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Lifewide learning in the city: novel big data approaches to exploring learning with large-scale surveys, GPS, and social media

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ABSTRACT

Despite UNESCO's Learning Cities agenda, which argues for the mobilisation of resources to promote education across all sectors and environments, there is little evaluative research on Learning City engagement which is both naturalistic and empirically rigorous. The research on informal adult learning in urban contexts is particularly sparse. This paper provides a case study of informal learning and lifewide literacies amongst Glaswegian adults using three distinct approaches to data collection: a household survey capturing rich data on learning attitudes, behaviours, and literacies; GPS trails that track mobility around the city; and the capture of naturally occurring social media. The work operationalises Learning City indicators, and explores domains beyond education, some of which have not previously been considered in surveys of adult learning, for example, physical mobilities and transportation patterns. We use theoretical concepts of social identity and capital to situate inclusion within explanatory frameworks of marginalisation in less tangible domains of informal learning using multi-stranded data. A triangulated analysis of city-wide participation in lifewide learning reveals a demographic picture of groups marginalised from learning opportunities and practices. We conclude with a call for new approaches to exploring learning participation which offer novel methods to evidence informal learning and lifewide literacies.

KEYWORDS

Lifelong learning; lifewide literacies; informal learning; widening participation; big data; inclusion; Learning Cities

Social inclusion processes aim at ensuring that society is accepting of all people, and those who are different from others are not only included, but given the possibility to participate in decision-making processes that affect their lives. The effect of everyone having the possibility to participate in defining the meaning of their own social identities will be a society which is inclusive and participatory, which embraces diversity and instils a sense of belonging. (DESA, UN, 2009, p. 22)

'People Make Glasgow' has been the slogan of our city since 2013, reinforcing the image of Scotland's largest city as culturally vibrant, confident, participatory, and inclusive. Glasgow City Council has been keen to develop rhetoric away from its post-industrialised identity which had aligned it with negative connotations of division, disadvantage, and declining health¹ in comparison to other post-industrial cities in the UK and Europe. Much like comparator cities, Glasgow has encountered periods of austerity in parallel with

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aspirations for regeneration and growth brought about through highly visible attempts to invest in new industries and to generate urban renewal for the most disadvantaged communities. With increasing migration and international student populations, the Glasgow of today is far different from the city at the turn of the last century. Its centre and the West End, including the post-ship-building harbourside, reveal a vibrant and diverse city, with a plethora of cultural and educational opportunities with new and growing industries. This article therefore explores less formal learning engagement within the city by triangulating novel datasets—from surveys and GPS trails, to Twitter data and images—complementing the work in this special issue, which likewise serves to explore educational trajectories and mobilities with novel methodological approaches. For instance, Facer and Buchczyk (2019) provide much-needed emphasis on transport and mobility infrastructure, as related to learning infrastructure, in synergy with our physical and social mobilities paradigm. In addition, Morrison et al. (2019) illustrate the significance of mobility in the city for learning trajectories, in line with our work on mobility implications for lifewide learning engagement.

Whilst widening participation to further and higher education for those from the most disadvantaged families remains high on educational and political agendas (Scottish Government, 2016), there remain clear poverty-related attainment gaps in Glasgow, and Scotland nationally (Accounts Commission, 2014). This is despite the considerable efforts that have been undertaken for over three decades to address inequitable participation in formal learning. Our concern here, however, is to provide a broader picture and to encompass the informal in our analysis of urban learning. Informal learning has been of less concern in research and policy despite Scotland's commitment to community learning and development (Scottish Statutory Instruments, 2013), the exception perhaps being the creation of procedures for validation of informal learning within the framework of the Scottish Credit and Qualifications Framework (Scott, 2016). Our research situates learning at the heart of the city development and explores the extent to which access to less formal types of learning is within the grasp of all citizens. It applies a mixed-methodology, multi-level approach to better explore adults' participation in all forms of learning. It highlights learning 'pinch-points' where, although there may be marginalisation based on a range of socio-economic and demographic factors, there is also the potential to redress inequities.

The theoretical and policy frameworks

We offer, as the guiding framework for this paper, UNESCO's Global Learning Cities Network (GLCN), which argues for the mobilisation of resources to promote education across all sectors and environments (UNESCO, 2013), harnessing lifelong learning to promote more equitable and inclusive societies in line with the Sustainable Development Goals (SDGs) (2015). We explore mobilisation of learning across diverse groups (such as older learners and those from deprived areas), including in diverse informal learning contexts in Glasgow, using Learning City key features (UNESCO, 2013) as a template for measurement.

Further, we apply theoretical concepts of Social Identity Theory (SIT) (Tajfel & Turner, 1979) and Social Capital (SC) (Bourdieu, 1977, 1985) to situate social inclusion within explanatory frameworks which interpret marginalisation in groups, places, and in less

tangible domains, such as informal learning, using quantitative, GPS, and social media data. According to SIT (Tajfel & Turner, 1986), individuals categorise themselves as belonging to many different demographic and social groups in society (see also Brown, 1988, 2011). This categorisation helps people to function according to social scripts, to better understand their social environment, and most importantly, have a feeling of identification with wider communities. Identification and individual self-representations in relation to others are by no means new, and such notions build on interdisciplinary principles of association and dissociation (Perelman & Olbrechts-Tyteca, 1973), identification (Burke, 1969), and more general inter-group processes, such as derogation, exclusion, and polarisation (Brown, 1988, 2011). Therefore, researchers must begin to apply a more intersectional lens (Cho, Crenshaw, & McCall, 2013; Crenshaw, 1991) to social inclusion, understanding that socio-economic deprivation effects are multi-layered and complex, but that inclusion in learning is indeed a key driver of prejudice-reduction and cohesive identification.

Bourdieu's (1977, 1985) widely acknowledged concepts of social, economic, and cultural capital are central to analysis of social inequalities, given the likely relationship of deprivation, and household occupational status, to explain differences in learning engagement and access to these wider forms of knowledge and competencies. Bourdieu's (1985) concept of 'habitus' further sheds light on the individual learner, in place, and is a useful theoretical premise from which to consider our research within areas of deprivation in Glasgow where there are variable levels of access to educational institutions, and more subtle forms of 'knowing' about successful decisions in the health, economic, digital, and environmental domains.

Social arguments for embedding learning at the centre of cities connect to the SDG 4, which calls for lifelong learning to be harnessed as a critical factor in the promotion of social cohesion, in increasingly diverse communities. This push to embed lifelong learning is mainly intended to address global socio-economic and wider inequalities, through citizenship and empowerment, particularly for those in marginalised demographic groups and communities. A key risk factor for marginalisation is social deprivation and lacking material benefits to meet basic needs, measured in Scotland by the Scottish Index of Multiple Deprivation (SIMD). Such material deprivation is associated with wider health and social deprivation, and barriers to participation in aspects of cultural life, such as education, cultural, and civic activities. Age, gender, and ethnicity may also factor into a city's model of socio-economic deprivation.

The need for lifewide learning inclusion in the Learning City agenda

Our research focuses largely on the social inclusion arguments for employing Learning City approaches, seeking to assess urban engagement in achieving lifelong learning's rhetorical aspirations. Using various types of data, we explore the experience of marginalised groups, identifying 'who is being left out of these learning conversations', and 'how we can reach out to promote public discourse'. The following section will elaborate on the measures of wider literacies (see Cook-Gumperz, 2006) as indicators of Learning City development (see Osborne, 2014), and the research we have conducted to explore attitudes, behaviours, and literacies around lifewide learning in the Glasgow area.

Although lifelong learning is most often associated with human capital development (in line with Bourdieu, 1985; Fejes, 2010), there are more radical and longstanding alternative discourses in debates concerning inclusion within the 'learning society', in part fuelled by concerns about and challenges to the marketisation and globalisation of learning (Husén, 1986; Jarvis, 2007; Raggett, Edwards, & Small, 1995). However, whether we adopt a human capital development or a social inclusion perspective, a false dichotomy in reality as improving economic prospects is ranked highly in many studies of those excluded from HE (Osborne, Rimmer, & Houston, 2015), lifelong learning offers an opportunity for re-directing the notion of learning within a place-based framework. In such a context, learning is most effectively examined in relation to the spaces and places where the needs and aspirations of citizens and learning providers can be explored via ecologically valid research. This conception of learning engagement has been captured within, and underpins the idea of the Learning City, which provides a discursive lens for this analysis (Yang, 2012). Researching learning embedded within place also offers the opportunity to explore learning across less formal domains, linking wider skills, competencies, and literacies to achieving the full actualisation of citizens' potentials.

Literacy in the educational literature is often equated with reading, writing, and mathematics, and more generally with being well educated and learned (Brandt & Clinton, 2002). However, UNESCO (2004) offers a definition of literacy as the 'ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts' (p. 13). This is a broad definition involving a continuum of learning, from formal to self-led skills development to enable individuals to achieve goals and actualise potential, and links to notions of how cultural capital affects later learning success (Stuart, Lido, & Morgan, 2011). The 'lifewide' conception 'brings the complementarity of formal, non-formal and informal learning into sharper focus. It reminds us that useful and enjoyable learning can and does take place in the family, in leisure time, in community life and in daily work life' (European Commission, 2000, p. 8). We bring these broad understandings of literacies and learning in the lifewide sense, under the umbrella concepts of lifewide literacies. We present such literacies as possible measurements to operationalise some of the 'key features' of UNESCO's Learning City model² that pertain to 'revitalised learning in families and communities', a 'vibrant culture of learning throughout life', and 'extended use of modern learning technologies' when engaging citizens in learning.

We thereby provide an approach to assessing less formal forms of learning or 'knowing' (in line with Bourdieu's forms of cultural capital) and assess how this relates to social belonging (in line with social identity [Tajfel & Turner, 1979]) within one's regional area, and implications of these knowledges for positive life outcomes. Lifewide literacies offer an inclusive and socially situated perspective, based on achieving skills as well as knowledges and competencies which allow the individual to actualise and adopt personal agency over their potential in terms of empowerment and participation, and in a particular social context. In this way a Learning Cities focus on building lifewide literacies in the broadest sense may offer the capacity to build citizens' agency through literacy practices and less formal learning opportunities.

In this way lifewide literacy competencies in a Bourdieuan sense constitute 'knowing the rules' for success within one's environment, just as issues of belonging, 'fit', and implicit ways of knowing have been shown to influence educational success (Stuart, Lido, & Morgan,

2009). We operationalise the main lifewide literacy domains of interest to our research as Health Literacy (HL), Financial Literacy (FL), Eco or Environmental Literacy (EL), and Digital Literacy (DL). Whilst political literacy, foreign language skills, numeracy (in everyday life), mathematics, and English in the workplace were also included in the survey element of our fieldwork, it is HL, FL, EL, and DL that stand out in the literature as having the strongest impacts on positive life outcomes such as general health and future work (e.g. Buckingham, 2010; Chew, Bradley, & Boyko, 2004; Lusardi & Mitchell, 2014; Orr, 1992).

Methods and analysis

The present work analyses data from the integrated Multimedia City Data Project iMCD, an element of the work of the Urban Big Data Centre (UBDC), a major investment of the UK's Economic and Social Research Council (ESRC). The project's four major data strands comprise an open 'data product' developed by our team for use by academics, policy practitioners, and the public alike to access and analyse, and include: (1) a large-scale household survey; (2) GPS trails around the city; (3) social media data capture; and (4) life-logging camera images taken automatically (these will be discussed further below). These linked datasets are currently housed, as open data, alongside other large datasets within UBDC's archive (such as satellite, mobile, and cycling app data). The strands of iMCD, singly and jointly, will be applied to assess Learning City inclusion, addressed by the following research questions (RQs), specifically using the first three strands of data:

RQ1 (Survey). *How* do lifewide literacies and lifelong literacy engagement predict positive life outcomes, such as general health? How do they relate to social inclusion for adults in the city?

RQ2 (Survey & GPS). *Who* are the adults engaging in lifewide learning in the city? *Where* are they going within the city?

RQ3 (Twitter and Survey—Open-ended data). *What* are the opportunities for lifelong learning engagement in the city, and *why* are people engaging?

Our approach can be distinguished from other work concerned with assessing engagement in adult learning in a number of ways. Firstly, it uses three distinct approaches to gathering quantifiable data, as opposed to traditional survey work, which has been the basis for most empirical study in the field (see Desjardins, 2003; OECD, 2016). Secondly, our survey strand alone is the largest adult household survey conducted in Glasgow, and goes well beyond socio-demographic data and educational trajectories, to operationalise attitudes, behaviours, and literacies, linking educational engagement to social domains not often considered, including travel patterns, housing, sustainability, technology/computer use, and cultural/civic participation. Existing national surveys in Scotland have not covered this diverse range of variables, nor linked them to diverse forms of educational engagement (e.g. Tett et al., 2006, in Scotland). Comprehensive international studies of adult competence, such as the *Programme for the International Assessment of Adult Competencies* (PIAAC; OECD, 2016), and earlier comparative analyses of the *International Adult Literacy Survey* (IALS; data by Desjardins, 2003) use a narrower range of defined

literacies and fewer linked variables related to urban life (e.g. travel and civic engagement).

Participants

We analysed 2095 adult surveys, including a qualitative interview component, collected over a 6-month period in 2014, representative of the Greater Glasgow census data in every way, except age. The age ranged from 16 to 102 years, with an average age of 49.42 years (Standard Deviation = 19 years); of these 45.7% were female and 54.3% male. The respondents were largely white (95.7%), and within this demographic group most were likely to be Scottish (82.1%) or British born, which reflects the demographic make-up of Greater Glasgow residents. The average household contained 2.23 persons, of whom 1.93 were adults, and of these, we successfully obtained responses from 1.5 adults per household. Households were stratified by deprivation to achieve a roughly even number of respondents in each deprivation decile.

RQ1 (Survey). How do lifewide literacies and lifelong literacy engagement relate to positive life outcomes, such as general health? How do they relate to social inclusion for adults in the city?

The survey questions supported by the interview and the survey itself covered a range of attitudes, behaviours, and literacies (operationalised as self-reported or quiz-based knowledge/skills) in the domains of: education, transport, sustainability, technology, and cultural/civic engagement. Past, present, and intended future learning engagement were assessed, including any recent (over the past 12 months) engagement in formal education (structured/leading to nationally recognised qualifications), non-formal education (structured but not leading to national qualifications), and informal (self-led unstructured or experiential) learning. Family learning was also assessed, including whether the learner was an older or younger family member. Lido, Osborne, Livingston, Thakuriah, and Sila-Nowicka (2016) provide further details on survey collection, validity, reliability, and findings specific to older learners.

The findings show that in Glasgow, adults report overall engaging in far less learning activity than comparative national survey measures of learning engagement (10.4% engaged in formal learning, 7.4% in non-formal engagement, and for informal learning, 10.9%). This falls far short of the Adult Education Survey (AES) and National Adult Learning Survey (NALS) estimates of informal/self-directed learning engagement, which has been estimated in the UK as varying from 24 to 56% over the last 10 years (AES, 2015; NALS, 2010). Some of this may be explained by our more stringent definition of informal learning participation in our survey, and a slightly older sample. The UNESCO (2011) definition above notes that informal learning includes learning that occurs in the family, workplace, local community, and daily life. Our report of 10.9% informal learning was also defined as self-directed; however, family learning was measured separately, and work-based learning was specifically mentioned in the definition of non-formal learning. However, it is worth noting that the relatively low levels of informal learning cannot be completely accounted for by this discrepancy, as both non-formal and informal learning combined still only reaches

18.3%. We recognise, however, that there is evidence from previous work (Sargant, 2000) that self-reporting by adults may minimise their accounts of informal learning.

All lifewide literacies (quiz-based measures of health, financial, eco, and digital) correlate negatively with *deprivation* (as measured by SIMD, all Pearson r correlations significant at $p < 0.05$). These lifewide literacies, particularly health literacy, correlate with 'proxy measures' of precarity such as ratio of people in a household to bedrooms, higher income and lower benefits, access to the internet, and age (all $p < 0.05$). Precarity differences in lifewide literacies were also demonstrated by more secure household tenure (home-ownership), more stable employment (versus seeking work or zero hours contract), and being Scottish (as opposed to being a non-national), all revealing t -tests significant at $p < 0.05$. Regressions will now be presented to explore the predictive relationship of lifewide literacies to area and positive life outcomes, such as social engagement and general health.

Regression Model 1³ indicates that all lifewide literacies predict positive self-reported general health outcomes, and together they explain 15.1% of the variance in overall reported general health ($p < 0.001$). Model 2⁴ suggests that one's relationship to one's area, in addition to predicting engagement in any form of learning (see also Lido et al., 2016), also predicts more positive life outcomes, such as self-reported general health. Furthermore, attitudes towards having a 'sense of belonging' to the local area and 'feeling safe walking alone at night' are two predictors that we have found to be important for both adult (and older adult) learning engagement and general health, as predicted by Social Identity Theory (Tajfel & Turner, 1979) notions of in-group affiliation associated with greater self-esteem and group participation.

Also, in line with social identity approaches, a third model⁵ suggests that 'social support' factors, such as frequency of talking to neighbours, engagement in community activities, and perceived social support together positively predict 16.1% of the variance in overall reported general health (also significant at $p < 0.001$ for the model). Ethnic diversity of friends was also a significant predictor, but explains less than 0.9% variance, so was not included in the model.

These models, taken together, indicate that lifewide literacies, much like formal educational outcomes, follow patterns of associations with low deprivation and low precarity; conversely high levels of deprivation in one's environs and high precarity in the household (tenure, income, and migrant status) are all associated with lower levels of the lifewide literacies we measured (health, eco, financial, and digital). The regressions reveal that these lifewide literacies are predictors for positive life outcomes, such as general health, in line with the more evidenced area indicators and social engagement factors, which also matter for general health. Highlighting, as above, that more attention be paid to the less formal knowledges that predict future life success.

To explore the directional relationship of these variables, a mediated regression reveals that these lifewide literacies are quite powerful, and fully mediate the direct effect that social engagement (and support) has on the positive life outcome of general health, as pictured in Figure 1.⁶

Our research reveals that lifewide literacies are correlated with measures of deprivation and precarity, but also represent unspoken forms of capital/knowledge/skills transmitted largely in informal, family, and community contexts, in line with Bourdieuan analyses. Lifewide literacies are a key driver for positive life outcomes, alongside social engagement factors such as speaking with neighbours and having someone to go to in times of crises, belonging, and feeling safe at night (in line with social identification).

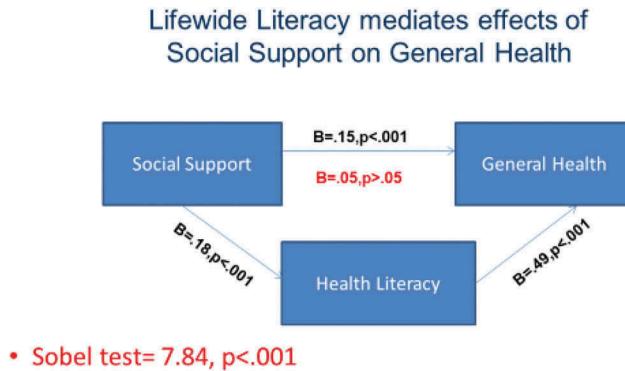


Figure 1. Lifewise literacy mediates effects of social support on general health.

These regressions are the first step in describing *how* lifewise literacies predict positive life outcomes, such as overall self-reported general health, as well as highlighting the significance of social networks for healthy adult populations in the city. This leads the paper to the next question, regarding the ‘who’ of lifewise literacies engagement.

RQ2 (Survey & GPS). *Who* are the adults engaging in lifewise learning in the city? *Where* are they going within the city?

To explore who these adults are and their physical (and social) mobility around the city, we utilised the iMCD survey to identify participants engaging in learning, and then examined GPS trails for engagement in such opportunities. Upon completion of the survey, participants were asked if they wished to take part in further research. If they agreed, they were followed up to take part in the sensor portion of the project which would require them to carry a GPS tracker and (for some) a life-logging sensor for up to a week, yielding $n = 358$ valid GPS trails for analysis.⁷ Of these 2095 participants, approximately 1538 had not engaged in any form of learning in the prior 12 months, and $n = 22$ adults had participated in all forms of learning, including formal, non-formal, informal, and family learning in the last 12 months. We visualise below GPS trails for learning engaged and non-engaged participants, sampled from areas high and low in deprivation (SIMD).

First, however, we explored the means, rankings, and significant differences of lifewise literacies and engagement in lifelong learning in the local authorities, and found that although there were significant correlations overall with deprivation (as discussed above), there were significant variations according to the type of literacy being measured, revealing that not all lifewise literacies are evidenced in the same way, and that an analysis based on area deprivation may be too simplistic. The rankings of specific literacies by local authority is beyond the scope of this paper, but warrants further exploration within these communities.

We now illustrate mobility patterns sampled from $n = 22$ learning engaged participants (high in lifewise literacies and lifelong learning engagement), and two were selected from the four possible GPS trails; one from an area that was more deprived and one from an area less deprived. We then mapped this comparison against two

matched individuals (for gender and geographic location) from a potential sample of 1538 individuals not learning-engaged (one sampled from an area of high and one from low deprivation). Therefore, the identity numbers of learning engaged adults who participated were identified and two were matched as closely as possible for age (middle-aged), gender (two male, two female), nationality and ethnicity (white British); however, they were selected to vary on deprivation and matched for geo-location.

The trails were then colour-coded and overlaid to explore the differences in mobilities, with density illustrating time spent in an area, and modes of travel also indicated. The mobility evidenced in the maps expose a pattern whereby (a) lifewide learning engaged individuals (Figure 2 Map on left) reveal more mobility around their city, including spending more time walking and talking within their neighbourhood than the non-learning engaged (Figure 2 Map on right); and (b) those from less deprived areas show more mobility around the city (Figure 2 Map GPS trails in red), than their matched counterparts from more deprived areas (Figure 2 Map GPS trails in green/circled). However, the main finding is that despite these mobility differences based on deprivation, learning engagement may indeed be a route for inclusion in urban life and full participation as a citizen in learning engagement opportunities in the area. In other words, beyond the learning engagement effects based on deprivation, learning engagement is associated with physical participation and inclusion in the city. This mobilities focus exposes physical engagement in one's urban setting as important for lifewide learning engagement in that setting (and vice versa), thus the two are likely closely related (Brandt & Clinton, 2002). Conversely our findings still reveal the gap in engaging marginalised communities in lifewide learning, and particularly mobility gains for lifewide learning engaged individuals from less deprived areas. In other words, economically deprived areas are statistically lower in lifewide literacies and lifelong learning

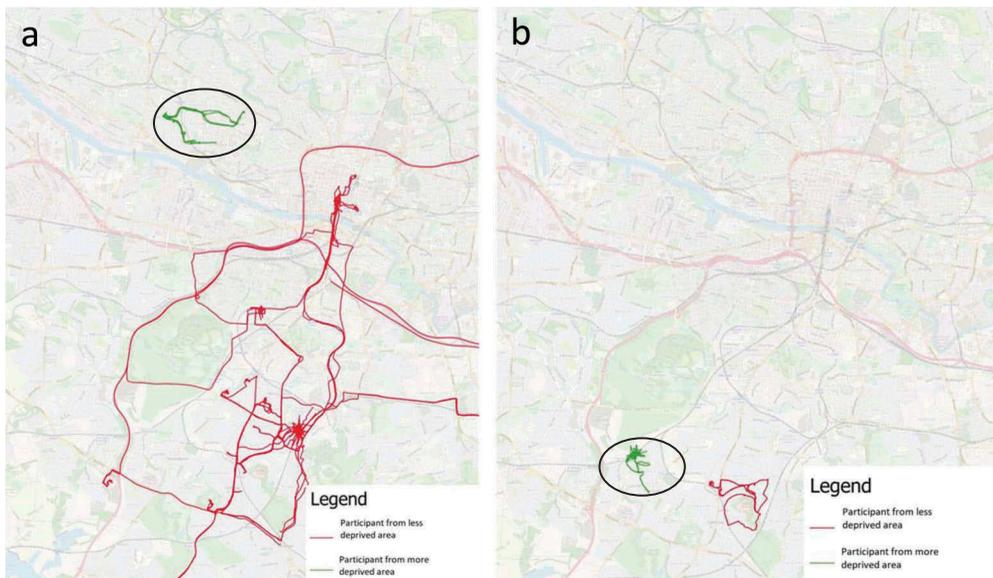


Figure 2. GPS trails of lifewide learning engaged citizens (left) and non-learning engaged citizens (right) in areas of high (green/circled) and low (red) deprivation. To view the image in colour please visit: www.tandfonline.co.uk/10.1080/03054985.2018.1554531

engagement, yet the sub-sample, who are lifewide learning engaged, are benefitting from positive outcomes of increased physical and social mobilities, albeit not as much as their more economically privileged counterparts.

RQ3 (Twitter and Survey—Qualitative data). *What are the opportunities for life-long learning engagement in the city, and why are people engaging?*

We triangulated the above findings with naturally occurring social media (Twitter) data, geo-located within the city of Glasgow. UBDC data afford analysis of the text content of Twitter posts and meta-data (e.g. user, time, location if any) for approximately 65 million tweets (4.1 Terabytes of compressed Twitter data) captured over the time period July 2014–November 2015. This includes tweets harvested from specified users within education and related fields (such as General Teaching Council, Education Scotland, Friends of the Environment Glasgow, What’s On Glasgow, the Education HUB Glasgow, and several other health, arts, and education-related users). These data offered an opportunity to see ‘what was going on’ in Glasgow for tweeterers to engage in informal learning opportunities (with hashtags searched around #Learning City[ies] Glasgow, #Skills [share/exchange] Glasgow, #Smart City[ies] Glasgow, #Open Learning Glasgow, and #UNESCO Glasgow). We note that although all learning captured falls into the UNESCO (2011) definition of informal, we are aware that we have likely harvested only a percentage of Glasgow (those who use Twitter), a small percentage of informal learning Twitter hashtags and domains in the City of Glasgow, and an even smaller sample geo-located within the city centre.

It is important to recognise that research utilising internet-mediated data and social media faces unique challenges (Weller, 2015). Social media research across disciplines, as yet, lacks standardised methods for ‘cleaning’ or linking and analysing datasets, as well as how to interpret data generated by users on social media whose interactions are fundamentally shaped by platform functionalities, such as character limitations, ‘likes’, ‘shares’, and ‘following’ (see Sloan, Morgan, Burnap, & Williams, 2015; Van Dijck, 2013; Weller, 2016). The ethical protocols for protecting the right of the individual are also trying to keep pace with increased usage and accessibility of these social media platforms (see BPS Ethics Guidelines for Internet Mediated Research, 2017). In addition, we acknowledge limits leveraging social media data such as Twitter for research purposes in terms of representativeness, such as age (younger), social class (middle-upper class), and cultural (Western) biases in the sample tweeting (Sloan et al., 2015). In addition, those in the most deprived areas are less likely to be represented here given access issues, despite the ubiquity of modern technology across Glasgow. Therefore, our research avoids presentation of Twitter user metrics, or numbers of ‘likes’, and rather presents a qualitative rhetorical analysis of what tweeterers in Glasgow are ‘talking about’ in terms of educational opportunities outside formal institutions, or ‘What’s On Glasgow’ for learning. Below we present findings regarding education-related tweets, geo-located in Glasgow, collected using a geographic polygon to denote boundaries of the city with terms inputted to the Twitter API (Application Programming Interface) to filter the global stream and collect our specified data through the harvesting of specific user accounts and hashtags as shown in [Figure 3](#).

The Twitter harvested by UBDC, using an advanced, geo-located search function, included key events, such as the Commonwealth Games and the Scottish Referendum, as well as topical policy debates on ‘Curriculum for Excellence’, falling levels of literacy

Hashtags most used



Figure 3. Analytics from @Glasgowlife for period of iMCD project (number of followers = 23,118).

and numeracy, the widening social class attainment gap in Scotland, and the migration crisis. Such events led to ‘pop-up’ learning engagement events around the city, such as by ‘Yes Scotland’ and ‘Better Together’ information sessions, and refugee and migrant inclusion events, such as those held under the banner of ‘Gramnet’ (Glasgow Refugee, Asylum and Migration Network), ‘One Day Without Us’, and ‘Refugees Welcome’, mostly in the city centre. The capture also covered formal events offered by the University of Glasgow, Strathclyde University, Glasgow Caledonian University, Glasgow School of Art, and Glasgow Clyde College, all geo-located within Glasgow City. The most commonly used hashtags from the two main City of Glasgow twitter accounts (@Glasgowlife @peoplemakeGLA) during the survey period included inviting citizen participation across a number of health, cultural, and social domains. For instance, the period of data collection coincided with social justice initiatives such as #volunteersweekscot; the esteemed arts competition, located for the first time in Glasgow, #turnerprize; and Scottish healthy living campaigns #movemoreglasgow and #getactivefeelgood.

Triangulation of findings

Statistically, our initial picture of Glasgow from closed questions in our survey was one where the participants were less engaged in learning than national averages; however, the Twitter and open-ended survey data yield a richer and more diverse picture of learning when we consider forms of learning outside structured courses. Even Twitter capture from the more structured (council- or university-led) accounts yields fewer and less rich tweets than those detailing truly informal, naturalistic learning, particularly those associated with cultural and civic activity within the city. As with the life-logging images, the tweets were less related to formal and non-formal learning opportunities and much more related to ‘wider’ conceptions of self-directed learning, illustrating lifewide literacy interactions situated in place.

From the free text response made available through the survey, we were able to capture a range of informal learning undertaken in the last 12 months. Through a process of Qualitative Content Analysis (in line with Hsieh & Shannon, 2005), whereby open responses to self-initiated informal learning activities were coded into sub-themes, then larger themes through an iterative process by three separate researchers, ultimately two categories were reached when codes were aggregated. We were then able to build a visual account (based on the frequencies) attributed to each area of learning, to illustrate the qualitative findings (note: the underlying survey data, including informal activities undertaken, are open datasets accessible via UBDC). These word clouds (Figure 4) demonstrate that even when exclusively coding unstructured self-initiated learning, there is subject overlap across the domains of formal, non-formal, and



Figure 4. What is being undertaken informally in Glasgow? Informal learning as a past-time—personal and professional development word clouds.

informal learning. Many of the learning opportunities accessed by the survey respondents within Glasgow were useful in both the domains of work (professional development) as well as within their own personal development. Language learning was a good example of this.

Discussion

We argue that there are two strengths to this research. Firstly, analysing traditional (survey) with GPS data, and housing them alongside naturally occurring Twitter data for the city provides a holistic picture of adult learning in informal city contexts, facilitating an exploration of who is learning, what, where, and how in the city. Secondly, expanding the notion of literacy to encompass a wide range of knowledges across less formal contexts widens academic discourse and policy initiatives beyond traditional discussions of adult literacy. Using diverse data strands, we have illustrated that such lifewide literacies predict successful life outcomes, such as better general health, and increased physical and social mobility (in line with Lido et al., 2016; Marmot Review, 2010). Thus, these literacies (health, financial, and digital/ICT in

particular) are indeed illustrative of social and cultural capital, serving as a useful lens to explore 'implicit' forms of knowing, associated with actualising one's full potential and engaging more fully in one's community. At the same time, a picture emerges statistically, and visually with GPS trails, that not all Greater Glasgow citizens have access to the lifewide learning opportunities available. Geographical, deprivation, and precarity barriers are evident, as well as the impact of population demography—such as ageing. Social belonging and safety indicators provide further evidence of marginalisation. Our findings are significant in that they offer stronger confirmation than previously available that lifewide literacy research is most ecologically valid when it not only incorporates measures to explore individual agents situated in their own locales but also looks towards larger enterprises such as the wider cityscape, the economic health of a city, and the culture within (Brandt & Clinton, 2002).

The findings on who is 'not included' in the Glasgow learning conversation can be understood through both theoretical and political frames. Rather than approaching the findings with a simple 'deficit model' that there are 'good' and 'bad' places for learning in Glasgow, we have applied concepts of in-group and out-group social identities to our findings to show how low levels of 'area belonging' and 'feeling safe in one's area' operate as important 'proxy' learning predictors. This is significant because it signals a potential need for the creation of community-led city spaces (virtual and real) for those with shared identities, interests, and aims to come together and exchange knowledge (creating superordinate identities of belonging [Tajfel & Turner, 1979]), such as Men's Sheds (Golding, 2015). The findings also suggest that spaces for those with very different identities shaped by age, and social and cultural backgrounds, through initiatives including inter-generational learning (Tambaum & Normak, 2014) are important. Likewise, Bourdieu's (1977) notion of social capital is evidenced in the relationships between social support and educational inclusion, as well as general health. Cultural capital more widely explains the importance of lifewide literacies (or unspoken, less tangible forms of 'knowing') for life success, and the need for inclusive education to address adults' informal lifewide literacy needs.

Learning Cities offer a practical framework to apply these theoretical explanations. They provide an opportunity to operationalise the meaning of adult literacies as a concept, and how (and why) cities can be more inclusive, not just in formal learning opportunities, but in lifewide learning for all. Therefore, we offer this paper in part as a concrete and unique exemplar of measuring the 'building blocks' ('Columns', UNESCO, 2013) of Learning City features, using lifewide literacies and informal learning as a proxy for successful community learning across the lifespan, applying them in a participatory loop to improve a city's educational offer. In this vein, we are now engaging in lifewide literacies outreach programmes (e.g. ESRC Festival of Social Science, Glasgow Science Sunday, and MoSSFest (Middle of Scotland Science Festival)), and moving to involve policy makers (through the SPICe (Scottish Parliament Information Centre) team) and schools themselves. These will serve to link our work and demonstrate impact with wider curricula for 'citizenship' and cultural education, as well as FE/HE curricular reform, moving beyond classrooms and course-specific skills to open access and online learning opportunities for adults.

In this paper we have used novel data strands to triangulate a picture of Glasgow as a Learning City; we have also shown how big and novel data can be used as a tool to present holistic pictures, engaging the public in conversations around their own cities and their own lives. We have drawn attention to the challenges associated with establishing comparative levels of psychometric quality alongside more traditional scientific methods of primary data

collection, particularly for Twitter and GPS data. In addition, we have not had time to fully explore the intersectional overlap of multiple identities of disadvantage; despite preliminary work with non-Scottish born participants (nearly 10% of the sample), and non-white Scottish participants (less than 5% of the sample), there is much work to be done exploring marginalisation from learning in the city. Nonetheless, we argue that the data as an opus reveal more than any single strand alone. We have been able to provide an original ‘learning snapshot’ of the City of Glasgow. In the face of funding cuts to adult and lifelong learning, and uncertain political agendas around Learning Cities, we believe there will be an increasing demand for harnessing existing, and perhaps more naturalistic, data that are robust and valid for addressing urban challenges, such as deprivation and inclusion and resultant inequalities in learning. We have demonstrated that intervention is needed to provide interesting and accessible informal lifewide learning opportunities in Glasgow. We have also shown that it is feasible, using inclusive adult educational practices, geographical or virtual, to include marginalised older adults in areas of deprivation so that they can feel a sense of belonging, whilst acknowledging safety concerns. We have shown how lifewide literacies—financial, eco, digital, and health—need to be, and can be, embedded into the everyday practice of Glaswegians.

Notes

1. The ‘Glasgow Effect’ of unusually low life expectancy has been attributed to ‘the convergence of multiple stress-promoting phenomena’ (Cowley, Kiely, & Collins, 2016, p. 370).
2. Crossing Sections 2.2, 2.4, 2.5, and 2.6 of UNESCO’s model found at <http://unesdoc.unesco.org/images/0022/002267/226756e.pdf>.
3. Model 1—lifewide literacies predict 15.1% variance in general health, with three significant literacy predictors; eco $\beta = 0.11$, financial $\beta = 0.20$, and health $\beta = 0.35$, all $p < 0.001$. Note health literacy moderates the effects of eco-literacy, all are correlated, but there is no violation of multi-collinearity.
4. Model 2—Area indicators predict 7.5% of variance in general health with four area indicators; area rating $\beta = 0.18$, area belonging $\beta = 0.21$, both $p < 0.001$, and feeling safe walking alone at night $\beta = 0.08$, $p < 0.001$, and plans to move out of the area negatively predictive $\beta = -0.06$, $p < 0.05$. Note some slight multi-collinearity between planning to move and feeling safe at night (collinearity index = 0.19).
5. Model 3—Social support indicators predict 16.1% variance in general health; predictors include frequency talking to neighbours, engagement in community activities, and perceived social support. Ethnic diversity of friends is also a significant positive predictor but explains less than 0.9% variance. Note: direct effects (no mediation).
6. Figure 1 indicates social support to general health relationship ($B = 0.15$, $p < 0.001$), becomes non-significant with the addition of health literacy ($B = 0.05$, $p > 0.05$), and health literacy is directly predicted by social engagement, and directly leads to general health as reported by participants.
7. The details of ethics of the sensor strand are beyond the scope of this paper, but ethical approval was obtained by the University Ethics Committee and a strict protocol for continuous informed consent was implemented. Data could be withdrawn by the participants at any point up until publication of research findings. The data presented here represent a de-identified sub-sample of respondents who agreed to carry the GPS sensor for one week (and to complete a written travel diary for comparison).

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