The quantified self for learning: critical questions for education
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While the quantified self community remains a relatively niche group, using technology to record and track information about at least one part of our lives is becoming more commonplace. Particularly in health, where people can now use technology to monitor exercise, calorie intake and other metrics to improve their overall fitness (e.g. Fitbit) or assist their own health or others through collecting and sharing data (e.g. PatientsLikeMe), we are starting to see data as a way to help inform our own life choices through providing us with a means of collecting information about ourselves over time, and sharing and comparing this data with others if we wish to do so.

In learning and education, less has been said specifically about the quantified self, although it can be seen in the current trends of 'gamification' for certain learning activities and connects closely to learning analytics and wider discourses about personalisation.

As Rivera-Pelayo and colleagues (2012) suggest, quantified self approaches to collecting data about an individual could support reflection amongst individuals about their own learning. Certain specific behaviours or psychological states relevant to learning (e.g. time on one task, number of words written per hour, emotional state) could be tracked and connected to specific learning outcomes (e.g. time spent on task and essay grade, or perseverance and score on maths homework). Such information could inform more effective study practices (e.g. knowing what times of day is most productive, increasing time on task) and give useful feedback on learning strategies (e.g. levels of resilience in difficult learning tasks); supporting metacognition. Such activities could be further broadened to connect more specific data about cognition and learning with wider data sets about the individual that are relevant to learning. This might involve, for example, adding additional information about location, content of websites explored, information about nutrition or exercise, peer or school nominated data, or data about friends or peers. Such data can be collected automatically and / or through self-report, and similarly an individual could become significantly involved in the analysis of their data, or the 'results' about their learning process and performance could be automatically fed back to the user at appropriate time points. Individuals could use this information over time on an individual or group level (Rivera-Pelayo et al., 2012).

It is possible to see a range of learning benefits from such activities, both to the individual by reflecting on their learning processes and outcomes by engaging with the data about themselves in a variety of ways, but also potentially by sharing and comparing data with others to perhaps become part of a community, there is specifically concerned with learning. While it remains an open question, it is reasonable to assume that quantified self approaches to learning will not only be an informal practice, but one that is adopted and used to some extent within the formal education setting.

Those engaged in the learning analytics field have noted a number of issues that need to be considered if the principles from the quantified self community are to be taken up in any kind of meaningful way by the majority of students in education. These include: how to determine what can and should be measured in order to support the learning process (Wise et al., 2013); how to develop measures that are relatively light touch, because if it is too much effort people will not provide enough data to the system (Rivera-Pelayo et al., 2012); how best to develop systems which enable individuals to engage with their data and / or with the support of others to ensure maximum learning benefit (Harfield, 2014); and how to address legal and ethical issues when combining individual's data from multiple data sets.

There is perhaps a risk, when such questions are asked, that we move quite quickly into a discussion of practical issues: of being careful to measure only those aspects of learning that theories in the learning sciences direct us towards; or developing institutional policies on the protection of students privacy and how the data will be used. Yet questions such as those listed above are not just practical, they speak to a wider set of arguments about our philosophical principles regarding the purposes of learning and education. Indeed, the use of practices related to the quantified self-movement are not neutral and, like personalised learning, could potentially be closely associated with neo-liberal education policies (Prain et al., 2013) if we choose to use them in such a way.

The seemingly simple act of using numbers to describe the incredibly rich and complex process of how we learn could result in a range of consequences that vary from individual to individual, and thus decisions about how we want to develop and support such practices need careful consideration.

For example, we know that one of the significant challenges of applying quantified self principles to learning is to determine what parts of the experience, process, and outcomes of learning can really be measured in quantifiable terms. There is likely to be a kind of trade-off between the reliability of the data that can be collected and the richness of what can be measured. This risks certain kinds of learning behaviours and outcomes (i.e. approved study practices or nationalised test scores) or an ideal learner being postulated and viewed as 'optimum', which may not adequately account for, or properly reflect, an individual's strengths, creative approaches to learning, or achievements of other messier learning outcomes. In turn this could lead to students focusing on improving a narrow list of certain kinds of behaviours. Indeed, in their study of how personalisation practices are enacted in schools, Beach and Dovemark (2009) found that if such outcome measures are very prescriptive and fixed, this leads to a lack of creativity in learning, where certain kinds of 'approved' behaviours are adopted in order to succeed in such a system. Rather than such systems improving and broadening the learning experience, it may in fact do the opposite.

Relatedly, the datafication of learning could also unintentionally shift the focus of reflecting on learning away from learning itself and instead on to the measures (Wise et al., 2013). Such measures could distract from learning as individuals start to focus on the countable aspects of the learning process, which can act as a comfortable diversion from the learning process itself. Hours spent revising, numbers of words written per day, multiple choice questions answered in half an hour, can all become the most important metric, rather than the quality of the writing, the mathematical thinking or the learning process itself. To try to prevent a focus on the data, discussions of metrics with educated others (Harfield, 2014), or using the data as part of some form of wider learning programme (Wise et al., 2013), could both be useful strategies. However, data has a captivating and powerful quality, as any assessor who wishes their students looked more at their feedback than the final mark will attest.

The powerful effect of data could potentially have other impacts. Over the lifecourse individuals develop a sense of self, strengthened or changed as a result of their life experiences. The way people interpret, understand and remember these experiences, and how they relate to their understanding of themselves, is necessarily partial and shaped. In a similar way, an individual's self-concept for learning is based on their recall of instances or examples from their learning lives that they hold up as key examples of who they are as learners. But what happens to the development of that self-concept when someone has access to a mass of data points, telling them quite a different story from what they expected it to say? What do people do in this situation – do they ignore their intuition – and prioritise the technically 'correct' version of themselves over their own messier (and perhaps more positive) perceptions? Having such information about themselves can be useful, but only if they are able to interpret it with an understanding of what the data is really capturing and

how far they should invest in it. In part, such reflection can be supported through programmes, the design of the system or an educator, but if the gap between a student's own 'truths' about themselves and the data is too wide, it could be challenging for even the most confident and experienced of learners.

Also inherent in a move towards facilitating quantified self approaches for learning, is that individuals take more responsibility for their learning. However, such data centric approaches may not be sensitive to wider social contexts, which risks individuals who are not performing so well being labelled a problem. This can be very problematic, particularly if the individual is someone who simply has not had the life experiences or life chances of others. Indeed, it is conceivable that such metrics may overvalue behaviours that only occur to those who are already better off in all kinds of ways. If an individual is deemed very different to the 'average', what happens to that person? This could be a significant issue as those who are from better off circumstances are likely to have more resources to counteract or contest such data than those who are from less well off backgrounds.

There are numerous potential benefits from the adoption and use of quantified self in learning: for the learner (enhanced motivation, additional support, informed learning choices, enhanced meta-cognition), their educators, and as a significant resource for researchers. However, there are questions too. We currently have a limited understanding of the ways the quantified self could offer new insights into learning or risk closing down creativity or alternative learning pathways, change learner self concept, or shape educational opportunities. What is essential though is a critical approach to the study of the topic. Encouragingly, some recent articles taking such an approach to various questions in data in education have appeared in Learning, Media and Technology (e.g. Anderson, 2015; Selwyn, 2015) and we would welcome more. Education and data is still a relatively new area which needs more careful and critical attention from the research community. The increasing focus on the quantified self is one area that raises numerous interesting but tricky questions to explore.

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