

Can mobile health training meet the challenge of 'measuring better'?

Niall Winters, Martin Oliver & Laurenz Langer

To cite this article: Niall Winters, Martin Oliver & Laurenz Langer (2016): Can mobile health training meet the challenge of 'measuring better?', *Comparative Education*, DOI: [10.1080/03050068.2017.1254983](https://doi.org/10.1080/03050068.2017.1254983)

To link to this article: <http://dx.doi.org/10.1080/03050068.2017.1254983>



© 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 05 Dec 2016.



[Submit your article to this journal](#)



Article views: 14



[View related articles](#)



[View Crossmark data](#)

Can mobile health training meet the challenge of ‘measuring better’?

Niall Winters^a, Martin Oliver^b and Laurenz Langer^{b,c}

^aDepartment of Education, University of Oxford, Oxford, UK; ^bUCL Institute of Education, University College London, London, UK; ^cAfrica Centre for Evidence, University of Johannesburg, Auckland Park, South Africa

ABSTRACT


Mobile learning has seen a large uptake in use in low- and middle-income countries. This is driven by rhetorics of easy scaling, reaching the hard-to-reach and the potential for generating analytics from the applications used by learners. Healthcare training has seen a proliferation of apps aimed at improving accountability through tracking and measuring workplace learning. A view of the mobile phone as an agent of change is thus linked with a technocentric approach to measurement. Metrics, initially created as proxies for what gets done by health workers, are now shaping the practices they were intended to describe. In this paper, we show how, despite some valiant efforts, ‘measuring better’ remains difficult to achieve due to entrenched views of what measurement consists of. We analyse a mobile health (mHealth) classification framework, drawing out some implications of how it has been used in training health workers. These lead us to recommend moving away from a view of mobile learning linked tightly to accountability and numbers. We suggest a focus on an alternative future, where ‘measuring better’ is promoted as part of socio-cultural views of learning and linked with a social justice conceptualisation of development.

KEYWORDS

Mobile learning; mHealth; categorisation

Introduction

Mobile phones are increasingly being used to support healthcare training in low- and middle-income countries (LMICs), driven by demand for more accessible and scalable training opportunities (Edgcombe, Paton, and English 2016). In Sub-Saharan Africa, the proliferation of mobile phones has generated keen interest to implement mobile learning in a range of sectors. In this paper, we focus on mobile health (mHealth) training interventions for community health workers (CHWs) in LMICs. mHealth is most often described as the use of mobile phones for health-related work. One example is Mobile Medic, an app that uses mobile messaging, decision support and data gathering for health system analytics. We analyse how an approach to measurement and classification used to evaluate mHealth has affected the relationships of learning and question whether there are ways to measure the unmeasurable better.

CONTACT Niall Winters  niall.winters@education.ox.ac.uk

© 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Definitions of what comprises mobile learning differ on whether the technical or the pedagogical elements are emphasised. However, there is a consensus among many education commentators that mobile learning must be understood as a socio-cultural form of practice (Laurillard 2007; Sharples, Taylor, and Vavoula 2007; Wali, Winters, and Oliver 2008; Pachler, Bachmair, and Cook 2009), with a strong emphasis on mediated activity, collaboration and personalisation (Kearney et al. 2012). However, in much advocacy for mHealth, this conceptualisation is not used: views of mobile learning as ‘delivering education’ still dominate the field (O’Donovan, Bersin, and O’Donovan 2015). While it is difficult to determine precisely why this may be the case, it may be the result of cultures of training in medical education, where a focus on ‘mastery learning’ (particularly in simulation-based training) remains common (McGaghie et al. 2014). In this field there is limited use of socio-cultural theories of learning although a number of medical education researchers have advocated this (Bleakley 2006; Mann 2011). The numerous mHealth training initiatives reported in the literature (see Appendix 2 for a list of systematic reviews) rely on measuring and classifying conventional learning processes and outcomes. Thus simple ‘how many’ questions regarding outcomes are posed. These result in an instrumental view of technology and mean the complexities of the relationship between pedagogy and technology are not examined. Thus the promotion of mobile technology for global healthcare training occurs without drawing on the more critical or nuanced perspectives developed in the context of educational technology research.

In this paper, we show how reductionist models of learning have been embedded in a popular classification framework used to measure the unmeasurable. We detail how these approaches then become part of the ‘common sense’ understanding of learning within mHealth. From a development perspective, this reductionist position has diverted attention away from alternative ways of thinking about technology, learning and development, which draw on social justice perspectives (Farmer 2003; Fraser 2008; Tikly and Barrett 2011), and capabilities (Sen 2001). We seek to offer a critique of current forms of measurement and to provide a rationale as to why we need to go beyond them. We suggest that *measuring better* is achievable when a social justice conceptualisation of development is promoted with an emphasis on capabilities. We discuss the need to build a relationship between views of development and learning if we are to move to an emancipatory model of measurement of learning in mHealth.

Unasked questions about technology and learning in mHealth

Much research on the links between technology and education generally, and on the training aspects of mHealth in particular, celebrates the possibilities or potentials that technology seems to offer (GSMA 2010; Qiang et al. 2011). Less time has been spent examining whether there is any evidence to support these hopes (Selwyn 2016). Using ICTs to support education delivered in schools in LMICs has been accompanied by an effort to establish an evidence base from the causal effect of technologies on learning outcomes. While some meta-analyses identify a small but positive effect of computer-assisted learning (e.g. Petrosino et al. 2012; Kremer, Brannen, and Glennerster 2013; McEwan 2015), the most recent and comprehensive systematic review comes to a more cautionary conclusion describing ICTs’ impact on pupils’ educational outcomes as mixed (Snijlsteit et al. 2016). These reviews, however, did not include mobile technologies focusing instead on

traditional forms of computing. Langer, Winters, and Stewart (2016), focusing solely the evidence of mobile learning's impact in LMICs, established that effects range from mixed to positive but with small improvements in learning outcomes.

Thus cautious conclusions based on the evidence from systematic reviews regarding technologies' impact on learning stands in contrast to claims made about its potential. To take just one example, UNESCO (2014) has attributed an educational revolution in LMICs to the use of educational technologies. As a consequence, over the last few decades, work in this area can be characterised as having gone through several cycles of hype and disappointment – a process that seems to be repeated each time a new technology emerges (Laurillard 2008). Alternative ways of thinking about measurement might help in moderating claims about the unmeasurable.

Part of the problem, is that most research in this area is concerned with similar kinds of questions (Friesen 2009). Many studies focus purely on whether something has worked, rather than exploring why it worked (Bennett and Oliver 2011). The consequences of this include fragmented discussions, inconsistent use of ideas and a body of evidence that frequently fails to explain issues beyond the immediate case being studied (Czerniewicz 2010). Indeed, some of the lack of impact of new technologies can be explained by the nature of the applied evaluation designs used to look at them. Langer and colleagues argue that the application of rigorous impact evaluation designs (e.g. randomised control trials) to evaluate the effects of mobile learning programmes, is of little value if these programmes continue to evolve and iterate during the trial (Langer et al. 2014). The approach to measurement in this case seems to be a poor fit for the evolving nature of the technology intervention, the values underpinning it and the educational contexts in which it is implemented. Furthermore, commonly used forms of evaluation focus primarily on learning outcomes that are based on test score indicators. Effects of the technologies on teachers, education monitoring and information systems, or more development-related outcomes, such as changes in livelihoods and capabilities, are not investigated.

This has resulted in the use of an over-simplistic model of the role technology plays in learning. It is frequently assumed technology can simply cause improvements – an appealing fantasy, but one that ignores the complexity of educational practice (Pelletier 2009; Winters 2013; Unterhalter, Poole, and Winters 2015). Research in this area rarely moves beyond deterministic models of technology use, remaining naive about social influences on learning, and failing to account for the complexity of social situations (Oliver 2011). This reinforces 'solutionist' thinking, suggesting that the answer to complex problems is simply to add technology, as if its presence will inevitably result in improvements.

Friesen's critique of work in this area (2009) is particularly helpful in drawing attention to the kinds of questions researchers could have asked, but did not. Friesen draws on Habermas' discussion of knowledge-constitutive interests in order to distinguish between three kinds of research. The first concerns instrumental questions, focused on technical interests that address prediction, control, effectiveness and efficiency. The second concerns practical interests, which are interpretive and focus on understanding peoples' experiences. The last concerns emancipatory questions, which address questions of power, control and domination. Instrumental research, Friesen argues, is frequently associated with measurement-based research methods, such as surveys or experimental tests; alternative methods are required to explore practical or emancipatory concerns,

drawing, for example, on the kinds of approach developed within phenomenography or ethnography.

This tendency towards instrumental research has been shaped, in part, by the historical association between research into educational uses of technology and military funding (Friesen 2004). In this context, he argues, the focus on efficiency forms part of a wider orientation towards a 'command and control' model of education, in which learning is understood as a closed system, with the learner as a component inside the system whose performance may need to be optimised. This cybernetic account of 'learning as a weapon system', explained in terms of input/output measures, leads to an

emphasis on technical standards and specifications as solutions to pedagogical problems. If these problems can be understood simply as deficiencies in engineering and design, then their solution lies in the development of rigorous technical standards, and the instantiation of these standards in strictly conforming systems and implementations. (Friesen 2004, 68)

The importance of 'measuring better' comes, in part, from the possibilities this approach offers to move beyond such reductionist accounts.

Asking different questions about learning in mHealth

Although Friesen's critique was developed in the context of formal education, clear parallels can be drawn with the use of mHealth tools in global healthcare training. A necessary first step in this analysis is to develop a more nuanced account of what 'development' means, to parallel the discussions that have taken place with respect to learning. A social justice approach takes a broad and philosophical framing of what development is or can be (Farmer 2003; Tikly and Barrett 2011). Social justice, Nancy Fraser argues is primarily about setting in place opportunities for everyone, irrespective of background, to participate in decision-making processes regarding the impact and outcomes of development on their lives (Fraser 2008). Her view aligns with the work of Amartya Sen and colleagues on developing the capabilities approach as a framework to understand development as an expansion of freedoms and capabilities that people themselves have reason to value (Sen 2001; Alkire 2005; Nussbaum 2011). This conceptualisation has led to a large body of work on the formulation of a range of different measures of development including the multidimensional poverty index (Alkire et al. 2015) and the human development index (United Nations Development Programme 1999).

This shift in defining development as an expansion of capabilities rather than monetary and economic measures has had an influence on interpretations of ICT and development (Zheng, 2009; Andersson, Grönlund, and Wicander 2012; Kleine 2013). Instead of understanding the provision of technology to primarily increase human capital and subsequent economic development, it is argued, technology should be positioned as a tool to allow people to expand their freedom and capabilities. Kleine (2013), for example, suggests that ICTs can enhance people's real choices and that the well-being and agency defined from this increase in choice are more relevant measures of ICTs impact on development than economic indicators.

The stress in the capability approach on agency connects with Freire's (2000) critical pedagogy framework. Some studies of this in ICT show how these technologies can serve as a tool of liberation if they enhance people's critical consciousness (Fernández-

Baldor, Hueso, and Boni 2009; Kim 2009). Mobile learning, in particular, has been linked with critical pedagogy due to its emphasis – at least in education – on socio-cultural understandings of learning (Andersson and Hatakka 2010; Balasubramanian et al. 2010). Contextualisation of learning and the ability to generate new and more personal learning content and events, especially in marginalised contexts, through the use of mobile devices is assumed to allow learners to gain a critical consciousness and to enhance their agency. Questions of measurements for learning and ICTs from a critical pedagogy perspective then would focus on how the technologies are appropriated as a tool by marginalised groups in society to obtain consciousness of their situation and to formulate voices and occupy spaces to claim their participation (Unterhalter, 2017). Fraser argues that development ‘requires social arrangements that permit all to participate as peers in social life. Overcoming injustice means dismantling institutionalized obstacles that prevent some people from participating on a par with others as full partners in social interaction’ (2008, 16). Thus parity of participation by those who are living in poverty is essential in any project concerned with ICT and development.

It is important that institutional (or national) approaches to use ICTs and measure their effects do not exclude the marginalised by making them ‘voiceless’ or misrepresenting their needs. To take an mHealth training example, some (older) mobile technologies may not have the capability to generate or collect complex data, which could lead to simplified forms of classification and measurement regarding the lives of the poor. One way in which this can happen is reliance on the information that can be gathered by text messages from low-end phones rather than developing more sophisticated learning tools for smartphones. In the worst case, data may not be collected at all. Thus a range of questions about development and ICT have a bearing on how to evaluate mobile learning in mHealth and the approaches to measurement they use.

Learning in mHealth

The extensive growth of mHealth initiatives since 2005 has been accompanied by efforts to develop a system of categorisation and comparison. According to Labrique et al. (2013), the proliferation of mHealth interventions has led to the need for classification of existing work. They propose that the ‘absence of a shared language’ and ‘lack of a common framework’ have hindered efforts ‘to identify, catalog, and synthesize evidence’ (Labrique et al. 2013, 161). This has resulted in a lack of informed engagement with health-sector stakeholders and key decision-makers on mHealth innovation, as well as a distinct lack of integration with the formal health system.

To overcome these challenges, Labrique et al. suggested a two-step process:

- (1) classify existing work into 12 application areas and
- (2) develop an mHealth framework that maps ‘mHealth-facilitated interactions’ between actors in the health system.

The focus in this paper is on the way learning has been discussed in this arrangement. In *step 1*, learning is positioned under the application area ‘Provider Training and Education’. This category describes existing work as follows:

Now, mobile devices are being used to provide continued training support to frontline and remote providers, through access to educational videos, informational messages, and interactive exercises that reinforce skills provided during in-person training. They also allow for continued clinical education and skills monitoring – for example, through quizzes and case-based learning. (Labrique et al. 2013, 166)

In order to begin asking different kinds of questions about experiences of mHealth interventions, it is helpful to draw attention to some of the assumptions being made in this categorisation. Bowker and Star (1999) have argued that classification schemes do not provide neutral descriptions of reality; instead, they structure the world in profoundly political ways. They illustrate this point by discussing examples such as medical classification processes, revealing the influence of colonial powers concerned with managing the spread of tropical diseases along trade routes; and census data that include ethnic categories, which carry very different connotations in South Africa under apartheid than they would in (say) contemporary North America. Such points of contention might be visible during the development of classifications, but are often rendered invisible once the schemes are in use. In order to start asking different kinds of question, it is useful to bring this contention back into view.

For this reason, it is important to examine the consequences of the ways in which the classification scheme proposed by Labrique et al. define ‘learning’. Here, learning is framed purely in behavioural terms. For example, mobile technology serves to ‘reinforce skills’ through quizzes (usually delivered via SMS) and case-based learning can be used to form the basis for ‘continued clinical education’. Information dissemination is given a central role, usually through the provision of video content. This constitutes one of the simplest, least developed accounts of learning possible (Mayes and de Freitas 2007), ignoring social or developmental considerations and treating the process of learning as though it were simply about information transmission, retention and activation. It ignores, for example, challenges to the idea of ‘skills’, which question the extent to which these can be understood purely in terms of qualities inherent within individuals, rather than as something that must also be understood in terms of the resources, people, social norms, expectations and so forth that are on hand each and every time any ‘skill’ is practiced (Gourlay, Hamilton, and Lea 2013). The simplistic information transmission account also has marked similarities to the idea of ‘learning as a weapon system’, as critiqued by Friesen (2004). Further similarities can be drawn with the way empowerment has been emptied of a critical meaning as analysed by Unterhalter (2017). This approach leaves unaddressed questions regarding how mobile technologies could be used by CHWs to lay claim to their participation within health systems.

Although such complexities may not be explicitly acknowledged, mobile technology mediates practice (in support, for example, of workplace learning) across all of the ‘12 common applications’. To illustrate this, we analysed all 12 application areas to understand the changing role of CHWs, who have been a key constituency for mHealth initiatives in many LMICs. Although the range of work undertaken by CHWs varies from country to country, in previous work (Oliver et al. 2015) we have detailed the nature of their work in Kenya. In this case, they are volunteers who receive minimal training but act the main link between their community and official health system. Their work involves acting as healthcare generalists dealing with maternal and child health, HIV/AIDS drug adherence and general well-being of the community.

The Labrique et al. framework focuses on the work of CHWs, using technology mediation as a lens. In our analysis, we clustered the descriptions of their work into four key areas, with a specific focus on how mobile technology was used to: support CHWs' interaction with patients; the ways in which mobiles mediated their work in new ways; how supervisors and programme managers used data generated from mobile phones to gain increased oversight and management of CHWs, and the ways in which mobile technology was seen to support strengthening of the health system more broadly. Further details are provided in [Table A1](#).

Measuring accountability in various forms was found to be a key part of mHealth work. This is associated with the promotion of performance monitoring (including real-time tracking), the transfer of decision-making from CHWs to automated systems, the increased volume of content delivery and the use of mobile technology to help health workers follow predefined guidelines. In the terminology of Freisen, the role of technology is understood as being primarily *instrumental*: its purpose is to cause efficiencies in health systems. CHWs are treated as having limited agency and therefore technology is needed to measure and ensure accountability. This framing does not recognise or value concepts of education and training that emphasise the importance of contextualised learning, supportive supervision, peer learning or participatory engagement in communities of learning.

Labrique et al. seek to define the relationships between the 12 common applications of mHealth and the health system. At a systems level, the aim is to 'focus on the needs of the health system and on the intervention that the mHealth approach is facilitating, rather than on the technology being used' (169). Although limited, there is some effort to make the move from the *instrumental* to the *practical*, when considering health systems' goals and constraints and the networks actors are working within (including their links, experiences and interactions). Current applications, however, are not assessed in terms of how well they support health system integration. Instead, the complex networks of interactions that are needed for a health system to operate successfully are emphasised in the evaluation model. This acknowledgement of the need for a shift away from a technocentric viewpoint is an opportunity to explore socio-cultural approaches to learning. However, a clear tension remains evident between the learning practices of CHWs and the implementation of mHealth technologies within health systems. Although Labrique et al.'s intention is to make visible a world in which mobile tools are integrated with the health system, achieving this requires relationships that extend beyond the mHealth sector. Labrique et al. (2013) conclude that 'building consensus around a common taxonomy and framework' (169) is needed. They frame this as a benign process of clarification:

As mHealth stakeholders begin to use this tool and employ this common language to describe their mHealth innovations, we expect to foster improved understanding between mHealth innovators and mainstream health system program and policy planners. (Labrique et al. 2013, 169)

But, as Bowker and Star (1999) note, the spread of frameworks remains an inherently political process, in which individuals, organisations and systems are recruited to bolster the security of the classification system, spreading its influence and making it increasingly hard to avoid. In this case, this spread risks consolidating an over-simplistic view of

learning, and an account of CHWs in which they are described as having little or no individual agency.

We undertook a scoping review of mobile learning in mHealth interventions to examine how the framework was being used. Our search strategy was deliberately over-inclusive; that is, search terms were formulated to identify any mHealth review in LMICs, and the results were manually filtered down to identify reviews relevant to training and education. Eleven reviews were found that included research evidence on the application of mobile technologies to facilitate training and education of CHWs in LMICs. (A list of the reviews and their areas of focus is provided in [Appendix 2](#)).

The methodology sections of the 11 reviews were analysed to identify the classification schemes that had been adopted. Approaches to classification differed across the 11 papers: 2 adopted, and 1 further review adapted, the framework advocated by Labrique et al. (2013). Two of the reviews did not include any classification scheme; these were excluded from our analysis. The remaining six developed their own classification scheme. (Three of these six were written prior to Labrique et al.'s publication.) ([Table 1](#)).

Of those using the Labrique et al. (2013) framework for classification, Hall et al. (2014) described it being useful because it covers the broad scope of mHealth interventions and Peiris et al. (2014) noted that a 'key strength of this framework is its focus on health systems rather than specific technologies'. Bloomfield et al. (2014) developed Labrique et al. (2013) by integrating it with frameworks from the WHO (Nolte and McKee 2008) and Karanja et al. (2011), noting that they wanted 'to identify specific areas where evidence to support the efficacy of mHealth interventions in NCD management has been generated as well as those areas where such evidence is lacking' (Bloomfield et al., 2014, 2). In this way, neither review developed the framework through a more sophisticated account of learning; instead, they focused on the need to iterate on it so as it would be more applicable to their own area of interest.

Given that the limitations of the Labrique et al. (2013) framework have already been noted, it is worth focusing on the three reviews undertaken since then that developed their own framework. It is possible that the frameworks that were developed here either rejected Labrique et al.'s work in order to develop something that had greater emancipatory potential. However, there is no reference in any of these three to Labrique et al.'s work; if the authors were aware of it, they offered no appraisal or critique of it, and did not explicitly reject it. This suggests instead that these three alternative frameworks were developed in parallel. This leaves open the possibility that these might offer an improved form of measurement, if these alternatives went beyond an instrumental focus to consider more practical or emancipatory concerns.

However, those who developed their own framework provided similar rationales for the classification scheme they developed. These were concerned with scoping and specifying what was considered to count as relevant practice, although the rationales might be framed in terms of inclusion rather than exclusion of areas. For example, the rationales

Table 1. A breakdown of the eleven relevant systematic reviews. Three used Labrique et al. (2013) in some form, three developed their own framework and five were not relevant.

	Uses Labrique	Builds on Labrique	Developed their own	Pre-Labrique	Exclude
11 Reviews	2	1	3	3	2

included the need to provide a ‘more diversified description of the projects reviewed’ (Källander et al., 2013), and were intended to help understand the ‘various dimensions of health care ... including data collection, surveillance, training, health education, awareness, supervision, and monitoring’ (Goel et al., 2013). Braun et al. (2013) chose to use a framework developed by the World Bank (Berman et al. 2011) rather than develop their own, as this was commonly used for ‘programmatic and policy decisions’ and had a clear focus on strategies for improving Health Service delivery. Agarwal et al. (2015) classified their studies along three main domains: feasibility, training of CHWs and effectiveness of mobile applications – a framework that, again, follows an instrumental logic, concerned with interventions and effects in a mechanistic manner. Similarly, in line with Labrique et al.’s (2013) focus on health systems, Chib et al. (2015) developed what they described as an ‘inputs-mechanism-outputs’ categorisation, once again focusing on instrumental issues.

The use of the Labrique et al. framework for classification within the papers reviewed focused directly on the application of mobile technology. This was despite the fact that health system integration was of interest (particularly to Braun et al. [2013] and Peiris et al. [2014]). It was thus surprising that the step in the Labrique et al. (2013) framework, which is specifically designed for health system analysis, was not used by any of the systematic reviews. What we find instead is that the categorisation of mHealth within all of these other reviews involved sorting studies in terms of commonly used technical applications, that is, a technocentric lens. The first stage of Labrique et al.’s framework has been adopted, but the second has been ignored. In other words, although Labrique et al. (2013) had begun to develop their framework so that it supported practical *and* instrumental concerns, even this complexity was lost when others took up the framework. In all of these reviews, the instrumental view of knowledge has won out.

How might we measure better?

The consistent pattern we noted across the reviews of mHealth discussed above was the way analysts avoided complexity, and consideration of meaning or experience. Instead simplistic and instrumental questions about effectiveness and efficiency were addressed.

This pattern is important for two reasons. The first is that, across all of these reviews, the world that has been constructed by researchers is one in which learning is narrowly defined, and can therefore be measured. This leads to a focus on using technology for the development of ‘skills’ that can be easily accounted for, rather than (say) acknowledging the difficult material politics of training people in privileged contexts and then sending them out to practice without sufficient resources or infrastructure to be effective.

Thus, the notion of what a ‘CHW’ is (or can be) as defined by their working practices becomes constrained to that which is measurable, and ignores the difficulties that individuals might experience when trying to act effectively in challenging circumstances. Technological innovation is then simply equated to ‘new opportunities’ to measure to a greater level of sophistication. This can be seen as another example of the kinds of ‘solutionist’ views of technology already visible in other areas of mHealth.

These rhetorics of technology-enhanced accountability have been re-implemented in the context of training and development in order to use learning as another way to gain oversight of CHWs. The idea of technology-enabled accountability, for example, rests on the assumption that what is measured *is* what ought to be done. However, we

contend that what gets measured only *acts as a proxy* for what is expected, and indeed may only approximate what *actually* gets done. However, the politics of drawing attention to some practices rather than others, through measurement, inevitably changes the priorities of those who are being observed (see e.g. Blalock 1999). The use of mobile technologies to promote new forms of measurement can thus reshape – and can distort – the practices they are intended to describe.

The second reason that this pattern is important is that the goal of *measuring better* is hard to achieve. The current default position favours simplistic and instrumental approaches that use technological innovation simply to reinforce traditional approaches to measurement, albeit delivered in new, technologically mediated forms. This way of doing things needs to change if we are to fundamentally reconceptualise what measurement is, to answer the rallying call of measuring better. This will be a significant challenge but the ability to *measure better* has the potential to reframe how learning is defined in mHealth. The question remains: how to achieve it?

One way is to build on the alternatives to the limited and distorting accounts of the role of technology. UNESCO, for example, propose that ‘ICT can extend educational opportunities to marginalized groups; increase education quality; and reduce inequalities based on gender, class, race, age and disabilities’ (2014, 7). Achieving these objectives requires an understanding of the experiences of different groups (a practical concern, following Freisen’s analysis), and also a commitment to improving the balance of power (an emancipatory concern). As part of such a framework, ‘measuring better’ can become a way to extend educational opportunity by moving beyond questions of ‘how many’. This entails moving towards a social justice conceptualisation of development, to ask fundamental questions about the role of technology in mHealth training. In doing so, more normative grounds of justification for the use of mobile learning and training to decrease marginalisation can be developed. This could, for example, be aligned with existing and extensive work in health care, which sees health workers taking a ‘preferential option for the poor’ (Farmer 2003). In technology terms, this would imply making the best technology interventions available to all, not just those who are easiest to reach. This would engender a focus on the lived experience of marginalisation (in Friesen’s terms, a practical concern), including the underpinning causal processes faced by socially excluded groups (i.e. emancipatory concerns). At its core, measuring better would need to ensure that the development of new technologies does not have unintended consequences, such as outcomes that result in continued marginalisation, even indirectly. This is an on-going risk when following traditional approaches to measurement (see e.g. <http://digitalprinciples.org/be-data-driven/>). We believe the key to addressing this emancipatory agenda is to have greater levels of participation from marginalised communities to help develop more reflective understandings of measurement. This would help address the multiple disadvantages that poor communities face regarding their lack of influence on the form, content and mechanisms of measurement applied to them. To change this, lessons could be learnt, for example, from the participatory development of multidimensional poverty indices (see e.g. Alkire et al. 2015). Going back to Friesen (2009), this would see the questions regarding the use of technology in training move from instrumental to emancipatory concerns in order to address questions of power, control and domination.

Applying this perspective to the kinds of classification being used in the context of mHealth immediately challenges the dominant accountability agenda. The idea of

'measuring better' lays the groundwork for moving away from the simplistic, solutionist 'numbers view' of mobile learning, and towards one focused on the new forms of interaction (such as that between health workers and patients) that mobile technologies make possible. Therefore, if mHealth is to promote a socially just and inclusive view of mobile learning and training, we need to change the ways in which mobile learning is understood and categorised within mHealth. Returning to Friesen's discussion of different kinds of concern – instrumental, practical and emancipatory – the analysis of reviews above shows how limited discussions of practical concerns have been, and no evidence of emancipatory concerns was found at all, either within the original Labrique et al. (2013) framework or in the subsequent systematic reviews. If classification were questioned, or developed in participation with the groups being studied; or even, simply, if attention could be directed towards important but less easy to measure processes, issues of power, control and domination could be brought into focus. Raising awareness of these issues would inform a new type of decision-making process, in which new technologies could be leveraged in the interests of the most marginalised. The narrative would shift, positioning technology not as a means of reinforcing the existing top-down structure that controls practice, but instead as a mechanism for supporting and recognising more emergent, participatory and socially just changes in practice.

Conclusions

Research in mHealth has focused on the improvement of systems. This is valuable work, but the focus only represents one kind of question that could be asked in a research context. As seen in the field of e-learning, it is also important to consider practical questions about users' experiences of systems, and also emancipatory questions about how interventions alter the balance of power between actors.

In this context, discussions of learning have taken on an instrumental character. Learning is discussed in relation to training, with the focus being on improving the performance of individuals as components within the system. This 'command and control' orientation may lead to performance improvements, but comes at the cost of dehumanising the individuals who are treated as 'components' in the system.

This can be seen in mHealth applications that are focused on improved efficiency (such as automating communication) or on monitoring performance. Automating these processes brings efficiency, and this can be measured relatively easily. It is less visible whether such automations offer those using the system more or less autonomy, or support new kinds of professional decision-making. In other words, it is unclear whether improved efficiency will lead to greater professionalism, or deprofessionalisation.

This kind of formulation makes certain kinds of evidence impossible to gather. Well-being or equality, for example, cannot be evidenced because they are absent from the discussion; they have been made unmeasurable, and perhaps even invisible. New kinds of questions need to be asked, and new kinds of measurement developed, in order to focus on these other kinds of question. Frameworks such as that developed by Labrique et al. (2013) go some way towards measuring other kinds of change – but not far enough. In addition, the reviews that have drawn on this framework have been consistently narrower than Labrique et al.'s framework in their focus. The focus in this work has remained instrumental.

A measurement turn that brings in practical and emancipatory questions requires a richer and more sophisticated model of learning. There are many ways in which such broader questions could be pursued. As Mayes and de Freitas (2013) argue, research in e-learning has been reshaped by theories that have moved beyond simple information-based accounts focused on transmission or accumulation, to consider cognitive issues about what sense individuals make of this information, or social questions about the ways in which knowing things (including knowing how to do things) repositions them relative to other people. Barnett and Coate's (2005) research into the Higher Education curriculum similarly raises new research questions. They define the curriculum in terms of knowing, doing and being. This three-part framework then allows relational questions to be asked, about how learning enables individuals to understand, act in new ways and to become something new (a professional, a historian and so on), which enables them to reposition themselves within society. These richer accounts of learning show clearly how simple accounts that focus on measuring the volume of information that people are exposed to will remain blind to important questions. Granted, such concerns are frequently explored through qualitative and interpretive methods (Friesen 2009), but adopting categorical approaches such as those used in phenomenographic accounts of learning would allow much more detailed and sensitive research questions to be asked, opening up possibilities for new and better forms of measurement.

This discussion shows what is at risk of being lost when research focuses on what is easiest to measure. The 'unmeasurable' – the quality of peoples' experiences, the change in power dynamics – are hidden when the focus is placed on instrumental concerns about performance improvement, even if the overall intention of the work is oriented towards the good of society. Attempts have been made to 'measure better', even if only in simple ways, such as by documenting experiences. Understanding the quality of peoples' experiences is a necessary first step; other questions about the quantity and prevalence of such experiences may then follow. However, in order to measure 'better' – to provide an experience that recognises these questions of experience and power that other work have missed – it is necessary first to illustrate, and then to explain (through the development of theory) what it is that conventional measures have ignored. This is the challenge of measuring better in the context of mHealth training in LMICs: not just measuring more, but measuring what matters.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Economic and Social Research Council and the Department for International Development (ESRC-DFID) [ES/J018619/2].

Notes on contributors

Niall Winters is an Associate Professor of Learning and New Technologies at the Department of Education, University of Oxford. His primary research interest is in developing technological interventions for healthcare training in low-resource settings.

Martin Oliver is Professor of Education & Technology at the London Knowledge Lab, a research centre of the UCL Institute of Education. Recent work includes exploration of students' digital literacies and the development of mobile applications to support community health workers in Africa.

Laurenz Langer is a Research Synthesis Specialist at the Africa Centre for Evidence, University of Johannesburg. He has a particular interest in the use of research evidence by decision-makers to design and formulate pro-poor public policies and programmes.

References

- Alkire, S. 2005. "Why the Capability Approach?" *Journal of Human Development* 6 (1): 115–135.
- Alkire, S., J. Foster, S. Seth, M. E. Santos, J. M. Roche, and P. Ballon. 2015. *Multidimensional Poverty Measurement and Analysis*. Oxford: Oxford University Press.
- Andersson, A., Å Grönlund, and G. Wicander. 2012. "Development as Freedom – How the Capability Approach Can be Used in ICT4D Research and Practice." *Information Technology for Development* 18 (1): 1–4.
- Andersson, A., and M. Hatakka. 2010. "Increasing Interactivity in Distance Educations: Case Studies Bangladesh and Sri Lanka." *Information Technology for Development* 16 (1): 16–33.
- Balasubramanian, K., P. Thamizoli, A. Umar, and A. Kanwar. 2010. "Using Mobile Phones to Promote Lifelong Learning among Rural Women in Southern India." *Distance Education* 31 (2): 193–209.
- Barnett, R., and K. Coate. 2005. *Engaging the Curriculum in Higher Education*. Milton Keynes: Open University Press.
- Bennett, S., and M. Oliver. 2011. "Talking Back to Theory: The Missed Opportunities in Learning Technology Research." *Research in Learning Technology* 19 (3): 179–189.
- Berman, P., S. Pallas, A. L. Smith, L. Curry, and E. Bradley. 2011. "Improving the Delivery of Health Services: A Guide to Choosing Strategies." HNP Discussion Paper. Washington, DC: The World Bank.
- Blalock, A. B. 1999. "Evaluation Research and the Performance Management Movement from Estrangement to Useful Integration?" *Evaluation* 5 (2): 117–149.
- Bleakley, A. 2006. "Broadening Conceptions of Learning in Medical Education: The Message from Teamworking." *Medical Education* 40: 150–157.
- Bowker, G., and S. Star. 1999. *Sorting Things Out: Classification and Its Consequences*. Cambridge: MIT Press.
- Czerniewicz, L. 2010. "Educational Technology: Mapping the Terrain with Bernstein as Cartographer." *Journal of Computer Assisted Learning* 26 (6): 523–534.
- Edgcombe, H., C. Paton, and M. English. 2016. "Enhancing Emergency Care in Low-Income Countries using Mobile Technology-Based Training Tools." *Archives of Disease in Childhood* 101: 1149–1152.
- Farmer, P. 2003. *Pathologies of Power: Health, Human Rights and the New War on the Poor*. Berkeley: University of California Press.
- Fernández-Baldor, Á, A. Hueso, and A. Boni. 2009. "Technologies for Freedom: Collective Agency-oriented Technology for Development Processes." Unpublished Paper Presented at Annual Conference of the Human Development and Capability Association, Lima.
- Fraser, N. 2008. *Scale of Justice: Reimagining Political Space in a Globalised World*. London: Polity Press.
- Freire, P. 2000. *Pedagogy of the Oppressed*. London: Bloomsbury Publishing.
- Friesen, N. 2004. "Three Objections to Learning Objects and e-Learning Standards." In *Online Education Using Learning Objects*, edited by R. McGreal, 59–70. London: RoutledgeFalmer.
- Friesen, N. 2009. *Re-thinking e-Learning Research: Foundations, Methods and Practices*. New York: Peter Lang.
- Gourlay, L., M. Hamilton, and M. Lea. 2013. "Textual Practices in the New Media Landscape: Messing with Digital Literacies." *Research in Learning Technology* 21: 214–238.
- GSMA. 2010. *mLearning: A Platform for Educational Opportunities at the Base of the Pyramid*. London: GSMA.
- Karanja, S., L. Mbuagbaw, P. Ritvo, J. Law, C. Kyobutungi, G. Reid, R. Ram, B. Estambale, and R. Lester. 2011. "A Workshop Report on HIV mHealth Synergy and Strategy Meeting to Review Emerging

- Evidence-based mHealth Interventions and Develop a Framework for Scale-up of These Interventions." *Pan African Medical Journal* 10: 37.
- Kearney, M., S. Schuck, K. Burden, and P. Aubusson. 2012. "Viewing Mobile Learning from a Pedagogical Perspective." *Research in Learning Technology* 20: 14406.
- Kim, P. H. 2009. "Action Research Approach on Mobile Learning Design for the Underserved." *Educational Technology Research and Development* 57 (3): 415–435.
- Kleine, D. 2013. *Technologies of Choice?: ICTs, Development, and the Capabilities Approach*. Boston: MIT Press.
- Kremer, M., C. Brannen, and R. Glennerster. 2013. "The Challenge of Education and Learning in the Developing World." *Science* 340 (6130): 297–300.
- Labrique, A. B., L. Vasudevan, E. Kochi, R. Fabricant, and G. Mehl. 2013. "mHealth Innovations as Health System Strengthening Tools: 12 Common Applications and a Visual Framework." *Global Health Science and Practice* 1 (2): 160–171.
- Langer, L., N. Winters, and R. Stewart. 2016. "The Effects of Mobile Learning in LMICs: A Mixed-methods Systematic Review." Presentation to the Department of Basic Education, 6 April 2016, Protea Manor, Pretoria.
- Langer, L., N. Winters, R. Stewart, et al. 2014. "Mobile Learning for Development: Ready to Randomise?" In *International Conference on Mobile and Contextual Learning*, edited by M. Kalz, 156–167. Dordrecht: Springer.
- Laurillard, D. 2007. "Pedagogical Forms of Mobile Learning: Framing Research Questions." In *Mobile Learning: Towards a Research Agenda*, edited by N. Pachler. London: Institute of Education.
- Laurillard, D. 2008. "Open Teaching: The key to Sustainable and Effective Open Education." In *Opening Up Education: The Collective Advancement of Education Through Open Technology, Open Content, and Open Knowledge*, edited by T. Iiyoshi, and M. Kumar, 319–336. Boston: MIT Press.
- Mann, K. 2011. "Theoretical Perspectives in Medical Education: Past Experience and Future Possibilities." *Medical Education* 45: 60–68.
- Mayes, T., and S. de Freitas. 2013. "Technology-enhanced Learning: The Role of Theory." In *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning* (2nd ed.), edited by H. Beetham, and R. Sharpe, 17–30. London: Routledge.
- McEwan, P. J. 2015. "Improving Learning in Primary Schools of Developing Countries a Meta-analysis of Randomized Experiments." *Review of Educational Research* 85 (3): 353–394.
- McGaghie, W. C., S. B. Issenberg, J. H. Barsuk, and D. B. Wayne. 2014. "A Critical Review of Simulation-based Mastery Learning with Translational Outcomes." *Medical Education* 48: 375–385.
- Nolte, E., and M. McKee. 2008. *Caring for People with Chronic Conditions: A Health Systems Perspective*. Geneva: World Health Organization.
- Nussbaum, M. 2011. *Creating Capabilities*. Cambridge, MA: Harvard University Press.
- O'Donovan, J., A. Bersin, and C. O'Donovan. 2015. "The Effectiveness of Mobile Health (mHealth) Technologies to Train Healthcare Professionals in Developing Countries: A Review of the Literature." *British Medical Journal Innovation* 1: 33–36.
- Oliver, M. 2011. "Technological Determinism in Educational Technology Research: Some Alternative Ways of Thinking about the Relationship Between Learning and Technology." *Journal of Computer Assisted Learning* 27 (5): 373–384.
- Oliver, M., A. Geniets, N. Winters, I. Rega, and S. Mbae. 2015. "What do Community Health Workers Have to Say about Their Work, and How can This Inform Improved Programme Design? A Case Study with CHWs Within Kenya." *Global Health Action* 8. Retrieved from <http://www.globalhealthaction.net/index.php/gha/article/view/27168>
- Pachler, N., B. Bachmair, and J. Cook. 2009. *Mobile Learning: Structures, Agency, Practices*. New York: Springer.
- Pelletier, C. 2009. "Games and Learning: What's the Connection?" *International Journal of Learning and Media* 1 (1): 83–101.
- Petrosino, A., C. Morgan, T. Fronius, E. Tanner-Smith, and R. Boruch. 2012. *Interventions in Developing Nations for Improving Primary and Secondary School Enrolment of Children: A Systematic Review*. London: International Initiative for Impact Evaluation (3ie).

- Qiang, C., M. Yamamichi, V. Hausman, and D. Altman. 2011. *Mobile Applications for the Health Sector*. Washington, DC: The World Bank.
- Selwyn, N. 2016. *Is Technology Good for Education?* London: Polity.
- Sen, A. 2001. *Development as Freedom*. Oxford: Oxford University Press.
- Sharples, M., J. Taylor, and G. Vavoula. 2007. "A Theory of Learning for the Mobile age." In *The Sage Handbook of e-Learning Research*, edited by R. Andrews, and C. Haythornthwaite, 221–224. London: Sage.
- Snilstveit, B., J. Stevenson, R. Menon, D. Phillips, E. Gallagher, M. Geleen, H. Jobse, T. Schmidt, and E. Jimenez. 2016. *The Impact of Education Programmes on Learning and School Participation in Low- and Middle-income Countries: A Systematic Review Summary Report*. London: International Initiative for Impact Evaluation (3ie).
- Tikly, L., and A. Barrett. 2011. "Social Justice, Capabilities and the Quality of Education in Low Income Countries." *International Journal of Educational Development* 31: 3–14.
- UNESCO. 2014. *Reading in the Mobile Era: A Study of Mobile Reading in Developing Countries*. Paris: UNESCO.
- United Nations Development Programme. 1999. *Human Development Report*. New York: Oxford University Press.
- Unterhalter, E. 2017. "Balancing Pessimism of the Intellect and Optimism of the Will: Some Reflections on the Capability Approach, Gender, Empowerment, and Education." In *The Capability Approach, Empowerment and Participation: Concepts, Methods and Applications*, edited by D. A. Clark, M. Biggeri, and A. Frediani. London: Palgrave.
- Unterhalter, E., N. Poole, and N. Winters. 2015. "Education, Information, and Knowledge." In *Thinking Beyond Sectors for Sustainable Development*, edited by J. Waage, and C. Yap, 51–61. London: Ubiquity Press.
- Wali, E., N. Winters, and M. Oliver. 2008. "Maintaining, Changing and Crossing Contexts: An Activity Theoretic Reinterpretation of Mobile Learning." *Research in Learning Technology* 16 (1): 41–57.
- Winters, N. 2013. "Mobile Learning in the Majority World: A Critique of the GSMA Position." In *Sage Handbook of Researching Digital Technologies*, edited by S. Price, C. Jewitt, and B. Brown, 402–411. London: Sage.
- Zheng, Y. 2009. "Different Spaces for e-Development: What can We Learn from the Capability Approach?" *Information Technology for Development* 15 (2): 66–82.

Appendix 1. Examples of the ways mobile phones are used in relation to CHWs work across the 12 mHealth and ICT Applications.

Table A1. Some of the ways mobile phones are used in relation to CHWs across the 12 mHealth and ICT Applications.

How CHWs interact with patients	How CHWs use technology in their work	How is technology used to manage CHWs?	How the use of technology relates to Health System Strengthening
Supporting behaviour change	Health content delivered to CHWs via their phones. This can be SMS-based	Accountability	Extended reach
Monitoring adherence to guidelines	Routine health collection & reporting (near-instantaneous) of patient data	<ul style="list-style-type: none"> Active reminders Prioritise follow-up 	Data reporting (for example, of mortality rates)
	CHWs using the phone in new ways:	Overcome inefficiencies with paper	Overcome disparities in health outcomes
	<ul style="list-style-type: none"> To follow defined guidelines (could be positive or negative) Automated algorithm- or rule-based instructions Checklists 	Aggregation to analyse health system or disease statistics, by time, geographic area or worker.	Enable <i>longitudinal</i> population information systems & health reporting
		Identifying patterns	Redefined the boundaries of Care coordination
		Reduction of clinical errors through CHWs'	Work across hierarchies
	Transfer decision-making to auto systems	<ul style="list-style-type: none"> Adherence to protocols Checklists 	Reinforce skills
	Support for remote consultation	Performance monitoring (also framed as 'supportive supervision')	
		<ul style="list-style-type: none"> Volume of digital productivity Real-time GPS tracking of workers Monitor exchange of SMS messages Visibility of system performance 	

Appendix 2. List of systematic reviews

Agarwal et al. 2015. "Evidence on Feasibility and Effective Use of mHealth Strategies by Frontline Health Workers in Developing Countries: Systematic Review." *Tropical Medicine and International Health* 20 (8): 1003–1014.

Aranda-Jan et al. 2014. "Systematic Review on What Works, What Does Not Work and Why of Implementation of Mobile Health (mHealth) Projects in Africa." *BMC Public Health* 14: 188. <http://www.biomedcentral.com/1471-2458/14/188>.

Bloomfield et al. 2014. "Mobile Health for Non-communicable Diseases in Sub-Saharan Africa: A Systematic Review of the Literature and Strategic Framework for Research." *Globalization and Health* 10: 49. <http://www.globalizationandhealth.com/content/10/1/49>.

Braun, R., C. Catalani, J. Wimbush, and D. Israelski. 2013. "Community Health Workers and Mobile Technology: A Systematic Review of the Literature." *PLoS ONE* 8 (6): e65772. doi:10.1371/journal.pone.0065772.

Chib, A., M. van Velthoven, and J. Car. 2015. "mHealth Adoption in Low-Resource Environments: A Review of the Use of Mobile Healthcare in Developing Countries." *Journal of Health Communication* 20 (1): 4–34. doi:10.1080/10810730.2013.864735.

Goel, N. et al. 2013. "Bridging the Human Resource Gap in Primary Health Care Delivery Systems of Developing Countries with mHealth: Narrative Literature Review." *JMIR Mhealth Uhealth* Jul–Dec; 1 (2): e25.

Hall et al. 2014. "Assessing the Impact of mHealth Interventions in Low- and Middle-income Countries What Has Been Shown to Work?" *Global Health Action* 7: 25606. <http://dx.doi.org/10.3402/gha.v7.25606>.

Hurt, K. et al. 2016. "mHealth Interventions in Low and Middle-income Countries: A Systematic Review." *Global Journal of Health Science* 8: 9. <http://dx.doi.org/10.5539/gjhs.v8n9p183>.

Källander, K. et al. 2013. "Mobile Health (mHealth) Approaches and Lessons for Increased Performance and Retention of Community Health Workers in Low- and Middle-Income Countries: A Review." *Journal of Medical Internet Research*, 15 (1): e17. doi:10.2196/jmir.2130.

O'Donovan, J. et al. 2015. "The Effectiveness of Mobile Health (mHealth) Technologies to Train Healthcare Professionals in Developing Countries: A Review of the Literature." *BMJ Innovations* 1: 33–36. doi:10.1136/bmjinnov-2014-000013.

Peiris et al. 2014. "Use of mHealth Systems and Tools for Non-Communicable Diseases in Low- and Middle-Income Countries: A Systematic Review." *Journal of Cardiovascular Translational Research*. doi:10.1007/s12265-014-9581-5.