inseparable from deep engagement with discipline-specific learning, such as in education, geography, international relations, law, linguistics, political science, population health, PPE and sociology. This programme of digital literacy is aimed at overcoming maths anxiety amongst women in the social sciences, seeking to equip them with not just coding skills, through engagement with packages like R and Python, but with data empowered attitudes. Students and higher education staff alike are able to access Q-Step ‘upskilling’ within higher education institutions, and additionally access funded studentships and work placements as part of Q-Step programme. This engagement with employers is a critical ‘test’ stage for the skills being developed and ensures that the HE learning maintains its ‘cutting-edge’ quality. The data behind this present paper

acknowledges the work of our Q-Step intern, and illustrates the knowledge exchange and capacity building potential of such programmes for training and employment within and out with higher education institutions.

[H1]Conclusions

This chapter introduced the concept of Big Data within a Learning City framework and presents case study of the integrated Multimedia City Data (iMCD) project, within the educational data archives, as an illustration of the ways in which more diverse technologies, big open datasets and novel visualisations can offer higher education institutions valuable and underutilised data. There is great potential within open source, big data sets for both local and global issues to be addressed in the context of learning engagement, and how learning engagement operates at complex intersections related to health, social inclusion and ‘place’.

The Learning City framework has provided a common language for embedding our research on lifewide literacies in current policy orientated discourse. This framework has also enabled our research to objectively explore educational inclusion in lifelong and lifewide learning, from ‘cradle to grave’, within and out with educational institutions. We offered this case study in an attempt to blur the lines between higher education institutions as formal institutions offering classroom-based learning to community-facing, publicly-engaged facilitators of knowledge and data co-created with citizens. We illustrated how our team is researching educational disadvantage, embedding it within place, and using the learning city indicators, such as regarding empowerment and social cohesion to assess the city’s successes, as well as groups still marginalised from such learning. We also illustrated our attempts to reach out and open dialogues with such marginalised groups, bringing the ‘literacies conversation’ to communities – in schools, but also in public engagement at Ikea. Finally, we presented the work of our partners in furthering the impact and engagement work in the area of data literacy – operationalising and creating curriculum around the research methods skills future employers might need. In this way, we blur the lines between methodologies and disciplines, but also regarding the role of higher education institutions in formal, and less formal literacies and learning in a fast-changing data and technology landscape.

Researchers must move beyond simple dichotomies of quantitative versus qualitative camps, toward a more holistic approach, revealing the naturalistic experience of citizens, particularly as it concerns engagement in learning opportunities. Triangulated, mixed-methods, learning city indicator data is useful to academics and policy-makers, but also to citizens for use and interpretation of their own neighbourhood opportunities. UBDC was created to address urban challenges, such as educational inclusion. Utilising their data, we can see that such inequalities are pervasive, affecting formal and informal participation, specifically with place-based barriers, such as belonging, feeling safe and having the socio-economic and work conditions to allow stability and opportunity for such engagement. This research has allowed us to identify, and even map areas (and educational organisations) that might benefit most from interventions promoting formal and informal (e.g. Lifewide Literacy) learning opportunities. This chapter is not an exhaustive analysis, but rather an exemplar of how Big Data and novel methods can inform approaches of ‘where’ to widen participation and ‘how’ we can engage marginalised groups in different forms of learning. It is essential, though, that such data are not just used by academics and policy-makers to suggest top-down decisions, but rather by engaged citizens in discourse to improve their own lives, and that of their neighbours, as evidenced in our public-facing outreach work.

[H2]Potential and limitations of the data

The full iMCD dataset is a combination of novel multi-methodological approaches, the first of its kind available as an open data resource, allowing immersion in learning environments, as opposed to

2-dimensional exploration of learning metrics. Such rich multi-level information is being used to inform educational expansion at the University of Glasgow, where we are presently undergoing one of the largest expansions of any urban-based University Campus in the world. Evidence-based expansion and provision of further and higher education learning approaches, combined with community outreach and blurring the lines between the formal and informal, sits firmly within the Learning Cities agenda. The success of such outreach initiatives could, in future, be assessed by changes in travel patterns around the campus and city (through comparison of pre-post GPS trails).

It is important to emphasize that the use of big and open data in education, research and the public and private sector require almost continuous reform of scientific governance that can keep pace with the greater interest, investment and availability of its use. This chapter has emphasized the public good that can come from the use of big data when it is orientated to address social problems such as inequality in educational attainment. However, all researchers who utilize this type of data must be fluent in recognizing potential privacy issues including legal requirements and limits of its use. For instance, how and where the data is stored, limits of confidentiality, individual rights and who is able to access it. As a team of social science researchers, we were able to abide by the ethical codes of research provided by our own professional body, The British Psychological Society, to guide our professional conduct. In addition, when applying for and utilizing the iMCD survey, we signed a license agreement and operated within the clearly stated responsibilities and usage policies. This fast-moving climate of data privacy will be informed through new General Data Protection Regulation (GDPR) which replaces the Data Protection Directive 95/46/EC and extends the scope of EU data protection law to all data provided and held by EU residents. This protection regulation is designed to be a living document, able to be updated and revised as new issues related to data privacy continue to evolve in an increasingly complex, digitally based world and where research is now being framed within a climate of ‘open science’. While data may be ‘big’, we are all responsible for ensuring that the rights of the individual who the data relates to are held in highest regard, which ties back to the role of higher education institutions at the forefront of the push for data transparency and openness with the opposing obligations to uphold data protection and ensure ethical privacy practices.

Whilst we are in the infancy of the ‘Big Data Revolution’, and we have much to negotiate in terms of the balance between privacy and open data, we feel that ‘Data Literacy’ is at the forefront of learning for the next generation of learners and researchers. More specifically, the complex, real-time learner data on engagement and mobilities should continue to be systematically gathered over a longer time span, and across cities, in efforts to evaluate learning participations (in all forms of learning) and promote attainment and literacies for improved lifelong and lifewide learning. In this way, we will have a better picture of ‘active learner citizens’ engaging with and contributing to their cities/ local environments, versus those who feel marginalized, lack a sense of belonging and safety within their physical environs. There has been a plethora of funding initiatives to promote learning in marginalized groups over the years, but little attention given to their sustainability and ‘success’. Given the recent push for open science and transparent investment, social scientists are well placed to get ahead of the curve by recognizing the opportunities of big data in helping to understand and respond to modern, urban challenges.

[H2]Big data implications for higher education institutions reform

Previous chapters of this book have explored global trends, such as increasing urbanization and migration, and showed the overlap of many higher education institutions, and the shared urban challenges many of us face. These chapters have woven interconnected trends of ageing and emerging immigrant populations, increasing diversity of learner needs, and increased concern over inequality of access/participation, particularly in regards of socio-economic status. Such global trends provide

pressing evidence for universities to play a more visible role in regional and national development. Public outreach to engage citizens through equitable access to further and higher education, as well as lifelong and lifewide learning, sits well within new UK frameworks for making real-world impact and ‘opening’ data up to citizens. The Learning City framework provides access to networks, such as UNESCO’s Learning Cities Network and the PASCAL International Observatory Learning Cities Networks and International Exchanges. These provide shared language around which higher education institutions may embed learning at the heart of their regions and reach outside their physical walls to research with and for citizens, particularly those previously marginalised from education participation; for example, as we have demonstrated in the case of older learners from deprived areas of Glasgow.

Multi-stranded data, such as the iMCD project, may reveal a more holistic picture beyond ‘the student lifecycle’ to the individual’s ‘learning lifecourse’ and allow universities and cities to better target interventions promoting learning within and outside of formal institutions, particularly for marginalised learners. Thus far, UBDC data has revealed a need for more targeted, place-based community learning outreach for some demographic populations, such as non-learning engaged older adults in areas of deprivation. In addition, more virtual, technological, flexible learning may be more inclusive for other marginalised learners, such as migrant groups in precarious work situations. Such interventions to reach out and engage the public in lifewide learning, in turn provide valuable data for educational providers, including higher education institutions, to identify who is and is not involved in the lifewide learning ‘conversation. Such diverse data on inclusion can be a real tool for change and HE reform, offering outcomes of increased educational participation by under-represented groups, as well as providing interdisciplinary research that is impactful. Therefore, we advocate higher education institutions, and interdisciplinary teams, to harness innovative technology and existing big datasets for helping their city-regions develop happy, healthy citizens actively engaged in lifelong learning, including further and higher education, but also non-formal and informal learning in the community and household, and in all aspects of civic life.

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