

Initiating and Supporting Practitioner Research in Higher Education

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Abstract

In this paper we describe how practitioner research activity around the theme of ‘Threshold Concepts’ was initiated and supported as part of an ESRC/EPSRC Technology Enhanced Learning Project. One element of the project was a series of seminars involving participants with teaching and research experience across eight disciplinary areas including pure and applied sciences, social sciences, and arts and humanities. They were introduced to the idea of ‘Threshold Concepts’ (defined by Meyer and Land, 2006, as concepts which are transformative, irreversible, integrative, bounded and often troublesome) and were then invited to identify potential threshold concepts in their own disciplines. While participants were encouraged to explore both teacher and learner perspectives on threshold concepts, the need for a set methodology was de-emphasised, and instead participants were provided with reviews of relevant literature and rich accounts of prior activities by researchers in specific disciplines. This was achieved through presentations and small group discussion within the seminars together with ongoing support from project researchers. Participants conceptualised their involvement in different ways; while for some it provided a means of initiating changes in practice at faculty, department or course level, others couched their involvement in terms of their own professional development or intellectual curiosity. We draw attention to the importance of promoting a culture in which enquiry and reflection are central, rather than simply the fostering of less specific ‘collegiality’; critical in this is the identification of points of focus which provide a starting point but which may be understood and operationalised differently by participants. At the same time, this culture needs to have structures and processes which encourage flexible patterns of engagement and creative treatment of problems. Perhaps most critical is a recognition that research approaches and methods emerge as part of the conceptualisation of the problem and through discourse around these points of focus.

Keywords: Professional Development; Higher Education; Action Research; Reflective Practice; Threshold Concepts.

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Introduction

In a university seminar room, a presentation is under way, with the speaker using an interactive whiteboard to illustrate the details of a case study of conceptual development amongst their undergraduate students: specifically, how learners develop their understanding of a particularly complex and challenging aspect of plant metabolism. But what makes this seminar rather unusual is the fact that the audience contains only a few other biologists; rather, it is made up of university teachers, researchers and students from across a wide range of disciplines: and the plant science presentation is followed by others on aspects of engineering, computer science, health sciences, sport sciences, English literature and theology. The focus of the seminar is ‘Threshold Concepts’: an emerging research agenda in Higher Education research, and the case studies have been developed by teachers and students as part of an ESRC-EPSRC research project funded under the Technology-Enhanced Learning Programme.

The seminar and the case studies being presented dealt not just with existing teaching and learning practices, but also with the outcomes of extended reflective practices on the part of participants, small scale research activities involving staff and students, and engagement with substantive methodological and epistemological issues. In addition, the participants were faced with the challenge of presenting their findings to an interdisciplinary group and were then charged with the task of identifying areas of commonality and difference across disciplines, as well as assessing the extent to which there were practical, pedagogical or epistemological points of reference to which they all could relate. This is a challenging agenda; in this paper we describe the context in which research activity took place and identify some of the factors which appear to have contributed to practitioner engagement in theorised research and development activity, and the discourse which has accompanied it.

Transforming Perspectives: the Project and the Seminar Series

The seminars were one aspect of a project funded for six months from October 2006 to March 2007 under the joint ESRC/EPSRC Technology Enhanced Learning Programme, which is part of the Teaching and Learning Research Programme. It emerged from a collaboration between members of the Teaching for Learning Network (TfLN) and a number of other projects funded by the Cambridge-MIT Institute. The project was directed from the Centre for Applied Research in Educational Technologies (CARET) at the University of Cambridge: it was comprised of two

educational researchers based at CARET, and one representative each from the Department of Plant Sciences and the Computer Laboratory.

The overall aims of the project were the establishment of an interdisciplinary network to explore perspectives on the teaching and learning of threshold concepts across a number of disciplines; and an exploration of opportunities offered by a range of technologies to support the teaching and learning of threshold concepts across a range of disciplines. To these ends, a series of project activities were undertaken including the compilation of a literature review; two series of seminars; the development of an online community; and technological scoping and pilot development studies. It is not within the scope of this paper to describe both the seminars and technological scoping; this paper concentrates on one particular aspect of the project, namely practitioner research.

‘Threshold concepts’ are described by Meyer and Land (2003) as: ‘akin to a portal, opening up a new and previously inaccessible way of thinking about something [... representing] a transformed way of understanding, or interpreting or viewing something, without which the learner cannot progress’, and generally characterised as “transformative, probably irreversible, integrative, often troublesome and probably bounded”. The emerging research agenda around threshold concepts has proved appealing and useful across a number of disciplines (see Burchmore, Irvine and Carmichael, 2007, the literature review undertaken as part of the project, for an overview of the development and location of this agenda in relation to other education research agendas and programmes). Some detailed accounts of the nature and role of threshold concepts have emerged, together with discussions of how they might be researched (Davies and Mangan, 2005). Davies and Mangan’s work within the ETC (Embedding Threshold Concepts) project aligns them explicitly with problem-based learning, and their transformative aspect (which demands that learners ‘rework’ their prior knowledge in the light of a new threshold concept) clearly identifies them with models of teaching and learning as conceptual change. Conceptual change may involve the abandonment of prior concepts; differentiation or coalescence of concepts; reanalysis of the structure of a concept; or recognition of some aspect of a concept as an instance of a more generalised case. These forms of conceptual change are reviewed (in the context of learning in science) by Carey and Spelke (1996), who also draw attention to the importance of conceptual changes that have an integrative function and ‘map’

across knowledge domains: much as Meyer and Land (2003; 2005) describe threshold concepts doing.

Threshold concepts are also potentially important in social, situated models that make use of what Sfard (1998) calls the ‘participation metaphor’ of learning. Lack of understanding of threshold concepts and of their role in discipline-specific discourse and practice may confine learners to a role which Meyer and Land (2003; 10) characterise as a liminal state, in which understanding is restricted to a kind of mimicry with only limited meaning to the learner. This seems to align well with Wenger’s (1998) ideas of learners as peripheral participants and suggests that threshold concepts can be seen not only as key elements of a community’s shared repertoire, but also the ‘points of focus’ around which specialised meanings, identity and membership are negotiated. This aligns closely with Meyer and Land’s notion of threshold concepts as being not only conceptual tools, but also setting the ‘boundaries’ of the community or discipline (Meyer and Land, 2003; 5). Threshold concepts may therefore represent learning ‘portals’ through which learners must pass not only to acquire advanced conceptual understanding, but also in order to engage ‘authentically’ in the practices of the community. This has been taken to suggest that the curriculum may need to be oriented towards these ‘points of focus’ and addressed through activities which are doubly authentic: authentic to the learner themselves, but also authentic representations of disciplinary practice.

Participants with teaching and research experience across eight disciplinary areas including pure and applied sciences, social sciences, and arts and humanities were invited to participate in a practitioner-oriented seminar series (referred to within the project as ‘Seminar Series A’). They were introduced to the work of Meyer and Land (2003; 2005) and presented with interim findings from the ongoing project literature review and the methods and findings of a pilot study based in the Department of Plant Sciences at Cambridge. Throughout this and subsequent seminars, participants were reminded that this was an emerging research agenda and that the project was charged with exploring new pedagogical opportunities, rather than application of established theory or practice; care was taken to establish that the relations between research team and seminar participants was one of co-researchers rather than of researchers and subjects.

Following this introduction, participants were then invited to identify potential threshold concepts in their own disciplines, and to explore these further over the next month through small-scale

enquires. By the second seminar in the series, participants had produced case studies of potential threshold concepts which had drawn on student and staff interviews, documentary analysis, focus groups and questionnaires. Participants presented their approaches and emerging findings to a progressively broader ‘graded public’ - initially within small groups, then across the broader participant group, and then in larger seminars, including a more explicitly interdisciplinary and multi-institutional ‘Seminar Series B’.

Discussions within the seminars demonstrated that participants conceptualised threshold concepts in different ways – some focusing on the importance of transformative ‘eureka moments’ involving radical transformation of conceptual frameworks; other stressing the importance of integrative ‘big ideas’; and others identifying their role in defining and bounding professional ‘ways of thinking and practicing’. They also conceptualised their involvement in the project and associated enquiries in different ways: either describing this in terms of initiating changes in practice at faculty, department or course level; in terms of professional development; or as addressing their own intellectual curiosity.

While participants were encouraged to explore both teacher and learner perspectives on threshold concepts, the need for a set methodology was de-emphasised, and instead they were provided with reviews of relevant literature, rich accounts of prior activities by researchers in specific disciplines (though often very different from their own) and a research ‘toolkit’ (comprising examples of interview schedules, focus group discussion starters and course documentation review checklists).

Researching Threshold Concepts: Self-Conscious Responses?

Given the varied conceptualisations of threshold concepts (the ‘point of focus’ of the seminars) and of participants’ roles of pedagogical enquiry, it was perhaps unsurprising that what was to emerge was a diverse set of research approaches, methods and interpretations. These differences are best illustrated with reference to examples of the case studies undertaken by seminar participants, who were subsequently interviewed about their experiences, but first it is instructive to relate these issues to current debates over the quality of qualitative research and to the status of action research in particular.

Carr (2007) suggests that the idea of ‘methodology’ in action research sustains a ‘distorted understanding’ of practice. He legitimises the role of action research by proposing a non-

methodological view which promotes a ‘historical self-consciousness’ that the development of practice ‘presupposes and requires’. He situates the legitimising role of methodology in terms of Gadamer’s critique of ‘method’. According to Gadamer, social sciences uphold their claim to rationality by ‘eliminating the distorting effects of bias and subjectivity from their enquiries’ (Carr, 2007: 429). However, our work with seminar participants de-emphasised the need for a set methodology, and the vignettes which follow demonstrate the ways in which participants carried out their poster task in highly ‘self-conscious’, subjective ways firmly based in their practice and suggestive of ways by which this practice might develop. Elliot (2006) challenges the notion that there is a composite of ‘universal criteria’ which are seen as being synonymous with ‘quality’ and contrasts ‘quality-as-measured’ with ‘quality-as-experienced’, locating the relative proximity of the evaluator to the immediacy and experience of the situation. ‘Quality-as-measured’ locates evaluation at distance from the evaluand, with criteria originating from the externally-generated discourse and from which standards are developed in order to reduce the claims of personal notions of quality (230). ‘Quality-as-experienced’, however, implies that:

the discernment of quality is a form of practically embodied knowledge – ‘at once both cognitive and emotional’ – that is acquired in the course of immediate and direct experience of practical situations and events and manifest in the actions and language of participants [...] Under these conditions *quality* is represented through narratives of personal experience (Elliott, 2006: 230).

The vignettes that follow thus represent ‘narratives of personal experience’ which are necessarily reflective and ‘self-conscious’: partly because of the lack of emphasis placed on the need for any set research approaches to be used, and partly because of the problematic and contested nature and status of threshold concepts as an organising concept.

Threshold Concepts in the Disciplines: Three Vignettes

Following their participation in the seminar series and case studies, semi-structured and focused interviews were carried out with seminar participants. Prompt questions were sent to participants in advance, along with an information sheet addressing issues of anonymity and subsequent use of interview data. The interviews fulfilled three main functions. First, they served as a project evaluation activity, assessing the content and usefulness of the seminars, the use of resources such as the case study toolkit and the literature review, and potential implications for subsequent teaching and learning activities. Second, they explored the ways in which participants conceptualised threshold concepts in their discipline. Third, they explored the extent to which

participants gauged levels of interdisciplinary engagement; the extent to which disciplinary perspectives and methodologies might prove interesting and instructive, and the reach and impact of the interdisciplinary perspectives with which they had engaged during the project.

To some extent this last aspect reflected not only participants' broader experience of interdisciplinary working, but also their recent experiences as part of the project seminars. The comparative rarity of interdisciplinary working meant that participants often talked at length about very specific experiences rather than about interdisciplinarity in a more abstract and generalised sense. When participants gave examples of interdisciplinary practices, these were often associated with knowledge transfer and cross-disciplinary collaboration rather than being concerned with sustained working in the context of interdisciplinary projects, which remain comparatively rare. In other cases, interdisciplinary working was focused around a specific issue, question or problem (in some cases, these being 'set' by external third parties in response to a local, national or global policy context). To some extent, the seminars organised by the project fit this model – although as we shall describe, both the initial 'point of focus' (threshold concepts) and the chosen methodology (case study embedded within discursive practices) allowed participants to develop distinctive approaches.

Vignette 1: Sports Science – Participant R

The dual focus of the interview with Participant R (an experienced canoeist and coach) was the poster produced as part of the case study and an associated set of interviews carried out with teachers and learners taking part in paddle-sport development activities. The candidate threshold concept this participant had identified and had discussed with other canoeists was that of the 'Static Paddle'. This was described on his poster as follows:

“An example of a threshold concept in canoe sport is the idea that the paddle does not move and is static during any stroke. For much of the initial coaching of novice paddlers the language and metaphors used in the discourse between the coach and the novice is filled with the idea of moving the paddle, for example “put the paddle in the water and pull it towards you”. However in reality the paddle only moves through the water when the edge of the paddle is presented to the water, for example on a sculling draw or when the paddle is returned as in an Indian stroke. For the rest of the time, the front of the paddle is presented to the water and in these cases the paddle could be regarded as “static”. The paddle is not moving - the boat is.”

The poster also raised a number of questions which reflected the participant's concerns as a teacher and coach:

“Will this concept help every paddler in their learning?”

The performative, experiential nature of sports is also reflected in an observation on whether expert knowledge in such contexts is ‘tellable’, and the participant cites Polanyi's notion of ‘tacit knowledge’:

“As with any practical skill that is learned, it may not be necessary for a person to learn the theory so that the skill can be acquired. There are many paddlers that can perform highly technical paddling moves but could not explain what they are doing, ‘we know more than we can tell’ (Polanyi 1966)”

Participant R used the model of the case study illustrated by the Plant Sciences case study described at the seminar, although he also referred to the work presented by the participants from the Engineering Department. This was not solely because of apparent ‘disciplinary closeness’, but also because of the role of an apparently simple underlying principle, understanding of which allowed learners to understand better a wide range of examples and problems. R described how the cross-disciplinary composition of the seminars, devised in order to promote exchange of ideas, subject knowledge and research approaches, helped to bring his own viewpoint into focus. He explained:

“You sit and try and dissect threshold concepts and stuff you know, and then when you try and dissect the stuff that other people know, it sort of gives you a better idea of what you're trying to do yourself”

There was no expectation that participants were representative of ‘total’, ‘typical’ or ‘exemplary’ disciplinary practices and viewpoints (to the point where some participants were keen to point out the extent of divides in their disciplines), it was clear that – on an individual basis – engaging with other disciplines stimulated reflection and reconceptualisation of issues in their ‘home’ disciplines. This, of course raises an important question: namely, whether interdisciplinary discourse can be ‘scaled up’ to engage whole communities, or whether it must of necessity be an issue of individual learning and development. Participant R also provided a ‘teacher perspective’ on this process, suggesting that it was easier to explain the concept of the static paddle to an expert, but non-canoeist, audience in the seminar than it had been to other members of his ‘home’ canoeist community.

Participant R suggested the five characteristics of threshold concepts are an appealing starting point, but not necessarily helpful except to initiate further questions about the relationship between teaching theoretical and embodied knowledge. A simple model of identification of threshold concepts followed by (in some way) ‘addressing’ them was rejected in favour of using the idea to initiate discursive practices about teaching, learning and assessment of performance in this specific context.

Having done this, it was notable that the teacher and learner perspectives documented by the participant in the course of his case study highlight similar issues, namely: the timing of the introduction of the theory of the static paddle; the distinction between domain expertise and teaching-of-the-domain expertise (what R described as ‘learning to do’ and ‘learning to teach’); and the role of ‘theory’ in what is perceived as an experiential, performative domain. The last of these may go some way to explaining why R found it easier to discuss the concept (the Static Paddle) and the meta-framework (threshold concepts) in the context of the seminars in which theoretical perspectives were foregrounded, than in one in which it is possible to achieve ‘mastery’ (at least in ‘doing’) without voicing theoretical or pedagogical commitments.

Vignette 2: English Literature – Participant C

The dual focus of the interview with Participant C (a research fellow and junior member of teaching staff in the department of English) was the poster produced as part of the case study, an associated set of questionnaires and an extended supervision carried out with learners taking part in the English tripos. The candidate threshold concept this participant had identified and had discussed with his students was that of ‘Ethical Reading in the teaching of Tragedy’. This was described on his poster as follows:

“This comes from the work (among others) of the American legal/literary/philosophical (herself a boundary-straddler, or boundary-disturber) critic Martha Nussbaum. We might summarise (in extremely brief terms) the ideas surrounding this concept as follows:

- ethics (particularly in its Aristotelian sense) asks what it means to live a good life, a life of *eudaimonia*, of goodness and wellbeing. Tragedy tells us that this can be disturbed or destroyed by things that are beyond our control, by things that happen to us (or that we do) without our choosing them to happen.

- tragedy, like other literary forms, can pose ethical questions, in a way that other kinds of philosophical enquiry cannot, since it depicts ethical dilemmas being encountered and worked through.
- our response to tragic drama or literature, a response that might be strongly emotional, should itself be analysed as ethical. These emotions are not merely useful in reaching a response to literature – they can be considered as a valid response in themselves and don't need to be transcended or moved beyond. (NB the frequency of response as a tragic motif – how does a character respond to the suffering of an other?)

Tragedy (like other forms of literature) is radical in that it forces us – as its audience, readers or critics – to see the world from a point of view that we might customarily ignore. It particularises, and forces us to imagine, a point of view that we do not usually imagine: “thinking outside [ourselves]” in the words of one of my students. In other words, tragedy is not just about pity, it forces us to pity, to have compassion.”

Participant C conducted questionnaires and an extended supervision with students, whose response to the difficulty of ethical reading of tragedy tended towards both problems of definition, and the challenge of isolating them from ‘social or aesthetic approaches to language’. The learner perspectives expressed during Participant C’s discussion with students convey a degree of ‘desperation’ in attempting to ‘define’ this ‘fundamentally inconsistent genre’. Reflecting the emotional response that reading of tragic texts provokes in learners, and the apparent absence of a conceptual vocabulary to speak about it, Participant C points out that to support learners is to encourage them to accept a degree of ‘confusion’ and ‘bafflement’:

“since it is a mode of writing that deals with unanswerable questions, and since there have been so many different attempts to answer these questions, that *they should feel slightly overwhelmed.*”

Participant C related a good experience at seminar series A, enjoying other people’s presentations as a ‘productive articulation of differences without necessarily resolving them’, aligning with his own assessment of the specific threshold concept he went on to explore. Comparisons with other disciplinary practice were drawn, based on contributions from scientific subjects, where threshold concepts appeared to mark directions for learning and were seen as something to be passed through in order to progress. By contrast, teaching in a ‘directional way’ is not easily accessible in English, where ‘pedagogically it sees itself as expanding in multiple directions’. What seems radical about teaching ethics is that the ‘significance in both literary and life terms resonates beyond the text’, and as such Participant C found another case study and poster on ‘Biblical Texts

as Literary Texts' of particular interest. In both cases the personal beliefs of students make the concepts work in different ways, as a variety of 'discursive positions' can be occupied. It is possible to have a 'conceptual acceptance' of the concept while simultaneously rejecting its possible 'truth-value'.

Participant C looked at the Plant Sciences template but did not look at other resources. As part of an extended teaching session, he explained the theory of threshold concepts to students and asked them to fill out a questionnaire which was to take 10-15 minutes to complete. They were asked: 'How would you define an ethical response to tragedy?', 'Is it a difficult concept, and if so, why?', and 'How would you structure a response to a question about tragedy?'. Students were encouraged to see the task as a revision exercise.

Participant C's activity generated a mixed response, as the exercise revealed how difficult the concept had been for students. They were 'uncomfortable' at being brought back to something they had had trouble with, yet are used to being asked to talk about the development of critical practices and expect this to take place. However, they had not experienced the 'meta-level' of being asked what they meant by a particular concept, and this is borne out in the principal issue being in expressing the nature of this difficulty and finding appropriate conceptual language. By the third term of the academic year (approximately six months after this extended tutorial), C reported that students demonstrated a much clearer approach, with ethical reading seemingly more 'completely integrated', in that students were able to reference more critics, demonstrate competence in their methodological approach, and re-question critical discourse.

According to C, there are very few instances where students are asked to explicitly say what they mean and are potentially very much 'on the spot' when this occurs: it is not part of a considered reflective process, but is more likely to take place in an adversarial setting. Engaging learners with meta-level issues and the conceptual vocabulary of difficulty might have been quite an interesting experience for them and an interesting activity in its own right. Participant C felt that the task made him think more 'objectively' about the way he conceptualised his teaching, and noted that this meta-level task alerted him to the ways in which students could occupy critical positions and use critical vocabulary in different ways: both to demonstrate a productive struggle with the difficulty or to 'satisfy' perceived expectations of them.

Vignette 3: Engineering – Participants A and H

The dual focus of the interview with Participants H and A (a senior member of teaching staff and a junior researcher in the Department of Engineering) was the poster produced as part of the case study and an associated set of interviews with staff and students in the Department of Engineering. The candidate threshold concept this participant had identified and discussed was ‘Spin’. This was described on his poster as follows:

“Spin is the term given to rotation of a body. It has an influence across many branches of engineering, in fact almost anywhere where there is motion. It is perhaps most obvious in solid mechanics, and this is where it is first introduced in the Cambridge tripos.”

The teaching of spin is seen to be difficult to teach for a number of reasons:

“[Its] integrative nature is not immediately apparent, as it is hard to see the links between different types of motion

[It] may require unlearning of preconceived ideas (e.g. that real objects behave as ‘particles’)

Although it is a simple concept to grasp, it is troublesome because it generates many counterintuitive results and is mathematically complicated – this is especially difficult in the first year, when students arrive with a range of mathematical abilities. However, it is an important topic to understand, as it is central to much of dynamics.”

In the context of undergraduate teaching at Cambridge, spin is taught through a variety of media and at various levels: the primary teaching method concerning a mathematical description and treatment of spin is through lectures, although these are supported by various activities (laboratory sessions, demonstrations and videos) to enhance understanding of the concept and its implications. It is seen as a topic in which visualisation is important, so videos, simulations and experiments play an important role in teaching and learning activities.

Participant A remarked that the seminars provided ‘a different way of looking at things’, and that the multidisciplinary aspect was interesting; while the contributions from humanities and social sciences were interesting, the examples drawn from the sciences (and Participant R’s ‘Static Paddle’) were methodologically and pedagogically more relevant and accessible. Participant H also found the interdisciplinary composition of the group interesting, but he raised questions of how potential threshold concepts might have been selected and whether other participants had modified their use of domain-specific terminology for the benefit of the other attendees. He

referred to his own choice, 'Spin' which he had selected as he thought it would 'work well in a mixed group'.

H's interest in threshold concepts appeared to have been stimulated not only out of an interest in gaining insights into effective pedagogical practice in engineering, but also out of general curiosity about, and exposure to, the wide variety of curriculum content, working practices and conceptual frameworks across the institution as a whole. While H appreciated the role and significance of other examples (and the reason for their selection as potential threshold concepts) he did not necessarily understand what made them difficult for learners in that field. By analogy with his own example of spin, however, he could accept that there might be 'huge complexities' behind them, and that he did not understand the 'territory in which other people were working'.

These observations echo R's comments about the differences he had experienced when presenting the 'Static Paddle' to other paddlers as opposed to an interdisciplinary seminar group, and suggests that there may be a difference between those concepts which, in the mind of the 'listener', function as *interesting* and *illuminating* 'boundary crossing' examples (but of which they as non-specialists might only gain a partial understanding); and those which appear to have methodological and pedagogical *value* and *relevance* in that they relate closely to either curricular demands, their experience of student learning within a domain, or align with established ways of thinking and practising within their discipline.

Both A and H noted that there were seen to be 'cultural differences' in what characterised teaching activities across the disciplines, and the role that these activities played within broader disciplinary practices. Discussion (including wide-ranging discussion which might go beyond prescribed boundaries) was recognised as being an intrinsic element of teaching and learning activity in the humanities, while in engineering supervisions, for example, learning resources tended to be marshalled into a set framework and there would be little need to expand on this in the event of discussion. According to A and H, this mirrored the broader academic culture in which publication of academic work was seen as the validation / vindication of the 'process' of getting there: while it was recognised that it is useful in engineering to exchange ideas it is not considered a necessary or sufficient prerequisite for the production of high-quality research.

Participant H was ‘still considering’ whether threshold concepts are ‘difficult or important’, ‘lines you simply cross’ or ‘decisions you make’, whether conscious or otherwise. He cited the potential circularity of the process in a manner similar to Participant C in English Literature, asking ‘when do you ‘get’ that 10 is an important number?’: recognising the problematic nature of both the ‘threshold’ and importance of metacognitive processes in which their significance is recognised.

There was ambivalence in the seminars as a whole about the appropriateness of the ‘threshold’ metaphor and the suitability of the term ‘threshold concept’, however, these vignettes demonstrate valuable insights which arise from the process of questioning them. This was pointed up in the context of engineering by H who commented on a wide variation in what they ‘look like’ and the ‘role they perform’, which he characterised in terms of the speed of their acquisition and assimilation. He also pointed to their relationship to tacit and explicit knowledge, and participation in expert discourse. By way of example, he argued, you know that if you put a hot frying pan into water it will buckle, but do you need to know it is related to the concept of entropy? This suggests that some of the most ‘meaningful’ threshold concepts might not necessarily be ‘difficult’ but they might involve grasping abstractions: in such cases the role of discourse and activity may centre around making the link between the theoretical and practical explicit.

Emerging Themes

Reviewing these vignettes and data collected from other participants, it is clear that the opportunity to participate in small-scale, focused research activities had proved engaging and enlightening. The opportunity to further participate in interdisciplinary activity, as well as to make explicit personal and disciplinary frameworks and practices to a mixed but receptive audience, differentiated the work of the project (and participants experience of it) from professional development activities more generally; there was a general agreement that engaging with ‘theory’ (even if only to critique it) rather than simply sharing practices or experiences represented an approach which could usefully be replicated in the context of staff training or professional development. There was also a wide recognition that such engagement represented a rare and challenging, but potentially valuable activity for learners – in this case, mainly undergraduate students.

The fact that participants were offered advice and support, and accounts of other explorations of threshold concepts in different disciplines, rather than being provided with a prescribed set activities or research instruments led to a variety of responses. Rather than interpreting this as a divergence from a preconceived plan, these provided the research team and other participants with insights into individual and disciplinary perspectives on the idea of threshold concepts, disciplinary norms, teaching and learning environments, and perceptions of the roles of teachers, learners and pedagogical strategies. The point of focus provided by a potential threshold concept and the associated question “Why is it difficult to teach (or learn) X?” may provide a context within which it is easier for teachers and learners to reflect than the more general “What do you find difficult to teach (or learn)?” or “How do you teach (or learn) difficult ideas?”. And, of course, it does not preclude the outcome that “You may find this easy to teach, but we find it difficult to learn” (or the opposite!) and the further discussion that this engenders.

These windows into disciplinary perspectives and practices highlighted a number of areas of interest:

Novice / Expert Distinctions and Liminality

Several of the participants couched their understanding of the role of threshold concepts as related to the distinction between experts and novices. Interestingly, when this was discussed within the seminars, there was lively debate around the questions of whether they characterised expert discourse or that which involved experts and novices together. This latter role seemed to link to ideas in the threshold concepts literature about learners who were in a liminal state of ‘almost-mastery’ of new knowledge for whom expert or expert-teacher intervention enabled them to gain full understanding. Some participants were dissatisfied by this account, arguing instead that effective learners were those who maintained themselves in a state of permanent ‘liminality’ as this left them reflective, receptive to new ideas and willing to accommodate disparate viewpoints on what otherwise might become a corpus of accepted knowledge.

Tacit and Explicit Knowledge

While participants were willing and able to identify potential threshold concepts, several, such as Participant R, talked about them in terms of ‘tacit knowledge’. The exposure or making ‘explicit’ of this knowledge was seen as being both an individually and collectively valuable activity,

although some participants felt that in making tacit knowledge explicit, some of its explanatory power might be ‘lost’. This may relate to the previous issue of ‘expert knowledge’ some of which may be tacit or represented in what Wenger (1998) calls ‘reifications’, and the question of whether this can be ‘taught’ or can only be developed through participation in the practices of a disciplinary community.

Underlying Simplicity and Revealed Complexity

There was extensive debate within the seminar series and discussion within interviews about the role of threshold concepts as ‘integrative’ organising concepts or principles. While in some disciplines (notably, but not exclusively, the sciences and engineering), teachers identified a need for learners to appreciate the underpinning principles which linked what had hitherto appeared to be unrelated areas, in other areas concept differentiation and the development of understanding that the opposite was the case, was also important. Some participants went further than this, arguing that the role of threshold concepts was ‘disintegration’ of preconceived ideas and that students needed to be supported in developing reflective and critical approaches. Examples from within the seminar series included not only Participant C’s account of ‘ethical reading’ but also the example of ‘Biblical texts as literary texts’ (intellectually and personally challenging for some students) and an account from biomedical sciences which discussed how teachers could challenge and problematise naïve notions of ‘disability’, but in so doing, students’ prior beliefs (and in some cases their self-image of themselves as ‘able-bodied’) were ‘disintegrated’. This goes beyond Carey’s (1991) notion of conceptual change as abandonment or replacement alone, as it combines these with extensive concept differentiation.

Subject Matter, Ways of Thinking and Practicing and Aspects of Professional Identity

This is perhaps the most significant dimension to our findings and one which presents the greatest challenge to a view of threshold concepts as an issue of ‘curriculum’. We became increasingly aware that potential threshold concepts were often not represented as ‘special’ as such in the curriculum – hence the difficulty our participants had in engaging students in discussion about them. Subscribing to ‘transmission’ models of learning which are not concerned with learning as conceptual change, and those which equate learning with memory (as exemplified by student accounts in particular) tended to lead to threshold concepts being seen as more ‘difficult’ but otherwise having no special status or characteristics. Even when conceptual change models were

applied, threshold concepts were still seen as being something to be ‘acquired’: this follows Sfard’s (1998) characterisation of constructivist perspectives as being essentially about the ‘acquisition’ of knowledge as a ‘good’ and hence of the curriculum as the organisation of a series of activities oriented toward their acquisition.

In Sfard’s terms, we also found instances of threshold concepts as characterising the distinctive ways of ‘participating’ in disciplinary discourses and practices – overlapping with the idea (above) that they represent aspects of the ‘expert’ or ‘core’ activities of a disciplinary community. This aligns neatly with Wenger’s bounded ‘communities of practice’ (1998), and there is an appealing simplicity in an interpretation of threshold concepts as representing some kind of portal on a periphery-to-core or novice-to-expert trajectory. But our vignettes provide an interesting counterpoint to this, namely the idea that perhaps threshold concepts are not solely the focus of expert-novice discourse *within* disciplinary communities, but that some at least may play a ‘boundary-crossing’ role *between* disciplines. When our participants from the Department of Engineering selected ‘spin’, this was not only to represent what students found difficult in learning engineering – it was also chosen to exemplify discipline-specific conceptual frameworks and to represent the individual and collective identities of the participants as engineers within a temporary *interdisciplinary* community.

Discussion

From our experience, and judging from the accounts of participants presented in these vignettes, threshold concepts can certainly act as a stimulus to activities in which the processes and ends of a set of practices are inseparable from the discourse, enquiry and reflection which accompany and generate them (Elliott, 2006; 231). Accounts of participation in project seminars and other activities, suggest, however, that prior discussion, legitimation and support are essential if teachers and learners are to feel as though this discourse, enquiry and reflection represents activity capable of generating outcomes of high ‘quality’.

But this is not the ‘quality’ which Elliott describes as ‘quality-as-measured’, however; the assessment of quality (as our interviews revealed) came from the participants themselves in reflective accounts, expressed as ‘quality-as-experienced’ and assessed subjectively in terms of ‘value-for-use’. The process of tentative identification, exploration, discussion and communication of potential threshold concepts to a variety of audiences (both domain experts

and interdisciplinary non-experts) appear to represent essential aspects of process of reflection-as-action rather than one in which enquiry is a precursor to public reflection-on-action. If there was one characteristic of the presentations made at seminars, it was the expression of tentative, but wholly legitimated and accepted subjectivity on the part of speakers, who for the most part began their presentations with disclaimers to the effect that “I think this may be a threshold concept ...”; “My students and I discussed this and we are fairly sure that ...”; or words to that effect. The responses of audiences to these presentations, and to the associated case studies, were discursive and exploratory rather than adversarial or dismissive. Even when participants (such as H, the engineering lecturer) were uncertain as to *why* a concept was difficult or had ‘threshold’ characteristics, they were prepared to attribute this to domain-specific subjectivities rather than to any deficiencies (or failings in ‘quality-as-measured’) in others’ understanding of the notion of threshold concepts.

The ‘five characteristics’ of threshold concepts might, of course, potentially take on the role of ‘measures’ in relation to threshold concepts (raising the question of whether can one threshold concept can be ‘better’ than another?) but they are better thought of as pointers or framing devices, or as evidence of their ‘value-for-use’ rather than as defining characteristics. Their transformative nature, for example, is best thought of in reflective and subjective terms: “understanding this idea changed the way in which I think about ...” rather than as some kind of intrinsic and objective aspect of a concept. In short, the problematic and discursive quality of threshold concepts makes it difficult, and possibly even undesirable, to attempt to establish universal ‘standards’ - nor does it allow the prescription of any particular research approaches or patterns of enquiry.

Better, though difficult, the right way to go? Further research into Threshold Concepts?

What do the views expressed by our participants and the perspectives offered by Elliott and others imply for the research agenda around threshold concepts and troublesome knowledge? Given that to date, much of the threshold concepts research agenda has been primarily concerned with identification of potential threshold concepts and associated implications for curriculum design (see Burchmore *et al* 2007), these views seem to suggest a substantial departure from this, revealing not only the potential concepts, but also their role as expressions of professional ways of thinking and practicing, and furthermore, as playing a part in the construction and

representation of teacher and learner identities. Even more significant may be the level of engagement that was achieved and the implicit and explicit critique of the very basis upon which participants had elected to take part in the project and on which they had been charged with the task of the exploring their own discipline. There may well be a ‘better but difficult’ research and development agenda to address here which goes beyond identification of empirical ‘things-in-themselves’ in the curriculum and ideas of teachers and learners as engaging with these uncritically, and asks of them that they consider the ‘value-in-use’ of concepts, meta-concepts, practices and strategies.

The work we report here has shown that appropriately conceptualised and supported practitioner research activity can lead to reflection and enquiry into disciplinary practice, and as such it may point the way for a more expansive programme of interdisciplinary practitioner enquiry into meta-level frameworks (including threshold concepts as an organising principle) and concerned with more generalised approaches to the development of practice and the creation of ‘knowledge-in-action’. One of the strongest themes to emerge from this work is the importance of subjective responses (which is not necessarily to be read as upholding individuality at the expense of utility) but rather should be read in terms of reflection and enquiry as elements of teaching and learning practices which support personally valued outcomes. In this regard, threshold concepts can be seen to have currency across disciplines, but their value as an organising principle arises from their not being a ‘fait accompli’ to be accepted or rejected outright. Second, in light of this departure from threshold concept as ‘object in itself’ to a ‘point of focus’ for this kind of personally valuable reflective practice, we now need to explore the idea of threshold concepts not just in the curriculum, but in terms of learning activities oriented towards developing expert discourse, and establishment and ongoing negotiation of individual learner identities. The investigation of learner identities necessitates exploration with both teachers and learners, in relation to other learners, other teachers, and other disciplines. If threshold concepts do indeed perform different roles and give rise to these kinds of issues, then further research into them needs to consider how these distinctions and identities are discursively constituted, and the roles that such threshold concepts and other forms of knowledge may play in these processes.

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