Adults' numeracy practices in fluid and unstable contexts:

an agenda for education, policy and research?

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Abstract   Numeracy practices are always dependent on the social context in which they emerge. However, these contexts are unstable because of a range of technological and socio-political changes. How does this instability affect people's agency in the world? After reviewing key approaches to numeracy practices research, we distill key findings from recent numeracy studies. We introduce the concept of the numerate environment to examine the context in which opportunities, , supports and demands present themselves for people's numeracy development, explaining how0 cultural-historical activity theory can be used to analyse effects of changes in numerate environments. We consider examples of social trends likely to effect such changes. We conclude with implications of shifts in people's numerate environment for future educational provision, policy and research.

Keywords   numeracy practices, numerate environment, cultural-historical activity theory (CHAT), adult education

1 Introduction

In this paper, we explore possible responses to the question: if the contexts of numeracy practices are unstable and fluid, what does this mean for numeracy education and policy? To take the example of work as a context of adults' numeracy practices, we read about changing technologies and automation, the rise of the 'gig economy' and the 'fourth industrial revolution' driven by digitisation that are creating uncertainties about what jobs may look like in the future. However, as Farrell and Corbel (2017) point out, we have yet to see examples of what skills will be needed and how they will be used in this future. The challenge this uncertainty presents, not only for numeracy education but for adult education more broadly, may be captured in the despair expressed by an Australian economic policy researcher writing about groups of older, retrenched workers in Australian industries facing significant decline: traditional manufacturing and mining:

> In places …, where specific industries have been at the heart of the local economy and community for several generations, it would be almost impossible to imagine a future without them. And it doesn't really help that so much of the talk about tomorrow's economy is of 'jobs that don't even exist yet' in 'industries that will look very different from those we know today'. How can anyone who isn't a tech-bro or one of those futurist wankers who do TED talks get a handle on what that means in practical terms for today's jobs and firms? How does an early-forties sprinkler fitter or plant operator go out and train for jobs that don't exist? (Rayner 2018, p. 71)

As Rose (2004) illustrates in his ethnographic studies of blue-collar workers in the United States, the workers in Rayner's studies would be highly skilled, including in numeracy. Like the carpentry work that Rose observed where he saw "a wide range of mathematical concepts and operations … embodied in carpentry's artefacts and routines of practice, and in ways suited to the properties of materials and the demands of production" (2004, p. 97), we would expect that Rayner's older workers would have developed distinctive mathematical skills and knowledge needed in their

particular work. The challenge for these workers is not that their numeracy was inadequate for the job they were doing, but the context in which their numeracy was needed has been disturbed and indeed displaced.

Economic and technological changes have been one key impetus for the Organisation for Economic Cooperation and Development (OECD) to initiate the Programme of International Assessment of Adult Competencies (PIAAC) as a vehicle for informing workforce development policies in their member states. The Survey of Adult Skills conducted in over 40 countries, assessed adults' literacy, numeracy and problem-solving in technology-rich environments (PSTRE), those skills that the OECD regard are key information-processing skills for work and everyday life (OECD 2012). A number of analyses of the Survey data have followed, including those focused on possible relationships between numeracy performance and factors such as migrant status, use and social outcomes (see for example, Grotlüschen, Mallows, Reder and Sabatini 2016; Jonas 2018; OECD 2018a). However, as analyses of a point-in-time, large-scale survey, these studies do not reveal the actual numeracy demands experienced by individual adults, and how they negotiate changing demands from their environment. Thus, of interest in this paper is how an individual's numeracy practice - that is, the *doing* of mathematics that has helped them to make meaning of and negotiate their current context - may become obsolete or ineffective as the context itself changes.

There is now a significant corpus of studies of adults' numeracy practices in their personal, community, educational and workplace environments (Yasukawa, Rogers, Jackson, and Street 2018). A number of different theoretical lenses including situated cognition (Lave 1988; Nunes, Schliemann, and Carraher 1993), Engeström's third generation cultural historical activity theory (CHAT) (FitzSimons 2005; Kanes 2002), (New) Literacy Studies (Street, Baker, and Tomlin 2005), and ethnomathematics (D'Ambrosio 1985; Knijnik 2002) have been used to study aspects of numeracy practices, including the social, historical, cultural and political aspects of these practices. Researching numeracy through these lenses has shown how numeracy practices are never separable from the particular social context in which they emerge. However, the fluidity and instability in the contexts of people's lives can expand or diminish people's sense of agency in the world, depending on how successfully they are able to negotiate the changes (Jackson, Rogers and Yasukawa 2018).

Our paper is a conceptual paper in which we consider three types of social change felt in and beyond OECD countries to illustrate how a focus on the environment, rather than on individuals' skills and practices at a point in time may provide new insights into how programs, research and policy might be conceived. The changing contexts considered in this paper are: the erosion of the welfare state and the concomitant transfer of a range of risks to individuals, the emergence of 'big data' and the loss of control over one's personal data, and the globalisation of work and labour. For educational provision and policy, we argue that spaces for critical and collective learning may need to be created or expanded where adults can develop

informed and sustainable numeracy practices that help them to make sense of the changes and retain or increase agency in the face of change. We further argue that investigating such spaces and/ or actively making interventions to create such spaces may be a new agenda for numeracy practices research.

The remainder of the paper is organised as follows. Section 2 provides a synthesis of recent research on numeracy practices as a backdrop to the specific research questions addressed in this paper. In Section 3 we explain our conceptual framing of numeracy practices as a cultural-historical activity system, and what it offers in the examination of numeracy practices in fluid and unstable conditions. We analyse numeracy practices in the three selected unstable contexts by viewing each of the contexts as a cultural-historical activity system in Section 4. In the final section, we discuss the insights gained from the analyses, and their implications for programs, research and policy.

2 Numeracy as social practice

Socio-cultural studies of numeracy practices have a rich history, influenced by several different but complementary scholarly perspectives. Yasukawa, Jackson, Kane and Coben (2018) surveyed these studies and identified four key perspectives: situative perspectives on cognition; cultural-historical activity theory (CHAT), particularly Engeström's third generation CHAT; New Literacy Studies; and ethnomathematics. Some salient features of numeracy practice research emerged from their survey, briefly summarised below.

The first was the dominance of ethnographic research approaches in many of the studies – not surprisingly given the aim of understanding what people do with mathematics, plus how, why, and with whom. Second, the research studies focused on what people *do* with mathematics in particular social contexts (work, community, home). This in turn highlighted questions of transferability across contexts: in particular, the apparent lack of transferability, or incomplete transfer, of what people might have been taught in formal school maths, to their everyday contexts. This, however, gave rise to the third feature which is the politics of knowledge , about whose knowledge counts, and whose doesn't: knowledge of academic vs 'everyday' numeracies; experts vs lay knowledges of how to solve the problems that matter to people in different contexts. Fourth, there were also the challenges in researching numeracy practices outside of the school contexts because of the invisibility of maths in many everyday practices: many people are *consumers* or *subjects/ targets* of mathematisation and mathematical models, such as digital algorithms and complex formulae that calculate the value of a service or how much one is to be paid – but few are the *constructors* of the models (Jablonka 2010). This raises questions of power relations because these algorithms and formulae are inaccessible and non-transparent to the people who are being 'measured' or valued, or in some other way affected by the operation of the models . Finally, numeracy practices research shows clearly that numeracy practices are multimodal (Street and Baker 2006), drawing on a range of symbolic, visual, material resources, and our sensory perceptions,

including touch and hearing, producing embodied numeracy practices. Rose (2004), in his study of carpentry apprentices writes about the inadequacy of available vocabulary to describe the kinds of *disciplined perception* that carpenters use in judging aesthetics, pressure, symmetry, safety and force as they work with materials and equipment.

Reflecting on the contributions made in their collection of studies of numeracy as social practice, Jackson, Rogers and Yasukawa (2018) made the observation that whilst a social practice perspective on numeracy privileges the context-contingent nature of numeracy, contexts themselves are not stable and rigid. And there are important implications that need to be taken up in researching numeracy practices. Some of these sources of fluidity and instability include:

- New and different 'trustworthy' (and untrustworthy) social relationships that emerge when people's situations change, and how this can change the way numeracy practices are mediated;

- Introduction of new material and social technologies and the different ways in which they change people's numeracy practices;

- Decline of a social safety net and the individualisation of life course risk management so that households and individuals have to absorb the risks presented by, for example, the privatisation of education, health and other social services;

- 'Limits of the local' and the effects of globalisation and standardisation - for example the increasing numbers of countries subscribing to large scale international assessments that affect what kinds of knowledge are valued in education;

- Negotiating the impact of climate change and having to adapt to degrees of uncertainties - such as for planting crops, that are outside human control.

The next section outlines the approach and theoretical resources that will be employed in our exploration: the concept of the numerate environment and its theoretical framing using the third generation Cultural-Historical Activity Theory (CHAT). Using this approach, the third section will analyse three case studies of instability or changing contexts of numeracy practices. The case studies were selected to illustrate the first three of the sources of instability and fluidity of numeracy practices identified above. The fourth section will discuss the analyses before drawing some conclusions in the final section.

3 Numerate environment as a cultural-historical activity system

According to the OECD, numeracy is one of the '"key information-processing competencies" that are relevant to adults in many social contexts and work situations, and necessary for fully integrating and participating in the labour market, education and training, and social and civic life' (OECD 2013, p. 5). When we consider that these contexts and situations themselves are unstable, a question that

arises is: what happens to those adults who were competent in a context that is reconfigured through economic, technological, political or other influences? For example, when a service - say, advice about welfare entitlements - that was once provided through human interaction between the service provider and their client is replaced by an online service, what new skills are needed for the client to be deemed competent in the new form of transaction? The new skills that they need may not obviously be mathematical skills, such as calculations of percentages or applying a formula, but it may include skills related to clarifying which formula applies to their circumstance, or how to lodge a dispute about an underpayment through an electronic medium to a faceless institution whose location may be anywhere in the world. Thus, while reskilling may be necessary and effective in meeting new demands placed on individuals in contexts that have been transformed, it is important to also ask: are there opportunities for all affected individuals to access retraining; what is the cost of retraining or of not retraining, and who bears the cost; what is transformed other than the relevance or obsolescence of certain mathematical skills? In other words, a more holistic perspective is needed to understand the implications of uncertainties and fluidity in the contexts of numeracy practices.

To provide such a holistic perspective to understand the implications of a reconfigured context, we draw on the construct of the *numerate environment* proposed by Evans, Yasukawa, Mallows and Creese (2017). Evans et al. developed the theoretical construct of the numerate environment to consider the context upon which numeracy practices are dependent, focusing on aspects of:

— the *opportunities* the practices may offer to the adult engaged in them;

— the *supports* offered, or conversely the *barriers* existing (or put up) within these practices, and in the surrounding cultures more generally, that impede the adult's numerate development (2017, p. 22); and

— the *demands* that the practices may make on the adult.

Any one or all of these aspects of the numerate environment may change when, for example, the national currency is changed in a European country in favour of the euro (Kubascikova, Evans, and Khan 2018). But the *demands*, *opportunities*, and *supports* presented by this shift are *subjectively* perceived and experienced. In other words, what one group of people may see as an *opportunity* may be perceived as a *demand* by another. In the following section, we analyse how these aspects of a numerate environment change when the context of numeracy practices changes. To undertake this analysis systematically, we employ the analytical tools of third generation cultural-historical activity theory (CHAT) as developed by Engeström (2001).

As surveyed by Yasukawa et al. (2018), CHAT-based analysis has been utilised in several studies of numeracy practices. In these studies, a numeracy practice is considered as a cultural-historical activity system, that is, as an *object-* or goal-oriented system of interacting cultural *tools* (language, symbols, formulae, calculating and measurement devices), sets of historical *rules* (customs and practices), the *community* with which the practice interacts and the *division of labour* by which the goal is achieved (Yasukawa et al. 2018, p. 8). A key interest for CHAT (Engeström 2001) is how a *disturbance* to the activity system could uncover inherent contradictions or incompatibilities that lead to a reconfiguration of the activity system as it attempts to accommodate or in some other way respond to the disturbance.

With reference to the study of currency change in Slovakia from the national currency to the euro, we can consider the decision to change the currency as a disturbance to people's everyday numeracy practices, for example shopping. Clearly, the decision shifts a key *tool* that people use - the Slovak currency, to the euro. We could imagine that in the transition to the euro, some revision may have been required to the implicit or explicit *rules* that people may have used to decide whether certain goods were affordable or 'value for money'. Kubascikova et al. (2018) showed that in Slovakia's transition to the euro, the whole society was a *community* scaffolded with a number of state supplied *tools* that helped the citizens make sense of the new currency in relation to their old currency. While the switch to the euro was argued as an *opportunity* by the Slovak government in political and economic terms – and this had strong support from many Slovak citizens at the time – it can also be assumed that it created a new *demand* on the citizens to learn to convert from the old to the new currency. For some this may have been experienced as a constraint or *barrier* to their sense of financial competence during the early the transition period.

As a way of illustrating the value of the construct of the numerate environment and the use of CHAT-based analysis, we examine, through the lenses of these theoretical constructs and analytical frame, three social phenomena described in published research.

4 Disturbing the numerate environment

In order to illustrate the construct of the numerate environment as a cultural-historical activity system which may be disturbed and reconfigured as a result of these sources of instability and fluidity, we consider numerate environments in three different contexts. In section 2, we identified a number of sources of instability and fluidity in numeracy practices: in this section we focus on three of the sources: the erosion of the social safety net, the emergence of 'Big Data' and new technologies, and new methods of work. The particular examples are selected from recent research that we believe lend themselves to be re-examined through the lens of CHAT and the construct of the numerate environment.

4.1 Erosion of the social safety net

Grotlüschen, Buddeberg, Redmer, Ansen and Dannath (2019) studied the numeracy practices of adults in Germany experiencing economic vulnerability: "adults with low proficiency in numeracy, unemployed adults, longterm unemployed, and overly indebted or homeless adults" (p. 5). They found that these adults, contrary to common stereotypes, engage in very frequent numeracy practices, particularly involving money. However, they found that, compared to adults in more economically secure positions, they use technical devices such as calculators less in their numeracy practices. The authors hypothesise that this may reflect lack of ownership of or access to such devices.

A small Sydney-based study by Morris, Hanckel, Yasukawa and Gamage (2017) of perceptions that homeless adults or those at risk of homelessness have about literacy classes found that some participants felt a need for assistance in "filling out forms" to access services because "You name it. Everything you've got to do nowadays is filling out forms" (p. 6), and for classes that taught form-filling to be combined with computer classes because increasingly communication with and application for services from government organisations and other services are being conducted online. While the implications for numeracy were not mentioned explicitly in the context of form-filling needs, it is not difficult to imagine numeracy being involved in applying for housing and other welfare benefits. But it is not simply the language and mathematical demands involved in form-filling that changes as the process shifts online: adults requiring social services in many countries including Australia, are also finding that the services themselves, including employment services, are being outsourced to non-government private and not-for-profit institutions, thereby fragmenting the provision of services and passing on the burden of 'choice' to the service recipients (Olney and Gallet 2018). An example of a 'choice' can be seen in the provision of Australia's government funded literacy and numeracy programs, known as the Skills for Education and Employment (SEE) programs for adults on unemployment benefits. Private for-profit, not-for profit and public training and education providers bid for the contract to deliver these programs, there are locations in which "one or more SEE providers compete for clients" (ACIL Allen Consulting 2015, p. 12).

It is neither possible nor our intention to treat adults experiencing economic vulnerability in different countries, or indeed within any community, as a homogenous group. However, if social service providers are to increasingly expect service recipients to interact with them on the electronic medium, the latter will need to gain access to the digital *tools* as well as the skills to use them, and to learn to navigate the *rules* around services and welfare payments differently to what they may once have been able to do face to face in a government office.

4.2 'Big data' and new technologies

The phenomenon of 'Big Data' is penetrating various aspects of the public and private sphere from national security, high finance, advertising and education (O'Neil 2016). One of the areas in which 'big data' together with cloud technologies and

social media have the potential to reconfigure people's numerate environments is personal health. The risk sociologist Lupton (2016) discusses the prevalence of self-tracking devices that measure individual's physical activities and bodily functions through the enrolment of their body in the Internet of Things.

A person who relies on a self-tracking device to monitor indicators of their health will require different numeracy skills to a person who relies on the advice of a practitioner in a medical service. The self-tracking device becomes a critical tool for maintaining or achieving better health status, a tool that the person who relies on a medical practitioner for advice will not have to negotiate. Moreover, the person with the tracking device can dispense with, or certainly decrease, their reliance on their medical practitioner , while the doctor remains a necessary support for the person without the tracking device.

 This difference in the *community* that each accesses also reflects the nature of the support that each has in responding to changes to their health. While the former will need to notice the changes themselves through what the device tells them and then decide whether they need to get specialist medical advice, the latter will typically have the changes interpreted for them by the medical practitioner who would provide them with advice about treatment at the same time.

Lupton (2016) makes an additional observation about the adoption of self-tracking devices. She explains that on the one hand, these self-trackers may provide users with *opportunities* for greater self-knowledge, self-awareness and self-entrepreneurialism; on the other hand, they are perhaps unknowingly, exposing themselves to unquantifiable risks as their data is absorbed into a large data assemblage that could be used by third parties in unexpected, and potentially social exclusionary (or other discriminatory) ways. For example, the large data set could be used to correlate certain behavioural practices (e.g. jogging more than 4 times a week) with what might later be seen as 'adverse' health outcomes. Thus, for those who want to see the adoption of these devices as a *tool* for greater control over their health, there are additional risks that cannot practically be assessed, even if in some sense the *demand* to do so is there.

Decision-making involving risks, especially in relation to personal health or the health of one's dependent is a numeracy practice in which trust becomes a critical factor: whose advice and opinion can one trust to inform the decision one makes. Bellander and Nilokaidou's (2017) study documented the accounts of mothers of children with congenital heart diseases as they searched and accessed online medical information, other parents' experiences and practical strategies about decisions they needed to make or approaches to care. In this study, the online communication technologies offered *opportunities* and *supports* through the formation of new 'peer'-based *communities* of parents with shared concerns that supplemented the advice they were receiving through consultations with the medical practitioners. Thus, the social media offered a *tool* for negotiating the risky decision-making that they were uncomfortable undertaking based on their interactions with the medical practitioners

alone, a *tool* that was not available less than two decades ago. Papen's (2012) study of the information-seeking and learning strategies of health care patients also confirms information-searching and critical literacy affords *tools* that could enable health care patients to learn to access and exchange what is sensitive and private information within a trusted *community*.

4.3 New methods of work

In the workplace, new methods of work are a *disturbance* that can affect workplace practices, including numeracy practices. Yasukawa, Brown and Black (2013, 2014) studied production workers' literacy and numeracy practices in workplaces introducing a *lean production* methodology: increasing productivity and reducing waste. For a hearing aid manufacturer in this study, the change created a *demand* for new numeracy skills needed to work with new *tools* that were introduced to increase efficiency and productivity: a 3-dimensional graphical software and 3-dimensional printer to model and produce 'shells' that would enclose the components of the hearing aid.

While superficially, the workers' response to the *disturbance* in this workplace is congruent to their employer's goal, the labour studies researcher Worthen (2014) reminds us that there are always two *objects* at work in any workplace: one is the workers' goal of 'earning a living', and the other is the employer's goal of increasing productivity. In the study of the hearing aid company, the goal for introducing a new graphical software system was, from the employer's perspective, to increase productivity (Yasukawa et al. 2014); thus, the numerate environment configured by the lean methodology was an *opportunity* for the employer to cut costs and to increase efficiency. Some of the workers may have viewed the shift as an *opportunity* for them as workers too – for example, to undertake this work more efficiently, but this *opportunity* is different in the underlying motive to what the employer saw. For others, it may have been simply a new *demand* from the employer with which they had to comply.

In addition to the *tools* of production, the introduction of the lean production methodology also reconfigured the workers' *community*, *division of labour* and the *rules* of the workplace (Yasukawa et al. 2014). Workers were divided into specialist teams which had to set, monitor and document their own performance targets. While the proponents of lean production present this as devolving decision-making to worker teams, these targets are also promoted as 'incentives' for teams to increase productivity (production and profit for the company), and while cooperation may increase within some teams, different teams are set up in competition to one another. Thus for the workers, learning how to document their performance against their targets in tables and bar graphs, and calculating percentages to show change in performance from week to week or month to month is not simply an *opportunity* to learn new skills; they are equally *demands* that they need to meet in order to satisfy their primary goal of earning a living. These targets may also be experienced as *constraints* by some on how they pace and plan their work.

That changes in workplace practices can reflect new discourses about work, which in turn are reflected in literacy and numeracy practices, has been found in other workplace studies (see for example Belfiore, Defoe, Folinsbee, Hunter, and Jackson 2004; Gee, Hull, and Lankshear 1996). Brandt (2001) further shows how workplace struggles of competing interests (for example, between employers and employees) in increasingly documentation- and accountability-driven workplaces can both "stimulate learning and affect the worth of one's skills" (p. 50). However, opportunities and access to learning may be scarce in some workplaces, especially when the power relations are pronounced. Thus *support*, for example in the form of trade union delegates (see for example Yasukawa and Brown 2012) to enable the workers to uncover 'hidden' assumptions embedded in the way new methods of work and employment are organised becomes crucial in turning the stimulus for learning into empowering knowledge.

5 Discussion and Conclusion

Using the analytic lens afforded by CHAT, we have considered, contexts of numeracy practices that have changed or emerged, giving rise to reconfigured or new numerate environments. In this final section, we distil the key findings from our analysis, and then draw some implications for adult numeracy education, policy and research.

Adults' numerate environments may be *disturbed* in different ways, however, whether the disturbance leads to *demands, opportunities, supports* or *barriers*, can be seen to vary for a range of different reasons. In the contexts of the Sydney or the German homeless people, and for the production workers in the lean manufacturing sector, digital skills or 'financial literacy' / numeracy skills, or indeed digital financial literacy skills, feature as *demands* for new skills for the communities of adults or workers in their reconfigured numerate environments. For both of these groups, the shift from the previous methodology of applying for and obtaining welfare benefits - or conducting their work - was a decision made outside their sphere of influence: by the government or the employer, respectively. Both the government and management may have provided o*pportunities* for the welfare recipients or the production workers, respectively, to receive training in the new skills, However, the agenda for the training would likely be determined by government officials or workplace managers.

On the other hand, the parents negotiating information about their children's heart disease or the Fitbit enthusiasts are seeing the digital devices and media as new *opportunities* to expand their knowledge or to save time or reduce dependencies on visits to the doctor. In these examples, there is greater personal agency in the technology users adopting these new methods of seeking and monitoring health information. In both cases, the *opportunities* to learn about and monitor health indicators that were afforded to them by the new technologies, also led to the creation of new *supports*: in the case of the Fitbit users, a continuous feed of their own health metrics; and in the case of parents with children suffering from a serious

illness, an expansion of an online support network that could help them make certain decisions or obtain and decipher medical advice.

It may be argued that skills to operate technological devices, or to gain close understanding of one's personal finance is important and beneficial for individuals, or that people finding convenience or reassurance about health matters through the use of the digital media is positive. However, if we are concerned about the implications of the changing contexts of social practices on numeracy *education* and in particular, education that empowers the affected individuals, we suggest that the nature and sources of *disturbances* to the existing numerate environments should also be part of the educational focus. We draw on Jacobson's (2016) call for critical education in formulating our view on educational implications.

Critiquing the dominant rhetoric that literacy and numeracy training is the pathway out of poverty and to employment, Jacobson (2016) argues that we need to be addressing structural issues that are normalising social inequities; citing Bowles and Gintis (1976) he says that "band-aid remedies of liberal education reform" is not the solution" (p. 15). Thus we can continue to perpetuate the notion that people who are not gainfully employed are in need of more skilling – and digital literacy and financial literacy are identified as key areas for skilling by the OECD (see for example, OECD 2016, 2018b) and member countries (see for example, the Australian Security and Investment Commission's Financial Capability website at https://financialcapability.gov.au/). However, training or skilling in digital and financial literacy can only be band-aid remedies if other elements of people's numerate environment are not examined. For example, why is the homeless person in the study by Morris et al. (2017) finding that every service one seeks requires a form to be filled out, increasingly online? Why can't a welfare recipient speak to a welfare officer about the range of services they want to receive and then fill out just one form with support from the welfare officer where they outline the range of services they are seeking? Why do the production workers receive training on using Excel to record outputs and produce bar graphs to track their performance against targets, but not on making a case for a pay rise proportionate to the increased profit the company makes from the productivity increases? Why do manufacturers of 'Fitbits' ensure that users know how to record and interpret their sleep patterns, heart rates and calorie intake, but not provide some assessment of the risk of their personal data being absorbed into a larger data assemblage?

At the heart of these questions is the reconfiguration of the *community* that interacts with people's numeracy practices. As Bellander and Nikolaidou's (2017) study shows, numerate environments may be reconfigured and present *opportunities* for new *communities* of trustworthy members to emerge. On the other hand, some changes may fracture a community into individuals isolated from any support structure, leaving them to fend for themselves, or enlarge and accentuate the unequal power relations in the environment, such as a workplace. The analysis of the numerate environment of the manufacturing workers highlighted the latter. In the

manufacturing company, an element of the activity system that was being reconfigured with the introduction of the lean production methodology was its *object* or goal; the workers' primary *object* of 'earning a living' was being subsumed by their employer's goal of achieving greater productivity and cost savings, with little room for the workers to negotiate the context to prioritise and advance their own *object*.

If numeracy education is to be more than 'band-aid remedies', then we concur with Jacobson that educational programs need to engage adult learners in examining the link between the wider societal changes that are emerging through the dominance of a neoliberal ideology and the *demands and barriers* (as well as *supports*) that are emerging in their reconfigured environments. This is manifested in "small government", outsourcing of government services to the private sector and shifting lifecycle risks to individuals (Cahill and Toner 2018). Resisting and challenging the impact of this ideology requires individuals to act collectively, and this is exactly what the neoliberal ideology is trying (and succeeding in many areas) to inhibit.

The analysis in this paper suggests how numeracy education policy needs to attend, not just to the skills levels and needs of adults, but to what needs to be in place in formal educational institutions and communities (and importantly in the interface between the two) so that adults are *supported* to access and engage in numeracy development. It also suggests the importance of the availability of mediator roles such as a union delegate / representative in the workplace setting, not only to act as a mathematical 'tutor', but also to assist in uncovering the cultural and historical background to the workplace changes and their implications.

In conclusion, we suggest that future studies of numeracy practices, particularly in unstable and fluid contexts, seek to uncover the cultural and historical 'logic' that is being disturbed. For *support* in terms of skills, expertise and material tools is needed in order to develop a critical understanding of what is generating the new *demands*, and what might be needed to negotiate, resist or directly challenge those drivers that are working against the primary *objects* of the people the research is concerned about. We suggest that numeracy education should be a site where a critical numerate environment can be created where learners understand new *demands* (as well as *supports* and *opportunities*) placed upon them in the context of broader socio-political changes, rather than simply learning to become competent *consumers* of new practices.

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