

“I, robot” free will and the role of the maths teacher - who decides how we teach?

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To what extent is our teaching practice controlled by external forces? Do we teach in the way that we do because we want to or because we have in fact internalised those forces? This paper presentation was based on a small scale study which sought to develop existing research on maths teacher's beliefs and practices by considering three adult numeracy practitioners in contrasting UK settings (teaching recruits in one of the armed forces, young people for whom English was not their first language and students on a Health and Social Care programme, respectively.) The study looked at how the institutions where these teachers worked affected not only their classroom behaviour but their own beliefs about maths too. The question of why we teach the way we do has long concerned those working in maths education. Whose agenda are we following? How do we accommodate institutional constraints and expectations with our own beliefs and principles about the teaching and learning of maths (and where do those principles and beliefs come from in the first place?) Are teachers of maths for adults 'free agents,' or are they robots who think they are free agents? Those attending this paper presentation were invited to reflect upon these and other questions.

Introduction

“A lot of long division and a lot of multiplication. Teach them how to do that and everything else falls into place.”

“I think it is thinking, problem-solving, using a bit of logic, looking at something and figuring it out. And I think it is the kind of thing students find hardest, but that is what I most like to get out of the class.”

“To get them to learn something that they can use on their course, in their work life and also in their everyday life as well.”

The quotations above are from three teachers working in the lifelong learning sector in England. All three taught numeracy ('basic maths') using the same curriculum content and all three worked with young people, largely in the 16-18 age range. Each was asked what they thought mathematics was 'about' and what they saw as the purpose of their lessons. One teacher, Andrew¹, taught recruits in one of the British armed forces, another, Caroline, taught participants on a health and social care course

¹ The names used in this paper are not the real names of the participants of the research work.

and the other, Kathy, taught young people who, at the start of the academic year, had recently arrived in the UK with little or no English.

Could you match the quotations to the teachers from these descriptions? Would it make a difference if you knew that Caroline's institution was an average sort of further education college with no real research culture, but that Kathy's college had received an excellent inspection grade and had been involved in a number of practitioner-led research initiatives?

The three teachers formed case studies as part of a research project which I undertook as part of my own recent Masters degree in Adult Literacy, Language and Numeracy. The research question was: "How do the beliefs and practices of numeracy teachers differ across selected institutions?", but this in turn was part of an attempt to answer a wider question which has long plagued me as a teacher educator in the field of adult numeracy, namely: what is it that influences the way that people teach maths?

Background theory and research

Each of the teachers in the study taught very differently and, as can be seen from their quotations, had differing views on what maths was all about and how it is learned. Does what you believe about maths therefore affect how you teach it? There have been a number of past research initiatives attempting to answer this question (e.g. Thompson 1984, Lerman 1990 and Swan 2002), mostly in the school mathematics sector both in the USA and the UK but at least one (Swan) in the field of Further Education in England. The majority of studies concluded that there must be a connection between beliefs about maths and pedagogical practice. So for example, a teacher who associated maths with an image of

a certain body of knowledge ... discovered by great mathematical persons
(Lerman 1990)

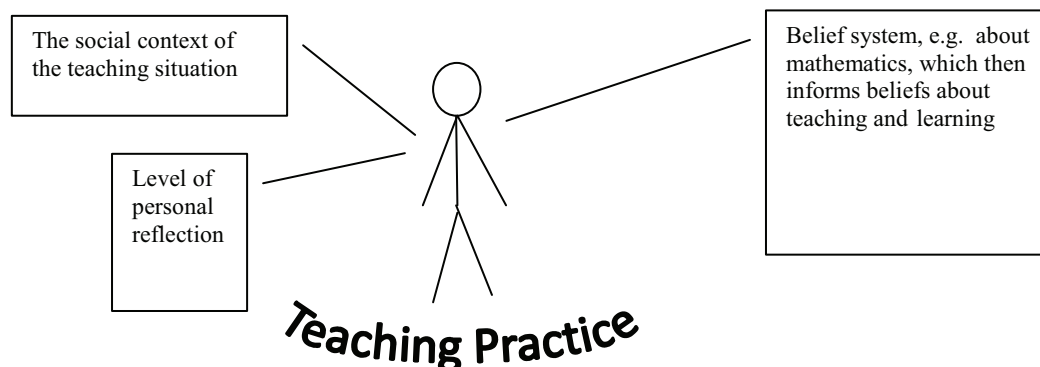
might be expected to teach in what has been termed a 'transmission' style (Askew et al 1997), for example, through teacher-led lectures and demonstrations. On the other hand, a teacher with a more fallibilist perspective, seeing maths as

a dynamic, continually expanding field of human creation and invention, a cultural product (Ernest 1989)

might employ a more interactive approach, facilitating the learning process so that students have the chance to make connections and discover mathematical meanings for themselves.

This model certainly has intuitive appeal. However, what several studies found was that there were some teachers with a fallibilist orientation to mathematics and its learning who still employed traditional, didactic approaches to teaching it. Furthermore, in a survey conducted by Malcolm Swan (2002), 40 out of 43 teachers claimed that their classroom practices were inconsistent with their beliefs, mainly due to institutional constraints. Meanwhile, Thompson (1984) noticed in her case studies of three US junior high teachers that it was the most **reflective** of the three who exhibited the greatest degree of 'integratedness' (consistency) between her conceptions of maths and her instructional practice. It seemed then, that other factors were at play in influencing teachers' behaviour in the maths classroom.

Ernest (1989) postulated that mathematics teaching practice was affected by a number of different influences, including the teacher's own system of beliefs (e.g. about maths itself, which then affected their beliefs about teaching and learning maths), their level of personal reflection, and the social context of the teaching situation (see diagram below).



Although his paper on this subject was a theoretical one, the findings of research studies such as those described above supported this model, particularly with regard to the conclusion that the institutional environment must have a role to play. Furthermore, what Ernest meant by 'social context' included not only the expectations of others, but also the 'institutionalised curriculum'. These factors then

lead the teacher to internalise a powerful set of constraints affecting the enactment of the models of teaching and learning mathematics (Ernest 1989).

The word 'internalise' here is of paramount importance. In fact, the social context referred to by Ernest is, I believe, shaped not only by institutional ethos but also by national policy regimes, and these give rise to discourses which attach value to certain classroom practices, which in turn imply particular 'truths' or beliefs which are absorbed by practising teachers. In other words, my hypothesis was that social context was not simply one of a list of factors which affects the practice of maths teachers. It affects their very beliefs themselves.

The research study

To explore this idea further, the three teachers described in the introduction above were selected as case studies from a list of numeracy practitioners who had participated in teacher education courses at London South Bank University (where I worked at the time), on the basis of their contrasting work environments and also with regard to ease of access to their geographical locations. With consent, each teacher was interviewed, was observed teaching and then interviewed again, after which they were asked to fill in a short questionnaire.

Two theoretical models were used in order to provide a language of description to compare the teachers' beliefs and practices, and to analyse each teacher's relationship with his or her working environment. The first model used the classifications of 'compliant', 'reflective' and 'interrogative' (Miller and Baker 2000) to categorise the teachers in the study. Broadly speaking, a compliant teacher would not see it as their role to question institutional/national policy relating to their subject area, but would be more concerned with 'covering' the curriculum and imparting the knowledge that was necessary for their students to achieve their qualification aims. The reflective

teacher would spend more time examining their own practice and trying out alternative approaches, but would not tend to challenge the system as a whole. In contrast, the interrogative teacher would take a critical stance regarding both institutional and national policy, and would see maths as a process that could potentially empower their students. It was important to recognise, however, that these categories were not necessarily mutually exclusive but described positions on a continuum rather than isolated classifications.

The second model used was that of Bourdieu's 'habitus' and 'field' (Bourdieu and Wacquant 1992). 'Habitus' comes from the Latin word meaning 'a habitual or typical condition, state or appearance' (Jenkins 1992), but for Bourdieu it also describes

...the characteristic dispositions of the social subject, that is deeply ingrained in habits of behaviour, feeling and thought. (Peim and Hodkinson 2007)

A 'field', on the other hand, is a network of positions (either of people or organisations) along with the relations between those positions (Wacquant 1982 cited in Jenkins 1992). While each field generates its own habitus, individuals also carry with them their own habitus, implying that when an individual encounters a new field, there must be an adjustment, either of the individual habitus or the habitus of the field, or both.

For new or training maths teachers, the contrasting fields of their current working environments (which include both their institutions and the wider sector), their teacher training establishments and their own prior personal experiences of maths education can combine to produce a new individual habitus. Zevenbergen (2006) suggests that habitus in itself forms a kind of cultural 'capital' (another notion from the work of Bourdieu) within a particular field. An individual teacher may thus develop the type of habitus that will give them the most advantage (or capital) in their particular field or institution. For example, Zevenbergen found that the most advantageous type of habitus for newly qualified or trainee maths teachers often embodied traditional approaches to maths education experienced from childhood. Zevenbergen was writing about the schools sector in Australia, but his ideas have been echoed in the work of Gleeson and James (2007) in the post-compulsory sector in the UK. Gleeson and James suggest that a person's 'professional capital' (which could be seen also as their professional identity) can be 'compromised' simply by placing them in a new field with a different associated habitus, so for example someone who questioned the value of spending time on paperwork might be respected for their views in one institution, but derided for them in another.

Armed with these two theoretical frameworks then, the aim was to find a way to describe and analyse how each of the teachers in the study interacted with their environment, and how this in turn affected their beliefs and practices regarding maths and the teaching and learning of maths.

Findings

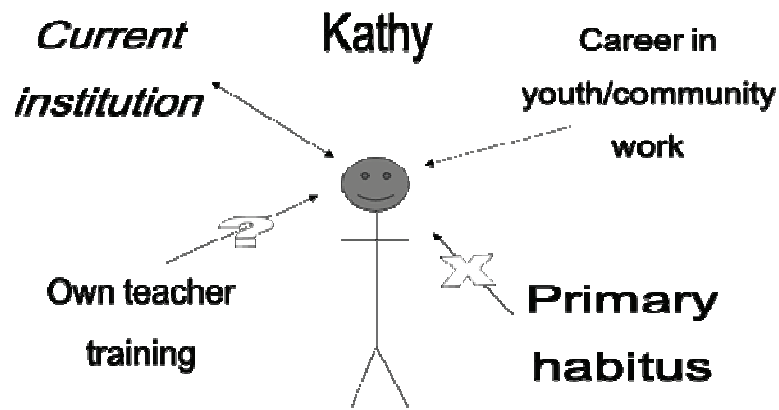
In fact, the first quotation at the beginning of this paper was from Andrew, who taught in the armed forces, the second, from Kathy, who worked with young people who did not have English as a first language in what might be described as a 'progressive' FE college, and the third was from Caroline, whose students were participants on a health and social care course in an 'average' FE college. Participants at the ALM workshop

of this title were largely successful in matching quotations such as these to each of the three teachers and institutions described. So can we conclude from this that the more ‘progressive’ the educational culture of your institution, the more process-oriented your view of learning mathematics is? Of course not. Andrew, Kathy and Caroline were isolated case studies and while the approach of each appeared to ‘fit’ the ethos of his/her respective institution, a great deal of further study would be needed before this could be claimed as a general truth.

So what does this study tell us about how the beliefs and practices of numeracy teachers differ across selected institutions? In two of the fields (or institutions) encountered, the practitioners employed traditional methods (largely practice in answering written questions) in order to prepare learners for summative assessment. However, while one, Andrew, was largely dismissive of collaborative or exploratory methods, and could generally be described as ‘compliant’ on the Miller-Baker spectrum, the other, Caroline, had at least attempted to introduce alternative approaches at the beginning of the year, and expressed some dissatisfaction with the conditions of her field and frustration that she could not teach in the way she wanted to. In other words she was more ‘reflective’. However, she stopped short of being ‘interrogative’ in that she did not challenge to any great degree her college’s practice of basing the content of maths education more on national test requirements than on the vocational needs of the students. In the third case study, Kathy was able to follow her preferred approaches to the numeracy/mathematics curriculum, namely group-work, practical and investigative activities, with a strong focus on language and conceptual understanding, approaches more associated with an ‘interrogative’ position. This could be partly because, with respect to the habitus associated with the field where she worked, these approaches not only were the accepted norm, but were encouraged through more contact time and less pressure to pass tests. For Kathy and Andrew, therefore, the fields where they chose to be employed accommodated each individual habitus respectively, with little conflict in either case. For Caroline, there was more adjustment required, both conscious and internalised, although not so much so that she felt unhappy in her role.

This suggests that, for these three case studies at least, the teachers’ pedagogical and subject-related beliefs and practices were not so much informed by their current institutions, as their respective choices of institution were informed by their beliefs. This fits with Thomson (2008) who suggests that people migrate to fields that have a close match with their existing habitus.

However, this begs the question as to how the existing habitus is formed, that is, where do teachers’ beliefs, assumptions and principles about the teaching and learning of maths come from? Trying to uncover the answer to this was one of the purposes of the interviews in the study. The diagram below gives a crude representation for Kathy in terms of listing the main influences on her attitudes and approaches to maths and its pedagogy.



For Kathy, the biggest positive conscious influence had been a previous career in youth and community work, where interactive, participant-led approaches to activities were valued, as was the development of process-based skills such as problem-solving or communication. Her own more traditional school experience, on the other hand, was something that Kathy wished to move away from, and she struggled to articulate what effect, if any, her teacher training had had on her practice. This was in contrast with Caroline and Andrew, who both cited inspiring teachers and positive school experiences as motivating factors in their subsequent careers in education. Kathy believed it was a happy coincidence that she had ended up in a college whose approaches seemed so much to echo her own, but the fact that she was asked to model a teaching and learning activity in her job interview there suggested otherwise, and furthermore her decision to remain at the college, even on an hourly-paid contract, was also significant. Finally, the two-way arrow between Kathy and her current institution illustrates the fact that the relationship between the individual and the field is an interactive one, for example with her institution nurturing and developing her interest in active teaching and learning methods in maths, and her experience of and enthusiasm for working with beginner English teachers contributing to a more language-focused approach to teaching maths in her department.

With regard to at least two of the teachers in the study, there were ways in which the values and discourses of the field of maths/numeracy education - both within institutions and in England at large - appeared to infiltrate each teacher's individual habitus. One illustration of this was the unconscious way that both Caroline and Andrew used jargon associated with curriculum levels in numeracy in England to label their students, both when talking about them and when talking to them directly: "Level ones sit over here please, level twos sit here" (Caroline, observed lesson). The idea that students might be too complex to be classified in this way simply did not exist for her within this context. Similarly Andrew, when asked about the validity of a five-day intensive programme for armed forces recruits, answered "I think our pass rate means it is perfectly long enough", and yet, while he felt that the national numeracy tests were 'needed', he could not articulate why. It seemed as if he operated in a capsule, where the ultimate aim was to pass the test, and questions about the relevance, transferability or long term retention of the skills learned were simply outside his radar.

Both Caroline's and Andrew's examples above illustrate a point made by Maton (2008), that one's habitus allows only certain paths or choices to be visible to one at any one point. In other words, with regard to the habitus associated with a particular field, certain beliefs are not just untrue, they simply do not exist. Kathy, on the other

hand, seemed to escape this ‘limiting of perspectives’, but perhaps this appeared this way to me because, out of the three teachers, her views most closely matched my own, in which case it could be argued that the same ‘truths’ or choices that were invisible to her were thus so for me as well.

Notwithstanding this, for all three teachers the relationship between habitus and field, or individual disposition and institutional culture, was in fact dialectical, with the one affecting the other and vice versa in differing ways. In fact, each teacher appeared to affect the associated habitus of his/her field through small, autonomous choices and actions, for example: holding fast to values not necessarily reflected in national policy (e.g. the intrinsic worth of young people or the soft outcomes of learning mathematics, such as improved confidence, or a common but subconscious refusal amongst all three teachers to use the government-preferred term ‘learners’ instead of ‘students’). Another example was engaging in a quiet avoidance (also called ‘mediation’ by Wallace and Hoyle (2005), in Gleeson and James (2007)) regarding policies thought to be of little use, e.g. none had specific lesson objectives (and in fact two did not have written plans at all), and all were dismissive of paperwork demands such as individual learning plans for students.

In these ways, the teachers in the study managed not only to be influenced by their institutions and the field of adult numeracy in England in general, but to influence in turn the cultures within their fields of employment by creating sub-cultures of their own, thus illustrating the dialectical nature of the relationship between habitus and field.

Conclusion

So as maths teachers, are we free agents or not? Who does decide how we teach?

Ernest (1989), as we have seen, suggested that mathematics teaching practice is influenced by a combination of beliefs (about mathematics and how it is taught and learned), the degree of reflectiveness that the teacher holds, and the effect of the social environment in which they are practising. My hypothesis was that the social environment not only influences behaviour but teachers’ very beliefs themselves. In examining how numeracy teachers’ beliefs and practices differ across selected institutions, my conclusion is that, just as Thompson (1992) suggested the relationship between beliefs and practices to be complex, so is the relationship between beliefs, practices and institutions (or indeed, habitus and field).

To summarise my findings:

- Previous environments – or fields – have a role in shaping beliefs about mathematics and its pedagogy.
- These beliefs in turn can then influence the choice of subsequent fields of employment or institutions (or at least the choice to remain in a particular field as opposed to moving on to another one).
- The associated habitus of the new field in turn then shapes, and is shaped by, the beliefs and practices of the individual practitioners who have elected to work there.

Overall, it seems that any research - or indeed, professional development activity - relating to teacher behaviour must take account not only of their beliefs but also of how they came to hold those beliefs in the first place, and the role that their different contexts and environments (past and present) have played in shaping them. Only then can we begin to support teachers in developing their practices in critically reflective ways, and thus empower them to bring about change, not only in themselves and their learners, but at institutional and national level too.

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