QUESTIONING UNDERSTANDING!?

Anna Llewellyn

Durham University, UK

In this article I examine the notion of understanding; how it is spoken into being and what work this does. I use post-structural analysis to examine primary school student-teacher interviews in relation to prominent socio-cultural research in mathematics education. From this I propose that understanding is tied to gendered and classed values which create hierarchical positions. I also argue that relying on psychological constructions of pupils is unworkable as student-teachers do not construct pupils as the rational automata presented by recent neo-liberal policies.

PART ONE: INTRODUCTION

In the field of teacher education the 'quest for understanding' is somewhat akin to the (re)search for the Holy Grail. Educational research is fixated with developing student-teachers' understanding of mathematics and enticing student teachers to teach mathematics for understanding. In England, both of these issues are raised in recent influential reports, Ofsted (2008) note that pupils in school can be 'successful' in mathematics without 'understanding' the work and Williams (2008) argues that student-teachers often lack a 'deep understanding' of mathematics. In these documents and in the majority of research, 'teaching for understanding' is viewed as something everyone should aim towards. Although at first it may appear difficult to argue against this aspiration, any term can benefit from deconstruction to determine its 'history of the present' (Foucault 1977, p.31). To suggest we can 'understand' understanding' is complicated. I do not deem that we can precisely determine what or how someone 'understands' but I do think we can discuss how understanding is spoken into being and the consequent work that this does. What happens when a teacher states that they desire understanding or to that they wish to teach for understanding? What is it they desire and what work does this do? What if our 'quest for understanding' (Boaler 1997, p. 111) is a masquerade for something else?

The research discussed in this article is post-structural. It is argued that this take upon mathematics education is particularly pertinent as many have the philosophical view that mathematics itself is rational and absolutist (Ernest 1991). If we continue to look at mathematics through a rational lens we will only see reason, by stepping outside dominant discourses, we not only challenge the nature of research itself but also the nature of mathematics (Walshaw, 2004a, Walkerdine, 1990). Primarily I use the work of Foucault (1972, 1977, 1980) and take meaning to be constituted through discourses and 'truth' to be a fiction. In this, language is ambiguous and meaning is created through discourses (MacLure 2003), where each discourse is specific to the current 'regime of truth… that is, the types of discourse which it accepts and makes function as true' (Foucault, 1980, p. 131). Furthermore power is 'constituted through discourses' (Walshaw, 2007, p. 20). However according to Foucault power can be enabling and ‘needs to be considered as a productive network which runs through the whole social body, much more than as a negative instance whose function is repression’ (Foucault, 1980, p. 119). Thus people are ‘active agents with the capacity to fashion their own existences’ (Walshaw, 2007, p. 24). In addition it is worth noting that England is a broadly neoliberal society which relies upon the autonomous, psychological self (Rose 1999). Within this, surveillance is high as the public sector borrows management models of working from the private sector (Ball 2003). Governmentality, the principle that governments or social systems produce normalised subjects, is in the ascendance, whilst we live under apparent freedom.

To examine how understanding is created through discourses I will draw on ‘evidence’ from interviews with five prospective primary school teachers, where (after initial coding) it was found that understanding was a dominant theme. These student-teachers were interviewed throughout their three years on an undergraduate degree at a University situated in the North of England. The interviews presented are from the final year of their course as they would have had the most experience of university and school. Each interview was conducted between myself and the student-teacher and took the form of an open ended ‘discussion’. They lasted between twenty five minutes and one hour. The student-teachers were fully informed of the purpose of the interviews however I am also a lecturer on their degree course, though my role is minimal. It is important to note that I am deliberately using a small amount of data and participants to allow space for an intensive analysis; I am not seeking to generalise results or represent the population. To set the data within the current regime, the interviews are supplemented with extracts from recent influential policy documents for mathematics education; all of which the student-teachers will have had exposure to. Specifically I refer to the primary framework for literacy and mathematics DfES (Department for Education and Skills) (2006) and the primary framework for literacy and mathematics: core position papers underpinning the renewal of guidance for teaching literacy and mathematics primary (DfES 2006). These documents are written for the government by private companies and are fundamental in guiding teachers on the mathematical content to be covered, the pedagogy to be used and the nature of pupils’ learning.

PART TWO: UNDERSTANDING

Whilst there is not space for a full historical analysis of mathematics education and understanding, it is important to highlight some aspects of the current regime. There are those that analyse understanding in terms of cognition. Examples include Skemp (1976) and his oppositional (hierarchical) classification of instrumental and relational understanding and more recently Barmby et al (2009) who examine it as a process of connections and representation. Others have examined the notion of learning and understanding from a social-cultural perspective. Two particularly influential social studies in the UK were carried out by Walkerdine (1989) and Boaler (1997) both of whom examined the affect of the presence (or absence) of ‘understanding’ in the classroom specifically in relation to gender. Throughout this article I use the terms boys and girls to fit in with the referenced sources, though I will attempt to critique these as indicators of enacted gender performativity (Butler 1999).

Twenty years ago Walkerdine (1989) highlighted an unnecessary gender division occurring in English mathematics classrooms. At this time, guidance on teaching mathematics emphasised the virtues of discovery teaching and of understanding and consequently the latter became a marker of proficiency with mathematics. Thus those who achieved high grades, but as a result of learning by rote, were positioned less favourably than those who achieved lower grades but could obtain true understanding. Moreover girls who worked hard were often constructed negatively whilst boys were often viewed as lazy or misguided but judged to have natural ability, with their superior and rational minds. In Walkerdine's view girls (or the feminine) were being punished for their achievements and science, rationality and reason had become the 'true' measures of mathematics and of success.

By the time Boaler (1997) was writing about girls 'quest for understanding' teaching for understanding would have been less popular in mathematics classrooms, as a result of the 'back to basics' agenda (of the Conservative and the Labour governments of the 1980's and 1990's). Boaler agreed with Walkerdine that 'girls' were alienated from mathematics; however Boaler differed by proposing that their exclusion was a result of the dominance of rote learning in the classroom. She argued that girls sought the understanding that was absent and thus excluded themselves. It would seem that girls were alienated in the 1980's and 1990's, but from very different classrooms, thus it is difficult to argue that pedagogy was the main reason for their isolation. In addition Boaler saw progressive classrooms (or classrooms which used 'open' approaches to mathematics) as offering freedom; though as Walkerdine points out – freedom is a fiction, the classroom is still governed but by covert rather than overt means. Being a pupil in Boaler's 'open' mathematics classrooms is not the free and liberating experience it is claimed; there is still normalisation and surveillance but it masquerades under a discursive construction of liberation. Whilst there is no disputing the influence of Boaler's work or the positives that have come from her conjectures you can of course offer alternative readings to some of her more essentialist claims. Although the multitude of policy (for example DCSF (2007)) that has accompanied these gendered assumptions may have raised some important issues about learning and may have helped improved attainment, this improvement could simply be because of the diversification of learning and teaching strategies, such that the pedagogy now meet the needs of more people regardless of their gender. However one point to contest is Boaler's treatment of gender. I argue that you cannot determine what boys and girls prefer because of their apparent gender (sex), instead you can only comment on their positioning and performance; to suggest anything more is too simplistic and can lead to heteronormative classrooms and classifications.

Since Walkerdine's study the guidance on the teaching of mathematics has largely been reactionary and cyclic, the movement has been from overt progressivism to traditionalism and now perhaps we are somewhere in-between. However many still adhere to the opinion that a significant amount of ‘high attainment’ in mathematics is the result of rote teaching and learning (Ofsted 2008). One thing that has changed over the last twenty years is the move towards specific policies that now govern the manner in which mathematics is taught in the classroom (see DfES 2006a). Furthermore, at present we live in a highly accountable society that is normalized and monitored by technologies of surveillance, such as league tables, performance management and the collection of pupil data. In 1999 (after Boaler’s study) the National Numeracy Strategy (NNS) was introduced into primary schools. This is a piece of documentation which ‘advises’ teachers specifically how to teach; for example by advocating whole class teaching, three part lessons and mental/oral starters. In line with government advice the majority of classrooms took the NNS fully onboard. Initially its merits and content were questioned by academics in terms of the advice given and the overtly prescriptive nature in which it is written (Brown et al 2000). As a consequence of the strategy there was an improvement in attainment by some but it is argued that this does not translate to an improvement in the teaching of mathematics (Brown et al 2003); in addition mathematics classrooms have became clones into which pseudo-children are designed to fit. Very recently the NNS was revised in the form of the Primary Strategy for Literacy and Mathematics (DfES 2006a); in the current version it is meant to be less formulaic and in terms of mathematics there is more emphasis on the ‘using and applying’ strand of the curriculum (the aspect concerned with the development of thinking and reasoning skills). Thus student-teachers in the classroom today may be influenced and exposed to both versions of the Strategy.

PART THREE: THE INTERVIEWS

In the interviews below I wish to explore some of the points that arise from Boaler’s (1997) and Walkerdine’s (1989) work as well as drawing out other issues from my student-teacher interviews. In the first instance I discuss whether girls seek understanding (and consequently that boys do not). With an alternative reading you could argue that girls ‘quest for understanding’ (and boys lack of) may indeed be a quest for something else. For example Boaler discusses how boys replace the desire for understanding with a desire for speed. However if speed is seen as an indicator of ‘natural ability’, one can suggest that speed may be about taking up a discourse of naturally able, in an acceptable and masculine way (this would also position ‘girls’ as the other). Another point to contest is why are boys’ ‘quest for speed’ and (not) their ‘quest for understanding’ in opposition and are these events mutually exclusive? Are we assuming that understanding cannot happen quickly, or that natural ability (which is being associated with speed) is distinct from understanding? This is confusing, especially when if consider that the government states that mathematically able pupils grasp new material quickly (DfES 2000). Whilst it is acknowledged that the use of binaries is widespread within our language this does not mean that these oppositions are ‘natural’ (MacLure 2003). Moreover these constructions are not helpful as they serve to position events and people into conflicting boxes, for example, right or wrong; masculine and feminine. To suggest that all (or most) girls would choose understanding is too simplistic. I am not in disagreement with Boaler that people proclaim to desire understanding, but desire is not always about the obtaining of the object, the production of desire 'involves a complex subject investment in …subject-positions' (Walkerdine 1990, p. 30). Indeed if we are to invest in psychoanalysis, Lacan's version of desire is 'about the quest for a secure identity (Walshaw 2004b. p. 130). Perhaps the girls' proclamation of a quest for understanding was the socially acceptable response to give: the obedient, common sense response, the 'trick of knowledge/power (Foucault 1972) which… leaves us unaware of the effects of our practices on ourselves and others' (Hardy 2009). Or it may have been the only response left to give. Conceivably the quest for understanding is a mask for something else, for acceptance or for the other. In the extract below Jane does proclaim to desire understanding, however she develops her 'understanding' by 'break(ing) them down' into small manageable chunks. The understanding is not about developing connections across mathematical concepts or developing reasoned arguments, understanding is about 'being able to do' mathematics with competence and perhaps even confidence, which is quite different to the notions of understanding discussed earlier (for example Barmby et al. 2009). It is about the taking up of a subject-position, and belonging to an identity.

> Jane: Now I'll look to find, what I understand and from this course I've learnt that there's things I do understand more than others. Like I taught myself the chunking method of division whereas before I didn't understand long division at all, I just couldn't do it, but I taught myself the chunking method by doing it with the children and that worked. I taught myself how to do the grid method with multiplication…But then because I've still got this back foot with maths, I think that's helped because the things I do know and understand I'll still break them down because I think well just because I understand them doesn't mean that everybody does.

That student-teachers desire to be able to do is perhaps not that surprising if we look at an extract from policy (DfES 2006b); the influential government advice on teaching mathematics. Children must 'have a secure knowledge of number facts and a good understanding of the four operations' (DfES 2006b, p. 40, 57). Here I suggest that understanding is written as the ability to do – it is also preceded by 'a secure knowledge of number facts' hence keeping knowledge high on the agenda. Though this is just one example, the document contains many such deterministic statements.

> 'As children begin to understand the underlying ideas they develop ways of recording to support their thinking and calculation methods, use particular methods that apply to special cases, and learn to interpret and use the signs and symbols involved.' (DfES 2006, p. 40)

Here understanding is written as something which is unproblematic and universal. For example, the suggestion of 'underlying ideas' is not only overtly prescriptive but suggests a rational and linear view of mathematics. In addition, both of the phrases 'use particular methods' and 'as children begin to understand' imply that there is an expectation of certain cognitive and social behaviour – that of a normal child and thus anything that does not conform is othered. There is little space in these documents for children that fail to follow linear and rational views of learning. Which could suggest that what teachers are allowed to both read and say is similarly deterministic.

With Sophie the desire to be able to do is even more explicit. She expresses fear for the process (or the connections) or for what some (Barmby et al 2009) might term understanding. She expects mathematics to come to her naturally, which is a familiar story (Mendick 2006)[i].

Sophie: That's my worst one! I hate the tables. 7s and 8s. 9s I know the trick with your hand so that's not a problem. 5s and 10s and 3s are fine. 4s are fine. It's just 7s and 8s.

Anna: Would you be happier, would you just like to know them and be able to recall them or work them out?

Sophie: I would love to be able to know them by rote and just be able to say '7 8s are…whatever it is' and know it, off hand, but I just can't. I haven't got that in my head. Whereas some people are more- they can visualize numbers so easily and I just can't do that. I need to sit down and go through them all one by one and get to the answer.

Anna: Right, so you know your fours?

Sophie: Yeah.

Anna: You could double your fours to get your eights.

Sophie: I can't do that because that's doing too much of a process so I could probably try that. I just think it's going to complicate it more.

Anna: I do it.

Sophie: I'll give it a try but…

Anna: Some people wouldn't know them all but would calculate to get each individual one.

Sophie: Yeah.

Anna: Or if you know 8 8s is 64, use that to get back to 7.

Sophie: Mmm. But it's all working out your long methods isn't it?

Anna: Yeah.

Sophie: I'm not good at that sort of thing of working out how to do things and making it complicated. I'd rather it just came to me naturally. But I'm never going to be that one! (laughter) Unfortunately.

Sophie's assumption that true mathematics comes naturally succumbs to the hierarchical and rational view of mathematics which is in accordance with the view that understanding belongs to the most able. Furthermore this places mathematics as divisionary and positions those who achieve results by rote learning as non-mathematicians, as noted by Walkerdine (1998).

> Nicola: My Highers can do fractions, equivalent fractions everything. The Lowers don't even understand basic fractions. The Highers are very good with their times tables. Or one boy, you can ask him anything in his zero to twelve times tables, he's like that [clicking of fingers], you get it back. He understands it perfectly. It's like using and applying is, I find more important for them.[the higher attaining]

Nicola views understanding as important, this is shown in part by the number of times she mentions it throughout her interviews. Her version of understanding is similarly aligned to the recall of knowledge and speed. This could be viewed as traits of cognitive ability or they could be viewed as social markers presented as understanding. In addition, her interview exemplifies Walkerdine's point that boys are more easily afforded the luxury of the appearance of understanding even when it is not apparent. Nicola also expresses the desire to work with the highers thus excluding the other - the lower attaining. This may imply that those who are able and can understand are worthy of praise, thus othering those who struggle to understand. The dangerous consequence is that these others are positioned as non-mathematicians and are no longer asked to understand (Bibby 2001). This is also shown where Nicola mentions the 'using and applying' strand of the curriculum, which can be tied to some cognitive notions of understanding. From this, I suggest that understanding is bound by hierarchical values that rely on rationality and reason and are tied to notions of gender and social class (Walkerdine 1989).

The next point I wish to build is the notion that understanding is produced as cognitive. Examining the interviews, I could not find one example of a student-teacher discussing a child in terms of cognition alone; more often their judgements had emotional contexts or the teachers discussed gender or confidence. Pupils were not positioned as the rational automata presented by government policy although there was tension between what the student-teachers 'rationally' expected (which aligns to over cognitive and simplistic policy) and the 'real' children that they worked with. Below are some extracts from each student-teachers' individual interview:

> Kate: I know one of the girls is terrified of fractions, really hates them… My high fliers are all three boys. Girls tend to be middle of the road.

> Nicola: They can do stuff like that and it makes them feel good about Maths…When the shutters come down it's … it is about convincing them they can do it…. The girls are higher but they're not as high as you could expect. With boys, they don't have the patience for it.

> Jane: Yeah, I see, I see children in two stances in maths whereas I don't in other subjects. I see the children that, that immediately think oh, oh no maths

Sophie: I want them to learn in a way that they feel comfortable.

Leah: But I would say that probably in Maths, boys are more confident on this table.

So what if understanding is positioned as the mathematical Holy Grail? What would this hierarchy contribute to the field of knowledge for student-teachers? To perceive something as innately good positions something else (rote-learning) as innately bad (MacLure 2003) however rote learning happens in mathematics classrooms and in universities. Indeed mathematics in society (which it is frequently argued school pupils should be exposed to) can be about the application of methods, for example within jobs such as accountancy or engineering. What version of understanding is relevant here – to be able to do or to make cognitive connections? In addition, if one of the purposes of school (or university) is to achieve qualifications (which it is in this high-stakes society) does the 'smart' person grapple with understanding or learn routines by rote, as the latter could help them achieve good grades? It is argued that in the interview data below Kate shows an understanding of systems and how to play the game. Tension is present around understanding where passing exams is presented as an unacceptable yet accepted version of learning and teaching.

Kate: So I think it is important that they understand it, but then again it's not really - it is… a kind of learning a way to pass if that makes sense. A teacher knows what's coming up in the paper, like bar charts always come up, whereas line graphs don't. So I think they target what they teach in relation to SATS, especially in Year 6, which if SATS went out of the window maybe they'd get more free range of what they could teach.

PART FOUR: CONCLUSION

In this article I am not presenting data as a generalisation or as the 'truth', I am not even suggesting this is a finished argument. I am merely beginning to question some of the apparent truths that circulate within mathematics education. I do not wish to say that there is something wrong with teaching for understanding, but suggest that it should not be seen as a 'common sense' piece of truth, something which is beyond question. From the tentative analysis above, I suggest that understanding is produced as hierarchical, particularly in relation to gender, social class and ability. It belongs to the privileged few, to the 'naturally' able, which are often boys (another unnecessary and unhelpful classification). To suggest that girls have a 'quest for understanding' is over-simplistic and gendered and in the first instance we should unpack how each version of understanding is constructed. Another danger is that such gendered assumptions produce and maintain hetero-normative classrooms and classifications. Finally, I suggest that students-teachers do not produce understanding as cognitive; the child is not an automaton who performs as the government text prescribes. Pupils and understanding are tied up with notions such as gender, confidence, and emotion.

There is no disputing the money and effort the current government has put into raising achievement in mathematics, however with greater prominence comes greater expectation. Targets are based upon exam grades that are publically dissected in league tables. Strategy documents (DfES 2006a; Department for Children Families and School (DCFS formerly DfES) 2009) promote the normalised expectation that pupils should be performing to certain levels. Within this, the perception is that learning is rational and linear and should happen when and how the documents advise. For this learners and teachers need to become autonomous psychological subjects; however this creates tensions within the student-teachers interviews as learners are produced as people with social and cultural identities. So should we look for different version of learners or teachers or should we look for different versions of mathematics? Perhaps we should question what else we do when we place teaching for understanding upon a pedestal? One version is not explicitly good or bad and every account has its technologies of surveillance and its regimes of power; though some are more covert than others. It is these less obvious forms of common sense masquerading as liberation that perhaps need closer inspection.

REFERENCES

Ball, S. J. (2008). *The Education Debate*. Bristol: The Policy Press.

Barmby, P., Harries T., Higgins, S., & Suggate, J. (2009). The array representation and primary children's understanding and reasoning in multiplication. *Educational Studies in Mathematics*, 70(3), 217-241.

Bibby, T. (2001). *Primary school teachers' personal and professional relationships with mathematics*. Unpublished PhD Thesis. King's College, University of London.

Boaler, J. (1997). *Experiencing school mathematics: teaching styles, sex and setting*. Buckingham: Open University Press.

Brown, M., Millet, A., Bibby, T., & Johnson, D.C. (2000). Turning our attention from the what to the how: the National Numeracy Strategy. *British Educational Research Journal*, 26(4), 457-471.

Brown, M., Askew, M., Millet, A., & Rhodes, V. (2003). The key role of educational research in the development and evaluation of the National Numeracy Strategy. *British Educational Research Journal*, 29(5), 655-672.

Butler, J (1999). *Gender trouble*. London: Routledge.

DfES (2000). *Mathematical challenges for able pupils in Key Stages 1 and 2*. London: DfES.

DfES (2006a). *Primary framework for literacy and mathematics*. London: DfES.

DfES (2006b). *Primary framework for literacy and mathematics: core position papers underpinning the renewal of guidance for teaching literacy and mathematics*. London: DfES

DCSF (2007). *Gender and education: the evidence on pupils in England*. London: DCSF.

DCSF (2008). *Making good progress in mathematics*. London: DCSF.

Hardy, T. (2009). What does a discourse orientated examination have to offer teacher development? The problem with primary mathematics teachers. In L. Black, H. Mendick & Y. Solomon (Eds.), *Mathematical Relationships in Education: Identities and Participation*. New York: Routledge.

Ernest, P. (1991). *The philosophy of mathematics education*. London: Falmer Press.

Foucault, M. (1972). *The archaeology of knowledge*. London: Routledge.

Foucault, M (1977). *Discipline and punish: the birth of the prison*. London: Penguin.

Foucault, M. (1980). Truth and power. In C. Gordon (Ed.), *Power/knowledge: selected interviews and other writings 1972-1977*. Brighton: Harvest.

MacLure, M. (2003). *Discourse in educational and social research*. Buckingham: Open University Press.

Mendick, H. (2006). *Masculinities and mathematics*. Maidenhead: Open University Press.

Ofsted (Ed.) (2008). *Ofsted mathematics report. Mathematics: understanding the score* London: Ofsted.

Rose, N. (1999). *Governing the soul*. London: Free Association Books.

Skemp, R. (1976). Relational understanding and instrumental understanding. *Mathematics Teaching*, 77, 20-26.

Walkerdine, V. (1989). *Counting girls out*. London: Virago Press.

Walkerdine, V. (1990). *Schoolgirl fictions*. London: Verso.

Walshaw, M. (2004a). Introduction: postmodernism meets mathematics education. In M. Walshaw (Ed.), *Mathematics education within the postmodern*. Greenwich, Connecticut: Information Age Publishing.

Walshaw, M. (2004b). The pedagogical relation in postmodern times: learning with Lacan. In M. Walshaw (Ed.), *Mathematics education within the postmodern*. Greenwich, Connecticut: Information Age Publishing.

Walshaw, M. (2007). *Working with foucault in education*. Rotterdam: Sense Publishers.

Williams, P. (2008) *Independent review of mathematics teaching in early years settings and primary schools*. London: DCSF.

---

[i] (another version of this story could be she is reacting against me, a lecturer, in a position of power)