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Researcher-led teaching: embodiment of academic practice

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This paper explores the embodied practices of leading researchers (and/or leading scholars/practitioners), suggesting that distinctive 'researcher-led teaching' depends on educators who are willing and able to be their research in the teaching setting. We advocate an approach to the development of higher education pedagogy which makes lead-researchers the objects of inquiry and we summarise case-study analyses (in neuroscience and humanities) where the knowledge-making 'signatures' of academic leaders are used to exhibit the otherwise hidden identities of research. We distinguish between learning readymade knowledge and the process of knowledge in the making and point towards the importance of inquiry in the flesh. We develop a view of higher education teaching that depends upon academic status a priori, but we argue that this stance is inclusive because it has the propensity to locate students as participants in academic culture.

Keywords: teaching, research, academic practice

Introduction

Links between research and teaching are a fundamental assumption for most university departments (Jones and Kinchin, 2010). The particular benefits of being taught by lead-researchers (or leading scholars/practitioners) have proved difficult to demonstrate (Blackmore, 2009), however, and while phrases such as 'research-to-teaching links' and 'teaching in research-rich settings' have become commonplace, they are also rather ill-defined (Hughes, 2005) and commonly neglect the literature of practice studies (e.g. Knorr Cetina, 1999; Rouse, 2002; and Rheinberger, 2010 for science and the many papers collected together by Camic, Gross and Lamont, 2011 for social science and the arts and

humanities) to which they might potentially be linked (see Hay *et al*, 2013).

In particular, ‘teaching in research-rich settings’ is a somewhat disembodied notion that does not necessarily implicate the researcher as being the teacher in the given field and ‘research-to-teaching links’ implies two already separate functions (one of research; one of teaching) that may, or may not, be brought together again (see Macfarlane, 2011). Nevertheless, the higher education community seems to be agreed that teaching students to reproduce textbook (or even recently published research) information is problematic, while the student learning literature shows the ways that non-researchers (non-specialist teachers as well as students) tend to prioritise formal teaching targets (e.g. Entwistle and Smith, 2002), while research prioritises the epistemic cultures of new knowledge-making (e.g. Latour, 1987; Knorr Cetina, 1999 and also Perkins, 1981).

Development

The issue of a distinction between learning readymade knowledge *versus* learning knowledge-making process is addressed in some of the literature of academic literacy (e.g. Greanleaf *et al*, 2010) and ‘new academic literacies’ approach (c.f. Lea and Street 1998), in particular (e.g. Lillis, 2003; Kress, 2003; 2010), suggesting that in writing (or in multimodal discourse) learners can begin to participate in ‘*knowledge design*’ (c.f. Kress, 2003). Nevertheless, in many academic fields there is still a gap between the process-knowledge made available in the published academic texts (papers and books, videos etc.) and the organising principles embodied by leading (principal) researchers/scholars/practitioners (see Barnett, 2010). This is partly because the practices of ‘experts’ tend to be tacit or so highly codified that they remain effectively invisible to those who are not expert already (e.g. Polyani, 1961; Collins, 2010). It is also because some aspects of the inquiry process are purposefully removed in the course of formal presentation (see Wineburg, 2011). More importantly perhaps, while the last three decades of research in higher education are consequences of the literary turn in contemporary philosophy (Stafford, 1991; McCartney, 2013), it is important to recognise that in some practices (in experimental bioscience, contemporary art and in many aspects of medicine, for example), non-linguistic action and materialisation has its own well-defined place (Stafford, 1993; 2007; Radder, 2012).

In the science-research context Knorr Cetina (1999) provides some explicit illustrations; distinguishing, for example, between: a) proto-data, cleaned and fixed for publication in a process of ‘laboratory talk’

which is not itself a component of the final paper (Aman and Knorr Cetina, 1988); and b) research narratives of laboratory life (e.g. Latour and Wolgar, 1985; Knorr Cetina, 1999) in which the *process* of inquiry as well as its product are the combinatory research objective. Research-work like this (combining a focus on the person, their method and *their* object), associated with the methodologies of science and technology studies, but also more recently developed in inquiry into knowledge-making practice in humanities (e.g. Grafton, 2011), financial market analysis (e.g. Knorr Cetina, 2011) and social science (e.g. Heilbron, 2011), throws light on how the researcher is inseparable from the identities (the epistemic things – Rheinberger, 2010) they manufacture in their practice (see Camic, Gross and Lamont, 2011). In her analysis of molecular biology Knorr Cetina (1999, p. 217) exemplifies this principle as follows:

‘...the individual scientist in the laboratories studied is not just an author of knowledge and a component of the setting, but also its integrating element – for example, if anything integrates a molecular biology laboratory, it is the laboratory leader. The laboratory, experimentation, procedures, and objects obtain their identity through individuals. The individual scientist is their intermediary – their organising principle in the flesh, to who all things revert.’

Such analysis has some fundamental implications for pedagogy in higher education, suggesting that rather than seeing the researcher/teacher as the person charged to tell the story of their discipline and field (where talk recounts a process which happens elsewhere), these people are more fundamentally *the form* the story takes; deserving of *direct* exhibit in the lecture theatre – where the researcher/teacher might embody the same organising principle(s) and element(s) that they necessarily embody in the laboratory, their academic interaction with peers and/or their potential function in the seminary model (e.g. Grafton, 2011).

It is these issues of embodiment, playing out quite differently in the practices which are essentially representational (i.e. linguistic) *versus* those which are primarily material (sensory and affective) which is most often neglected by the higher educational literature of research-to-teaching links (e.g. Healey and Jenkins, 2005: 2007; Kreber, 2005) and likewise by related scholarship of inquiry-based learning practices in research-led settings (e.g. Levy and Petrusis, 2010). In this paper we explore these issues further, drawing on two case studies, both of which

focus on imaginative embodiment, whether this imagination is literary (Bakhtin, 1982) or the imagination bounded by the plausibility of material realisation in scientific experiments (Radder, 2012). Both cases (one located in experimental bioscience and one in reading in humanities) were carried out in a single elite university in the UK and in this context the central contention which we develop to unite these studies is that when the identity of leading researchers is taken as being part of the object of inquiry then the *potential* identities of what is otherwise invisible (or at least uncertain, tentative and even perhaps, previously unimagined) begins to find a materiality which can then be labelled and exchanged (negotiated). Further, we contend that, without this view, this perspective of relations between the ‘thing’ and the person who also makes it (so to speak), teaching tends towards transmission only while acknowledging ‘the knower’ and ‘the known’ as a relation releases making-knowledge for the student also. Thus we argue that in contact with the identity of a leading neuroscientist, an image of the unknown regulatory function of brain cells gains a plausibility (because of the ways that leader fuses extant scientific knowledge with their unique experience of methods, craft, material etc.); while in contact with a particular historian, the potential economic and political identity of 18th Century mercantile London (for example) acquires a potential identity which likewise depends on the individual researcher and the problem/process which they *are* standing for.

Embodiment

Several recent ethnographies of science practice emphasise the ways that researchers use their imaginative body-sense to know the identities of ‘things’ (like protein structures, neuron cells and planets). Myers (2008), for example, documents the ways that protein biochemists learn to sense what is possible and plausible to know about the three dimensional structure of particular proteins because the craft-work experiences of manipulating proteins in experimental settings gradually creates a sensory (and of course imaginative) relationship towards the otherness of protein worlds. This is achieved through ‘*body-work*’ whereby protein shape is understood physically (as well as cognitively) and it comprises learning to occupy the realm of molecules, molecular bonds and stereo-chemical interactions (Myers, 2008). Likewise scientists working on the Mars Explorer Rover Project use visualisation and physical embodiment to ‘*see like the Rover*’ extending their body-sense through the machinery they develop and operate in order to explore the Martian environment (Vertesi, 2012). In both examples, imaginative body-sense constitutes a vital part of ‘*trained judgement*’

(Daston and Gallison, 2007), entering directly into the ‘data’ that accrues in the field and determining an ability for individuals to critique and show respect for the work and findings of other individuals (Vertesi, 2012). In this regard, many science fields are organised (i.e. led and structured) by the unique ‘signatures’ of individual scientists (Hay et al, 2013), whereby an ability to label a particular line of inquiry distinguishes one goal from another; one leader from another – thereby determining the functional boundaries of identity which mark both the *potential* of the scientific object (as knowledge) and degrees of expertise manifest in the making of that knowledge (Kawatoko and Ueno, 2003).

Neuroscience

Some of our recent research of teaching has drawn on these ways of seeing practice. We now summarise two case studies, the first of which was designed to explore teaching in neuroscience. In the course of this project, Hay *et al* (2013), but also Wingate (2010), have documented the brain-cell (neuron) drawings of: a) undergraduates; b) trainees (PhD students and postdoctoral research staff); and c) laboratory-leaders (principal investigators), exploiting the fact that neuroscience hinges upon an intrinsically visual image (of the neuron-cell identity) as its object/methodology (see Wingate and Kwint, 2006). Some of our data are exhibited in Figure 1, illustrating how these groups of drawing-authors exhibit discrete neuron-drawing preferences.

The drawings of trainees [C_{4.6}] tend towards exhibit of actual observations events (where neuron-cell preparations are visualised in the laboratory). These emphasise a tendency towards ‘*mechanical objectivity*’ (Daston and Gallison, 2007) where ‘data’ is reported without interpretation (as much as this is ever possible). The Principal Investigators’ drawings [D_{7.9}], however, include a forceful assertion of *potential* neuron-cell identities that coincide with the contribution that each research-leader hopes to make in neuroscience. These leaders’ drawings are essentially imaginative images and we have called them the ‘signatures of expert neuroscience’ because they advocate an individual hypothesis/approach that is objectively recognised by others (i.e. undergraduates, trainees and other leading researchers) as organising the work of particular individuals and the direction of the laboratories which they govern.

One of the most intriguing findings in our study is that the ‘signature’ image-type (e.g. drawings D_{7.9} in Figure 1) is consistently identified as being ‘expert’ by all groups of participants even while undergraduates and trainees do not choose to show a ‘signature’ themselves. We point towards the apparent force of different virtues

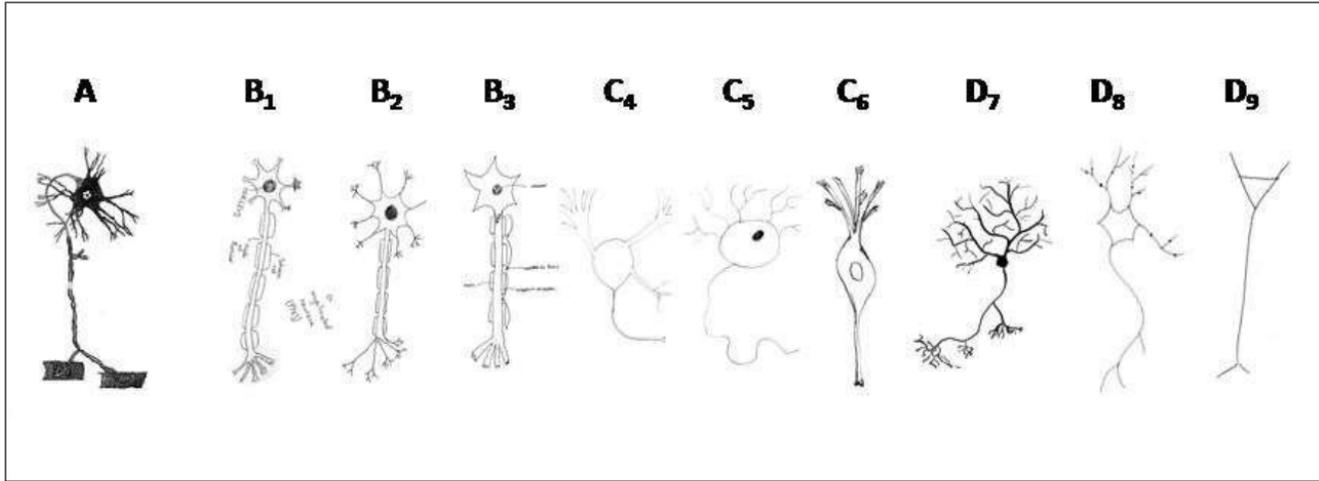


FIGURE 1

A: The textbook neuron image (redrawn from Grey's Anatomy [Warwick and Williams, 1978] and first produced as the image of the neuron-cell type by Lewllys Barker in 1899 [Barker, 1899]). This image [A], is also the formal target of undergraduate drawings [B₁₋₃] (and see Ranaweera and Montplaisir, 2010); while the drawings of trainee researchers [C₄₋₆] and principal investigators [D₇₋₉] exhibit different epistemic virtues.

dominating different contexts: a) the authority of the ‘correct’ or single archetypal image in lecture theatre (and in students’ common-place expectations of what is asked of them in the teaching/assessment setting); b) a faithfulness towards actual observation which apparently coincides with laboratory ‘worker’ status; and c) the broader social ‘licence’ which corresponds to status and the role of ‘leader’ (see Feldman, Divoll and Rogan-Kyle, 2009). But we also suggest that it is the imaginative body-sense correspondence that has gradually accumulated between lead-researchers and their neuron cell-purposes which enables leaders to project the brain cell identities that they use to organise research (socially) and in terms of what is plausible in experimental settings.

In order to explore these issues, two of our participant lead-researchers designed two teaching interventions to give undergraduates a simulated experience of their research perspectives. Briefly, the first intervention ‘placed’ students as odour-detection systems in the laboratory so that each student was required to determine their physical location using just the smells of roasting coffee and tea tree oil released from known locations on opposing sides of the room. This was a proxy for the ways that neuron cells locate themselves within the developing embryonic brain (see Wolpert *et al.*, 1998) and it corresponds with the ways that researchers imagine themselves into the ‘neuron cells’ position’ (*as if* the researcher were the neuron cell identity). The second intervention involved the students walking through the laboratory space, turning and creating individual trajectories of movement in response to life history questions (e.g. ‘*have you ever dyed your hair?*’). Again this choreography corresponds to the ways that researchers try to experience the ‘neuron cell as subject’, developing and growing in response to cues and previously established life-history (see Stockeli and Landmesser, 1998). Figure 2 shows some of the brain cell drawings made by a new cohort of participating students immediately after these two interventions.

Some of these images (A, B and C) comprise parts of the archetypal neuron image that was previously reproduced by *all* students (Figure 1 [B₁₋₃]); but none of them are exactly textbook copies. Drawing D is reminiscent of the observational image-types produced by trainees (Figure 1 [C₄₋₆]), but also perhaps suggests cell-to-cell communication (an aspect of neuron cell identity *not* exhibited by any trainees in our study). Images E and F are essentially imaginative drawings, however, and in subsequent sorting tests were objectively determined as being indistinguishable from the ‘signature’ drawing types of lead-researchers.

We do not argue that our interventions gave students the ability to

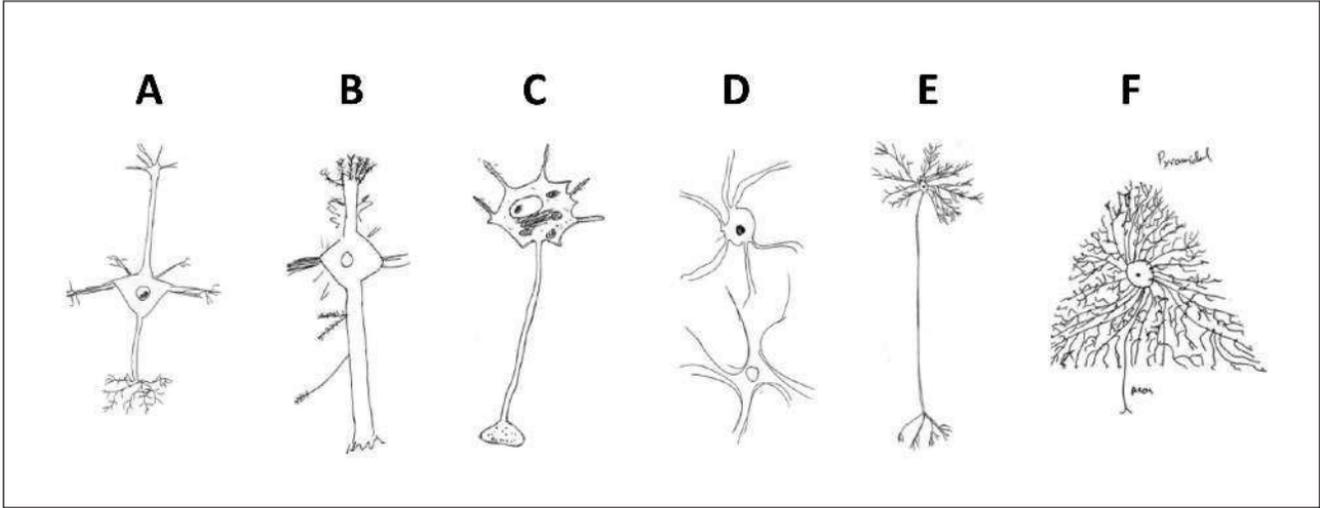


FIGURE 2

A sample of some of the post-intervention drawings of undergraduates.

embody potential neuron cell identities, circumventing the years of work manipulating neurons in experimental settings through which the relevant imaginative body-sense is thought to arise (see Knorr Cetina, 1999; Myers, 2008): but we do suggest that these interventions (designed because of making the embodied experiences of leading researchers the object of analysis in the design pedagogy) have been successful in shifting students out of the '*knowledge-trough*' (Wingate, 2010) of the single archetypal image and relocating them in a research-like perspective from which it is apparently possible (or licensed/ permitted) to be imaginative.

Critical reading in humanities

In a very different academic setting, Weller (2010) also points towards the advantages of treating scholars as an object of inquiry rather than relying on them to narrate their practice in the course of teaching. She documents the ways that leading humanities faculty read critically: paying careful attention to context beyond the given text as well as to the ways that text treats context. This is contrasted with students tending to read for information-only where the surface-level outcomes of the text *per se* are a barrier to critique/development of the inter-textual *process*. Again, the analysis highlights the ways that what is apparently visible to 'experts' is largely hidden from 'novices'. Like our neuroscience data the difference of the 'expert' stance appears to be a willingness/ability to be participative from *within the process*: in this case, 'leaders' being the active elements whereby what is read is deliberately re-written (interpreted) through the act of reading. The study demonstrated that for expert academic readers, literary texts are constituted as palimpsestic, overwritten, sometimes literally, through the process of close reading as experienced readers draw on other texts to generate meaning.

One important implication of this reading study is that each researcher/teacher needs to exhibit their experiences of reading *as imaginative re-writing*, a process that highlights their u-turns and changes of viewpoint perhaps even more prominently than explaining their final interpretation (see Wineburg, 2011). Missteps along-the-way are rarely made explicit in a finished narrative, but Weller's (2010) contention is that *experience* of leading-writers' u-turns (in the *reading process*) exhibits the criteria through which their writing 'signatures' are shaped in ways necessarily neglected in subsequently reported lectures and/or finished research or 'teaching' outputs. Again, we point at the importance of 'peering from inside' the reading process where reading is the lived exhibit. Thus, like Wineburg (2011) in his analysis of how to teach history students to read like a historian, we suggest that leading

humanities scholars should sometimes set about reading publications that are new to them by making margin-notes as they go, and speaking their successive thoughts aloud in real-time (to a recorder) so that these examples (of embodied reading – and thus also of re-writing) can be captured and shared with students.

Just as our neuroscience interventions entailed students walking (and smelling) a path through the laboratory (mimicking the ways that a lead neuroscientist imagine themselves as *being* developing neuron cells) so humanities students might *follow* leading-scholars from the *inside* of their reading process, thereby (potentially) achieving a point of entry into inter-textuality *in their leaders' footsteps*. Douglas *et al* (in press) draw on this idea of reading as embodied action in literary studies of pedagogy by both talking about, and practising, the skill of close reading in 'hands-on' ways and acknowledging this as critical engagement that is experienced physically by both students and teachers as readers. Thus, engaging students in reading and reflecting on the act of reading seeks to 'make reading visible in the minds and study habits of tertiary students as a *disciplinary practice in which they are being trained*'. Critical close reading is, therefore, a contextual experience learnt both from within the act of reading and through making transparent the reading practices of others.

To draw our claims together, relating the physical, sensory and affective prevaricates of neuroscience to the literary practices of humanities (and vice versa) one might envisage what it means to read, to sense and to feel another's musical composition. In order to be critical in music-making, one must gather a sense and feel for what the composer tries to do, then one must hear a note: a bar, a phrase, a cadence – as it is written – but also in relation to what else might have been there quite differently. In doing this one adds to a personal understanding of the composer's aim while also being able to judge the composer's contribution realised within that published turn of phrase. This is to uncover the imagination which is both *material* (in terms of what is possible to make available) while also developing the imagination as a more general and communicative potentiality. This exemplifies a bridging principle, relating linguistic and material creativity through the metaphor of music and pointing at the individual who is this metaphorical bridge in the embodied flesh. It is this principle (and principal) which we identify as the (potential) distinctiveness of experts as teachers. Our image is a much more individual 'signature' than the one generally accorded to the literature of 'signature pedagogies of the disciplines/professions' (Schulman, 2005): for us, the notion of researcher-led teaching turns upon the principle that individuals are the

principals of their own research and only these principals can bring an otherwise invisible form to light in teaching. While the Scholarship of Teaching and Learning (SoTL) literature and the related strands of higher education research linking inquiry based learning approaches to research-like practices (e.g. Healey and Jenkins, 2005; 2007; Levy and Petrulis, 2007; 2009; 2010) have had important impacts on teaching in universities (Entwistle, 2009), nevertheless, these literatures are also to be criticised because of their relative neglect of research-work in the field of practice studies (see Hay *et al*, 2013, for example). Without intending to refute the important teaching-practice gains which have been achieved because of SoTL and its allies, our work is also critical of the SoTL literature, suggesting that often the potential virtues of apprenticeship in researcher-led teaching are foreclosed by more generalised educational accounts in which principles alone emerge as rules or dicta for organising students' work in relation to reified or generally applicable laws (Stafford, 1993: 34) rather than celebrating the principals who might bring to life both practice and its pedagogy (Gamble, 2001).

Concluding remarks

We conclude that being taught by an academic leader with a hard-won practice 'signature' is itself a good reason for attending university; so long as these leaders do, in fact, teach and while doing so remain willing and able to carry their research identity into the classroom. In our specific examples, this means bringing the hidden process of imagining the neuron cell perspective into teaching, or making the 'black-box' of the reading process more transparent through deliberate (re)enactment. These processes (of imaginative body-sense and of creative reading) are vital transaction-sites of disciplinary knowledge-making and their exhibition constitutes a unique researchers' virtue. In this regard our label: researcher-led teaching is a deliberate point towards individual researcher/scholar's practice.

It is also vital that students are helped to find the 'licence' to explore tentative and imaginative practice becoming willing and able to make turns in their knowledge-making process; at least as much as research-leaders apparently do. As we envisage it, this licence is entreaty into dialogue with knowledge-making culture and as Wegerif (2007: 46) explains, dialogue is an educational '*ends in itself*'. In our approach, students must still be generally viewed as being novices in higher education, but we model two very different examples of pedagogy in both of which students' knowledge-work might be located in a single trajectory of practice rather than confining 'learning' to a separately bounded-space where readymade knowledge is the only authority.

In the title of this article, we have coined the term ‘researcher-led teaching’. We use this phrase to emphasise the importance of the unique research identities embodied by leading researcher/scholars/practitioners. The organising principle of our concept of researcher-led teaching is the need for researchers to *be* their practice ‘signatures’ in the teaching setting. We acknowledge that our arguments link teaching potential with research identity, thereby projecting the somewhat controversial view that the quality of higher education depends on a teachers’ *research* status *a priori*. This is particularly charged at a point in time when different UK higher education institutions are all attempting to negotiate and position themselves in relation to an intended Teaching Excellence Framework. Nevertheless, we also suggest that our move to explicate the potential distinctiveness of researcher-led teaching might help to make the ‘hidden curriculum’ somewhat more visible and therefore more inclusive. We suggest that there is much to be gained by treating research-leaders as objects of inquiry and perhaps this is an important direction for the academic development staff of institutions who seek to foster the integration of research and teaching practice while also developing their own research of research in higher education settings.

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