What is 'mathematical well-being'? What are the implications for policy and practice?

Tracy Part

London Metropolitan University

> This project will attempt to investigate the 'usefulness' of the capabilities framework as a means to empower adult learners to identify and reflexively consider the mathematics that holds intrinsic value to them. The discourse terrain offered by the twin concepts of capabilities and well-being will be used to sketch a theoretical landscape to show how a learners approach to learning mathematics can either impinge or capitalise on the substantive opportunities that present for improved mathematical wellbeing.

Literature review: background to the capabilities framework

Amartya Sen, Nobel prize-winner, economist, and political philosopher is one of the twenty-first centuries key thinkers and is the architect of the multi-dimensional capabilities framework; a broad analytical model that makes normative (moral) assessments about the quality of life and equality of social arrangements. The approach lies within the liberal school and forms its roots from a sometimes curious plurality of perspectives including Aristotle, Adam Smith, John Stuart Mill and Karl Marx (Sen 1999), whereby the heart of the paradigm revolves around two core principles

> "first, that the freedom to achieve well-being is of primary moral importance, and second, that freedom to achieve well-being is to be understood in terms of people's capabilities, that is, their real opportunities to do and be what they have reason to value" (Robeyns, 2011).

Sen (1999) posits that in contrast to the contemporary Utilitarian evaluative indicators (with a focus on income and wealth), social arrangements should primarily be evaluated through a focus on the actual living that people manage to achieve; the obstacles that they face but more importantly, on the freedoms to achieve the types of lives they want to lead. Sen describes well-being as the substantive freedoms people have to achieve the functionings that they value; a recognition of freedom and opportunity that is independent of whether or not translated into achievement. Well-being is developed through capability vectors, which Sen describes as

> "the various combinations of functionings (beings and doings) that the person can achieve (or do) ... reflecting the person's freedom to lead one type of life or another ... (or) to choose from possible livings" (Sen, 2009)

Advocates of the Capabilities framework in an educational setting argue that traditional indicators fail to adequately consider the cultural, social and political barriers that can serve to perpetuate inequality through the educational system. I hope to use the Capabilities framework as the conceptual means to collapse and disaggregate the notion of agential freedom to evaluate the extent to which a small sample of adult learners have been able to distinguish between the mathematical competencies (for qualification purposes) and the capabilities for well-being. This

research also intends to investigate the usefulness of the notion of well-being as an appropriate proxy for learners, practitioners and policy makers to reflexively evaluate an individual's response to *real and lived* opportunity as they present throughout the learning experience.

The capabilities framework, however is a tool to measure (in)equality and does not attempt to provide an evaluative spotlight to gather insight into how an individual comes to navigate their life experiences. In realising that I wanted to ask the learners about their own learning experiences, I became keenly aware of the apparent limitation of the discourse to embrace the particularities brought about by individual voice. Elaine Unterhalter (2006) provides a useful framework from which to start to interweave the theoretical purposes that may traditionally, be regarded as threads that should not be readily stitched together.

She advocates that it is essential for researchers to continue to challenge universal definitions, with particular regards to gendered assumptions about the ways in which learners approach education. She argues that although normative guidelines are necessary to make evaluative statements about the equality of social arrangements; she also asserts a continued need to focus on the fluid and often shifting processes that create identity. Especially, she argues, for those more likely to experience marginalisation and she posits an and/both approach that views different purposes as opposite sides of the same coin; as opposed to theoretical tensions that need to be resolved.

With this in mind, I intend to supplement the capabilities framework by drawing from a variety of educational discourses to capture the sense making processes and the concurrent representations (Squire, 2009), as the individual participants position themselves with regards to mathematics and wider learning. Three perspectives will shape my interpretations including Bourdieu's understanding of *habitus* (1977) and *field* (1993), a Vygotskian focus on language as a cultural tool and a Foucauldian interrogation of power dynamics through discourse analysis.

Gap in knowledge

Given the size of the sample and the methodological approach that I have undertaken, I feel it would not be useful to attempt to construct, at this stage, a multi dimensional measuring device for evaluating the impact of learning mathematics on an individuals' freedom to live a life that they value. Instead, drawing from strands of critical mathematics pedagogy and post-structural literature on voice, I intend to use the interview space to explore difference by encouraging the participant to problematise their approaches to mathematics with particular reference to the structuring factors of class, race and gender that have impacted on their opportunity to learn. I then propose to use the richness of the multiple horizons (Rapley 2004) to pool the emergent themes in order to investigate the potential usefulness of the twin pillars of capabilities and well-being as a powerful tool for learner self assessment.

Outline of research

Research questions

- To what extent do values and beliefs influence the ways in which learners approach classroom mathematics?
- How do learner perceptions of formal mathematical structures affect their learning progress?

- What are the implications, for policy and practice, of using the concepts of capabilities and well-being for improving the experience of learning mathematics?

Sample

The sample is non-probability based and has been purposively constructed to capture a breadth of learning contexts. In total there is a sample of 11adult learners (19+) from a variety of educational settings including:

- discrete numeracy settings including an adult education college, a residential women's college, family learning provision within a primary school and work based learning (classroom assistance)
- embedded numeracy provision including foundation tier (business), ESOL learners (IT) and an access to HE programs (nurses and teachers)

The learner participants have been drawn from a small sample of experienced and specialist mathematical teachers who, to a varying degree, interweave mathematical discourse (as a pedagogic approach) into the learning of mathematics.

Methods

The data has been collected through a variety of techniques drawing from a narrative approach to capture learners' voice, non-participatory observation for discourse analysis and then followed by a semi-structured in-depth interview. In taking a flexible methodological approach, I have attempted to ensure that the data collection tools serve to complement rather than restrict participant voice.

Oppenheimand (1992), Rapley(2004) , Ritchie and Lewis (2003) all concur that with preparation and reflexivity, the researcher should aim to humanise the interview process. Whilst Rapley (2004) warns against the interviewer falling into the binary trap of attempting to choose between neutrality and opting for personal disclosure prior to meeting the individual participants, Oppenheim (1992) jutaxposes this stance advocating a more determind line. He argues that the processes of interviewing are "inextricably and unavoidably historical, political and context bound" stating that it is simply not useful for a researcher, particular an inexperienced one, to attempt to situate themselves as neutral tool. Instead, he likens the use of personal disclosure to that of a walking stick; that is as a tool that can help some participants to find their feet during the interview process. It is with this view in mind that I have undertake a narrative approach to collecting the learners' life educational history.

I designed an open interview guide, to create space for the participants to talk about and to prioritise their learning experiences. Throughout this phase, I asked the participant to identify their own personal as well as mathematical strengths, which I then used as a platform to interpret how they construct and respond to the obstacles that, thus far, have prevented them from becoming the mathematician that they feel they could have achieved. In taking this approach, I held two purposes in mind: The first is to co-construct a positive (rather than a deficient) space for the participants to discuss their approaches to learning and the second, to analyse the role of agency, capabilities, and well-being, in overcoming complex (material, personal and cognitive) barriers to learning.

However, asking a participant to relay (with examples) what mathematics means to them and to describe the sort of a mathematician they aspire to be, is abstract and almost impossible to visualise let alone answer. If I am to ask the

research participants such abstracted questions, I need to do so in a meaningful way. I want to be able to discuss how they approach learning through the theoretical lens of analysing how they 'do' mathematics and how the solution was negotiated within the group and I intend to use the second interview to achieve this focus. I will use observations from a mathematical class as the tool to conduct a semi-structured interview from which to co-construct an account of the learning experience.

Interpretative paradigm

I am for the moment, using grounded theory as a theoretical guide to allow the learner voice to generate theory however, I remain keenly aware that even with a more fluid Glaser or Charmezque (Charmaz, 2010) framework; I am not undertaking grounded theory research. There are many points of similarity which has allowed me to use the initial part of the framework as useful structure as I learn to interpret voice. Nevertheless I am coming to this research as an experienced practitioner and if I were to view my teacher self through a grounded theory lens, I would have to create a veil of ignorance to cover my professional knowledge in order to remain open minded to participant voice. I can see the dilemma but would prefer to use a reflexive biographical approach to identify and reconcile my preconceptions so that I can use my knowledge professional and personal strengths to guide my findings. Once I am confident that I have listened to (rather than inferred from) participant voice, I will then move towards a more thematic approach to investigate the root causes of the barriers that have thus far prevented this small sample of adult learners from becoming the sort of mathematics that they feel they should have achieved.

Findings

Thus far I have completed all of the initial narrative based interviews and am about to start the non-participatory observation and subsequent semi structured interviews. Although I have by no means analysed the data, there appears to be some promising emergent themes.

… on relationship with mathematics

According to Heather Mendick (2005), learners often hold a fluid, fragmented and often-contradictory identification with mathematics where mathematicians tend to be characterised as independent thinkers who are separated from, rather than connected, to the rest of the world. 'Real' mathematicians tend to be different to other people and the preliminary result of this research shows similar patterns of identification. Within this small sample, many of the learners have constructed their relationship through the lens of an idealised often masculine vision of a 'mathematician' and this tendency to view mathematics through a lens of 'otherness' is nicely captured by J's remarks in her initial interview

> ... So it's almost like hands off, I don't know. So I think I have been brought up in
> that sort of environment although my father worked as an engineer so it's almost
> like, well he's the one that knows it all so ... yeah. (J 2011)

… on the narrative of the ideal learner

M studying mathematics on a foundation learning tier course in Business, like J, she voices her (in)ability to 'do' mathematics in relation to 'otherness' generated by her vision of an 'ideal' mathematician. M is not alone in her thoughts; according to Boaler (2009) speed and memory are often cited by learners as the key mathematical skills that must be learned in order to succeed.

> "Yeah it takes me so long and everyone will do it like that (clicks her fingers) and do it in there heads and stuff. I mean there is this guy who kind of knows everything and so he will teach me it but it will be like derrr and then it's gone"

... *on capabilities and well-being*

H studying mathematics through IT is very frustrated by his performance in mathematics. H has lived in the England for 2 years and has achieved a very high standard of English. H has a very successful academic history and despite an impoverished childhood, the first in his family to gain an undergraduate qualification, he too told a story of his struggle with mathematics. Throughout his interview, he demonstrated very effective and critical learning capabilities but was frustrated and angry with himself (and the curricula) for not being able to transfer his generic learning capabilities into the mathematical space.

> All this numbers you know it was like some kind of magic ... all these things I learned before but now they slipped and I couldn't answer the questions. I was thinking this is ridiculous to forget all these things but I don't ... (but) this kind of exercise it give you the possibility to go around ... this curriculum ... for example if it doesn't make me learn these things that I don't know ... it doesn't help me, he (it) destroy me little bit.

.... *On agency*

It is also evident that although the notion of agential freedom needs to be disaggregated in order to gain a better understanding of the learner and their relationship with mathematics, it remains integral to the learning story. D another ESOL learner, but this time with a poor experience of learning in school, demonstrated a strong sense mathematical capabilities and an emerging sense of mathematical well-being.

> "Yes as long as the problem is give you this liberty, yes I like it because ... on your own you can say, you know, this is my result because ... but I have been taught (in Romania) and I got used with problems that give you something strictly asking (questions) so you look for the answer on thinking of those askings."

... But in recognising his emerging sense of the self, throughout the interview he made statements that suggest a poor sense of agency. The teaching of mathematics is changing and there is according to Swan and Swain (2010), some progresses towards mathematics teachers adopting the kind of pedagogic principles that require learners to reason rather than to recall answers. This sort of approach could frustrate D unless he is giving the curricula space to consider reflexively his changing approach to learning mathematics

> ... but you tell me exactly what you want me tell me exactly how you want it to be done ... If you want something you have to say what the askings...

In summary, this research intends to capture learners' voice through collating narratives to compile a mathematics and/or educational history to be interpreted through Bourdieu's notions of habitus and field. Participant histories will then be used to identify the key themes and subsequent, more targeted, in-depth interviews will provide the thick descriptors for interpreting their learning experiences. A Vygotskian lens will provide the theoretical framework for the discourse analysis on the structures that underpin the mathematical discussions and a Foucauldian lens to analyse the sequences and development of conversation and the power structures that create and maintain the norms of the learning environment.

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