

Threshold Concepts, Disciplinary Differences And Cross-Disciplinary Discourse

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‘Threshold concepts’ have proved a useful framing for enquiry into teaching and learning in higher education and early professional learning. Most studies have, however, been concerned with the nature and role of threshold concepts in specific disciplines. This paper discusses how they can also be used as a means of initiating cross-disciplinary discourse. In so doing, they challenge teachers to consider what is distinctive about their own disciplinary ‘ways of thinking and practicing’ and invite reflection: not simply on teaching and learning ‘in the disciplines’, but also on the potential for working across disciplinary boundaries. This also raises important issues about the recruitment, induction and orientation of students as they make transitions into higher education in the Gulf context, as elsewhere.

INTRODUCTION: THRESHOLD CONCEPTS

The idea of 'threshold concepts', has, since its introduction by Meyer and Land (2003, 2005, 2006), stimulated much interest and discussion amongst teachers and researchers in further, higher and early professional education. A threshold concept is described as "akin to a portal, opening up a new and previously inaccessible way of thinking about something", in contrast to a "core concept" (Meyer and Land, 2006, pp.4–6). Meyer and Land identify five properties or characteristics of threshold concepts, namely that they are "transformative", "irreversible", "integrative", "bounded", and "troublesome". Not all threshold concepts display all these properties, however; Meyer and Land say they are 'likely' to do so, that the 'boundedness' is not necessary and the 'troublesomeness' is 'potential' (pp. 7–8).

Meyer and Land (2003, 2006) acknowledge that threshold concepts as they define them can be understood and researched from both cognitive and social learning perspectives: disciplinary conventions and social activities play a role in the personal transformation of understanding (see also McCormick (2008) for an analysis of Meyer and Land's characterisation in terms of 'acquisition' and 'participation' metaphors for learning). Cousin (2006) also highlights the importance of considering social influences and outcomes associated with cognitive change, particularly when this is potentially unsettling and challenging to learners. But despite this, research into threshold concepts and the discourses that accompany their teaching and learning has been dominated by cognitive perspectives, and by accounts that seek to identify threshold concepts in specific disciplinary settings (see, for example, Meyer, Land and Smith, 2008).

These studies examine threshold concepts in areas including economics (Davies and Mangan, 2005; Davies, 2006; Meyer and Land, 2006); computer science (Eckerdal et al., 2006); geology (Miller, 2006) and politics (Korosteleva, 2010). Other research, offering a wider examination of threshold concepts and 'troublesomeness' within disciplines, has included a discussion of the reasons why business students find learning commercial law so difficult, and illuminating the bounded nature of the legal discourse that itself presents problems to students (Allen, 2007); and of the idea of 'caring' as a threshold concept for healthcare students, where a personal framework blending personal attributes and professional practice needs to be constructed by students as they work with patients (Clouder, 2005). Other studies discuss transitions into professional practice and early career learning, for example in music (Burt and Mills, 2004) and health care (Fessey 2002; Kell and van Deursen 2002; Clouder and Sellars, 2004).

Threshold concepts have been linked with distinctive 'ways of thinking and practicing' in a number of disciplines: biology (McCune and Hounsell, 2005); sociology (Jones, Jary and Rosie, 2004); and history (Anderson and

Day, 2005). The wide literature on conceptual change in science, although largely based on research in schools, has been linked to threshold concepts, in particular by Davies and Mangan (2005), who use Carey's (1991) work on conceptual change as a basis for their elaboration of threshold concepts. Some more general work discusses conceptual change within a broader context of individual learning and identity and disciplinary definition, particularly in emerging and contested disciplines such as cultural studies (Cousin, 2006), and in workplace settings where informal patterns of learning and tacit knowledge make threshold concepts more difficult to identify, teach and learn (Atherton, Hadfield and Meyers, 2008).

This paper discusses the work of a project with a rather different approach to exploration of threshold concepts: the 'Transforming Perspectives' project, which began at the University of Cambridge in 2006. This subsequently became part of a larger funded initiative, the 'Ensemble' project (<http://www.ensemble.ac.uk/>), which is exploring the potential of new web technologies to support learning with cases in areas of complexity and contestation – including those in which threshold concepts are well-represented. 'Transforming Perspectives' (the name was selected to represent both the nature and role of threshold concepts) sought, from the outset, to explore the idea of threshold concepts in a *cross-disciplinary* environment. It also engaged participants not only with the identification of potential threshold concepts in their disciplines, but invited them to think more broadly and to critically engage with the 'concept of threshold concepts' across disciplines as well as within them.

DISCIPLINARY RESPONSES TO THE IDEA OF THRESHOLD CONCEPTS

The project involved participants with teaching and research experience across eight diverse disciplinary areas including pure and applied sciences, social sciences, and arts and humanities. An initial seminar introduced the idea of threshold concepts and discussed how these might be investigated in different teaching and learning settings. Participants were then invited to identify potential threshold concepts in their own disciplines, and to explore these further through small-scale research activities. This research activity was supported by members of the project team who acted as 'critical friends' and by the provision of a number of online resources, including a poster template, a 'toolkit' of appropriate research approaches and a literature review which was concurrently being developed as part of the project.

Over the following three months, participants produced case studies of potential threshold concepts: these drew on student and staff interviews, documentary analysis, focus groups and questionnaires. The concepts identified were wide-ranging, and included 'Spin' (produced by participants from Engineering); 'Reflexivity' (Social Anthropology); 'Photoprotection' and

'C4 Photosynthesis' (Plant Sciences); 'The Static Paddle in Watersports' (Sports Science); 'The International Classification of Functioning' (Biomedical Science) and 'The Y-Combinator and Recursion' (Computer Science). Participants produced posters about these concepts and the research activities that they had undertaken. These were then used as the focus for further discussion both within the initial group of seminar participants and also in a further set of seminars in which an extended cross-disciplinary group engaged with broader questions of the nature and scope of threshold concepts, and the potential of learning technologies to support their teaching and learning.

If we take one of these examples, it may give a flavour of the kind of concepts that were identified and the enquiries that were undertaken. A group of plant scientists identified 'photoprotection' as a threshold concept: this is the term given to a wide range of biochemical and physiological adaptations that allow plants to survive in high-energy (bright, hot, arid) environments. The concept was identified on their poster as 'transformative and irreversible' in these terms:

In order to reduce the effects of photoinhibition [too much energy leading to damage], plants have evolved a complex and imperfect system involving photorespiration, non-photochemical quenching and physiological adaptations ... Understanding the concept of photoprotection should lead to an appreciation of the level of adaptability that plants need to survive in changing environments. ... Once you have opened your mind to the idea that the physiology of plants has evolved as a compromise which is unlikely to be ideal you no longer assume logic in plant design.

Full understanding of photoprotection also involves integration of understanding from across the plant sciences curriculum: ecology, plant and cell physiology and biochemistry. Interviews with teachers and students confirmed that this is a 'troublesome' for learners; not only does it seem counterintuitive that, although plants need light to survive they can get too much of it, it is hard for them to imagine that plants have not found some way of harvesting all the light available to them. This challenges a naïve view promoted in school-level biology that living things are optimally adapted to their environments.

Another very different example from the context of health sciences, was the World Health Organisation's International Classification of Functioning (ICF), or rather, the shift that underpins it, from a medical to a psycho-social view of 'disability'. The poster articulating the role of the ICF began with description of a woman (A) with cerebral palsy and then stated:

A's and all of our functioning and disabilities are classified by

the World Health Organization's International classification of Functioning Disability and Health (ICF). The classification of functioning and disability is applicable to all people, and 'mainstreams' the experience of disability, recognizing it as a universal human experience. We are all on this continuum. The view of disability as generated by the ICF overturns the medical model, which sees the disabled person and 'their condition as the problem'. Understanding this view of disability as something shared and based on the 'person living in their world' is a threshold concept.

This threshold concept, for students encountering it for the first time, also had an unsettling, disruptive effect: not only opening up new ways of thinking about disability but also challenging their prior beliefs, attitudes and even behaviours. Examples such as these were of particular interest within the group of project participants because they highlighted a growing critical engagement with Meyer and Land's definitions of the characteristics of threshold concepts: as one participant, a theology lecturer who presented 'the scriptures as literary texts' as a threshold concept commented: "'Transformative' yes, but not so much 'integrative' as, for many students, 'disintegrative' of their prior beliefs".

One of the project's aims was to assess to what extent understanding of threshold concepts could inform the development of learning technologies, and the posters provided valuable articulations of teacher and learner perspectives with which designers and developers of these technologies could engage. A subsequent seminar focused on different learning technologies that might be used to support the teaching and learning of threshold concepts. These included examples oriented towards both individual conceptual development (concept mapping software and adaptive assessment systems) and collaborative knowledge building (such as online discussion and chat environments, authoring tools and 'Web 2.0' applications), the epistemological eclecticism of the idea of threshold concepts being reflected in a wide range of technological responses.

At the end of the project activities, participants were interviewed. These interviews not only contributed to evaluation of the project: they also provide vignettes of how practitioners across a range of disciplines had engaged with educational theory, identified potential areas for enquiry, and undertaken small-scale research and development activities within a broader community of enquiry established by the project and the seminar series. The outcomes of these activities have been reported elsewhere: Irvine and Carmichael (2009) draw on these case studies to assess the potential for the idea of threshold concepts to act as a point of focus or stimulus for teachers in higher education to explore their own practice; a similar argument is presented by

McLean (2009). This paper describes how the broad definition of threshold concepts does not enforce a particular epistemology or pedagogy, nor does their nature dictate a particular form of enquiry: this breadth proved useful as a means of structuring documentary analysis for some participants and for framing student focus groups for others. The idea allows participants with diverse disciplinary backgrounds and epistemological frameworks to “reflect on and elucidate notions of ‘value’ [and] provides an alternative to approaches which encourage decontextualised ideas of ‘reflection’ or overly generalized commitments to discover ‘what works’” (Irvine and Carmichael, 2009, p.116).

THRESHOLD CONCEPTS AND CROSS-DISCIPLINARY DISCOURSE

As mentioned above, one of the distinctive features of these enquiries into threshold concepts was that they took place within a project and seminar series that involved participants from different disciplinary backgrounds. Seminars involved these participants presenting their work and discussing threshold concepts in their teaching and learning with a mixed audience including established academics from across the disciplines as well as educational researchers and learning technologists. Exploring threshold concepts ‘across the disciplines’ rather than ‘in the disciplines’ broadened discussions from identification of potential threshold concepts to a critical engagement with the idea of threshold concept itself and with Meyer and Land’s definitions. Some participants, particularly from the social sciences and humanities, challenged the notion that threshold concepts could be identified as ‘things-in-themselves’ and emphasised that the focus needed to be on learner *abilities or commitments*. This aligns with work by Rowbottom (2007) and this concern is reflected in a broadening of work on threshold concepts to include abilities and skills (the 2008 International Conference on Threshold Concepts, held in Ontario, Canada, for example, calling for papers on threshold concepts and threshold *skills*).

What also made the project distinctive was the fact that it used threshold concepts as what Wenger (1998) describes as a conceptual ‘point of focus’ for discussion within a group which was, at least for the duration of the project, held together by a common purpose. At the same time, this involved working within what was, for most participants, a new and cross-disciplinary ‘community of enquiry’. As a result, they had not only to engage with the idea of threshold concepts, but also had to establish how to interact within the group and how best to present the subject and results of their enquiries in their ‘home’ disciplines.

This kind of working across disciplines differs from more established approaches to cross-disciplinary and interdisciplinary work, which characteristically involves a team being deliberately constructed to solve some

pre-existing and well-defined problem. Instead, it aligns with Strathern’s call for cross-disciplinary work “... to speak of possibilities that lie in being captured by another’s concerns ... for it also makes visible the interest of those who are identifiably ‘other’ to the discipline in hand” (2006, p.203). Strathern argues that cross-disciplinary working, appropriately supported, can provide a critical mirror and stimulate reflection on existing practice, informing the development of new notions of quality and value. At the same time, working across disciplinary boundaries even in well-supported and accepting environment such as the Transforming Perspectives project seminars demands what Mason (2006) calls a ‘multi-dimensional logic’. It requires that ‘hinterlands’ of research practices (Law, 2004) are respected and that what Haythornthwaite (2004) calls the ‘specificities’ (approaches, practices and discourses) of each contributing discipline are maintained; while at the same time participants are encouraged to frame questions, formulate problems and undertake enquiries in experimental and unfamiliar ways.

Participants in the project seminars reflected on the experience of hearing from, presenting to, and discussing their work with those from other disciplines. The opportunity to ‘talk about doing’ in such a setting was seen as valuable, albeit challenging:

I find the idea of talking about things ‘we do’ quite difficult and attending seminars talking about the things that ‘we do’ is a second tier activity. Doing the things that we do has to take priority. Yet at some stage we have to discuss the things we do in order to do the things we do, better. We don’t find the time to discuss the things we do (H, Engineering Lecturer)

C, a lecturer in English Literature, commented, in an interview towards the end of the project:

differences [between threshold concepts in different disciplines] weren’t resolved ... but I found it a very productive articulation of the differences between disciplines.

This idea that the seminars were a space for the ‘articulation of difference’ was echoed by other participants; the emphasis on the pedagogical practices and the discourses that accompanied them allowing the disciplinary boundaries to become more permeable, or, at the very least, better understood.

The threshold concepts identified by participants were functioning in some respects as ‘boundary objects’ (Star and Griesemer, 1989, p.393; Bowker and Star, 1999). Boundary objects allow the individuals to deal with ‘both diversity and cooperation’ as they ‘inhabit several intersecting social worlds’ while also satisfying the ‘informational requirements of each of

them'. Thus they allow some degree of shared activity or discourse while respecting the 'specificities' of which Haythornthwaite speaks, and allowing that 'articulation of difference' identified by our participant, C. This, however, exposes an interesting dimension to threshold concepts. The examples of potential threshold concepts identified by our respondents were well supported by teacher and student accounts, documentary evidence and, in some cases, by research literatures; they were sufficiently robust and meaningful to maintain currency in the 'home' disciplines of the participants. But at the same time, they were also being used to represent, in the context of a cross-disciplinary seminar, what was distinctive about the disciplinary 'ways of thinking and practicing'. These were not merely thresholds internal to the discipline, to be confronted by students as they developed subject mastery; they were also representations of disciplinary identity within a diverse multi-disciplinary group.

D, who presented a case study on a threshold concept in computer science, the 'Y-Combinator' described how he located and characterised this concept:

What came out was that they were the core concepts ... not foundational ... the things that help *define the discipline*. You got really quite a good impression of different areas ... it was difficult to explain why I chose the Y-recombinator ...the threshold concept *really* is recursion ... [but the Y-recombinator] is like the pinnacle of research in recursion ... when you have understood this you have reached the summit. [italics added]

This distinction between the 'real' threshold concept and the discipline-defining 'pinnacle' to which it leads exposes a complex relationship between threshold concepts and disciplinary identity. Recursion may be the threshold concept, but look where it might take you! These are the kinds of expert ways of thinking and practicing that not only define expertise *within* the academic computer science community but also represent the face that is presented to the world.

D extended this argument further, explaining how the computing sciences (he emphasised the plurality) also used specific conceptual markers, which in many cases shared the features of threshold concepts, to define both 'membership' criteria of sub-disciplinary groups and to characterise their distinctive approaches to a wider world. In many cases, these concepts 'did the same work' but were expressed in distinctive and even antithetical ways:

You often see analogous concepts evolving in different parts of the discipline ... the threshold concepts in there define the boundaries ... say you've got a functional programming research group ... they have particular ideas that could plausibly be seen as threshold concepts because they are particular approaches to doing things ... and many of them are very counter-intuitive. If you exploit a particular threshold concept ... you're seen as within that particular sub-discipline.

Participants from engineering also talked about the difference between the threshold concepts that might be a useful focus for development of pedagogical practice within their undergraduate programmes and those that exemplified a distinctive 'engineering' perspective in a cross-disciplinary environment, one (H) commenting on the presentation they had made:

We chose that particular example [Spin] because it is something that works well in a mixed group. If I were to talk about some different things I think it would be a very different matter... let's say, Mohr's circle¹: a fantastic threshold concept, but boy, try and talk about Mohr's circle in a mixed audience ...

He continued, suggesting that similar distinctions might be drawn in other disciplines, with some threshold concepts being only discernable from 'within' the discipline and others fulfilling a more outward-facing, 'boundary' role, the difference being in their degrees of abstraction and accessibility:

Some of the most meaningful threshold concepts ... they needn't be difficult, but they can be very abstract ... entropy is abstract, Mohr's circle is an abstract concept ... and there are going to be [many] of those in the humanities, which I will just never come across.

What we have in the accounts of D and H are different responses to the question of how one might articulate disciplinary differences in engaging with 'others': on the one hand (D, in computer science) presenting the pinnacle, the epitome, of disciplinary practice and difference; on the other, (H, in engineering) seeking to offer an accessible representation of that practice and difference. But these, of course, were academics, teachers and researchers, seeking to present the specificities of their disciplines in the context of a research seminar. What of the representation of such specificities to students and potential students?

THRESHOLD CONCEPTS, DISCIPLINARY PRACTICE AND STUDENT INDUCTION

We have now touched upon two distinct contexts in which threshold concepts can play an important role: first, in teaching and learning in higher education; and second, in the context of cross-disciplinary discourse about curriculum content and pedagogical practice between teachers, researchers and technologists participating in project seminars. This raises a further question about the role of threshold concepts. The former context is concerned with teachers and learners working together within teaching and learning environments, in curricular settings where there exists some degree of what Biggs (1996) describes as ‘constructive alignment’ between student expectations, teaching and learning activities, assessment processes and outcomes. The latter involves the articulation of differences, specificities or practice and disciplinary identities. But what of learners in transition into higher education? While they may share some of the commitments and perspectives of teachers and more advanced learners, they may be ‘othered’ from authentic disciplinary practices and discourses as our participants in the cross-disciplinary seminars were.

This is particularly an issue when transition from school into university, or from undergraduate to postgraduate study, involves a shift in disciplinary orientation, or where individuals’ learning takes a ‘vocational’ turn. If we consider the perspectives of our seminar participants we find some interesting insights. In engineering, our interviewees reported that the example of ‘spin’ was useful not only in mixed academic audiences, but as a way of engaging potential students taking part in schools ‘outreach’ activities. So ‘spin’ as a concept can be used to exemplify and communicate the ways of thinking and practicing for engineering, a discipline that is not generally taught in schools, and where student recruitment is, at least in part, dependent on offering potential students an engaging insight into new disciplinary and pedagogical opportunities. Threshold concepts and the problems they help to address become part of a ‘window’ into a distinctive disciplinary environment and worldview.

Participants from social anthropology reported needing to address student misconceptions about the nature of the discipline in the first few terms of undergraduate courses. Like engineering, social anthropology undergraduates arrive at university with diverse school experience and few have previously studied the subject in detail. This led to some, at least, being overly concerned with material practices and research methods, one teacher commenting ruefully on a tendency for students to be ‘excessively interested in spears’. The threshold concept identified by our seminar participants was ‘reflexivity’ which was exemplified through the study of researcher accounts and described on the case study poster as follows:

Reflexivity, as the ability to reflect not just on others assumptions and preconceptions, but to simultaneously use them to reflect

on one’s own, is not only a technique anthropologists use to interrogate literature, but it underlies anthropological approaches to research and knowledge production in general.

D, one the participants, taught first year social anthropology students and reflected on what this meant in practice:

What this actually means for teaching anthropology ... this kind of reflexivity as a kind of threshold concept, talking about it not as a concept, but as a core activity of ‘disciplining’ students, of becoming an anthropologist. It gives you ways of talking about the value of an anthropology programme and an anthropology education ... as a way of dealing with the more complex world and self worth.

Threshold concepts here become not only ‘in the discipline’ but play a role ‘in the disciplining’ of learners and in characterising the nature of the academic discipline. As with engineering, the threshold concept plays a role in shaping students expectations of how their future learning in a comparatively poorly understood discipline might unfold.

A further example of this transformation of learner’s understanding – not of single threshold concepts, but of threshold concepts as stimulus for wholesale reconsideration of the relationship between learner and subject – came from the case study on the International Classification of Functioning described above. Teaching about the ICF on a postgraduate course on assistive technologies often radically reoriented the perspectives of students whose experience and motivations for undertaking the course had been shaped by medical models. C, reflecting on the implications this had for teachers, asked:

How do you actually deal with, and support, students who are changing as a result of threshold concepts? There’s a change of the whole person ... change of attitude, of beliefs [is] required. First of all, initial surprise, almost shock when it comes across to them ... and then more tolerance, respect, of the different client groups of disabled people ... not seeing them as ‘other’.

This extends the scope of research into the role of threshold concepts not ‘in the disciplines’ but as a means of engaging others with practices, discourses, motivations and values: whether in the context of cross-disciplinary and interdisciplinary research; public understanding of specialised disciplinary knowledge; and the recruitment and induction of new students into disciplinary and sub-disciplinary communities.

This raises an intriguing question: as teachers in higher education, should we seek to engage new recruits by exemplifying ‘the pinnacle’ of disciplinary

expertise (like the Y-combinator) and articulating the still 'open' questions that one might aspire to answer? Or is our role to set out the threshold concepts with which one might wrestle once one is studying 'in the discipline', disavowing potential social anthropologists of the notion that the subject is 'all about spears'? Or should we carefully select the seductive and accessible concepts that present an enticing and accessible proxy for our real 'ways of thinking and practicing': 'spin' for now, 'Mohr's circle' once you have found your feet?

DISCUSSION: GULF PERSPECTIVES

The final section of this paper focuses on contributions and reflections from a seminar that took place at Zayed University, Dubai, UAE, in March 2010, in which participants were invited to explore both the idea of threshold concepts in general and some of the examples described above. Of particular interest was the extent to which the particular circumstances of higher education in the Gulf region threw up distinctive perspectives on threshold concepts. With a rapidly expanding but still very diverse higher education sector in the region, were there specific drivers or barriers that affected teachers' and students' engagement with threshold concepts and troublesome knowledge?

Seminar participants were able to identify a range of potential threshold concepts 'in the disciplines': for example, those involved in teaching courses related to film and media studies talked about specific 'expert' techniques (such as the '30 degree rule' in film editing²) and which, once acquired by learners, not only transformed their practice as film-makers but also caused them to revisit prior work and reflect critically upon it. However, there was a more wide-ranging discussion about the place of threshold concepts in student recruitment and induction processes, stimulated by experiences of supporting student transitions from the Gulf region's highly directed, formal school systems into higher education courses.

Specific disciplinary settings generated particular challenges that reflected the disjunction between student experience of formal, performative schooling and the demands of higher education. For many students undertaking academic courses that demanded extended academic writing, the transition from seeing writing not as a process of 'template application' but one of 'problem solving' was described as troublesome and challenging. A tendency to 'map' all questions to a limited repertoire of templates acquired during schooling (a strategy which may have served them well prior to their beginning higher education) means that these students remain in a state of 'liminality', superficially addressing the demands of the course but not analysing the problem set or engaging with its conceptual basis or the cognitive challenge it was designed to present. What students perceived as negative feedback on writing was a source of resignation, conflict, or even

abandonment of courses: what Dweck (1975) has described as the 'learned helplessness' of students whose prior learning experience has been 'ego-centred' and who find themselves unable to cope with tasks which demand that they take personal responsibility for engaging with new learning challenges.

A further contribution from participants working in media technologies also pointed up the importance of addressing student expectations and prior school learning. Students enrolling on audio engineering courses are required not only to gain expertise with a wide range of technological systems, but also to understand the conceptual basis on which their successful deployment rests. The concept of 'sound as a wave' is a central and potentially threshold concept but it points up both cognitive and social issues. It requires students to return to school-level physics and re-engage with its often simplified curriculum content, in Carey's terms (1991) 'reassessing' their conceptual understanding, and 'abandoning' some prior conceptions and familiar and even iconic representations of physical systems. This is challenging enough, but the teacher also has to address student expectations of 'what' audio engineering involves: "I didn't think I was going to be doing physics" is a common response. Just as the social anthropology students described previously may have been surprised by the lack of spears in their course, the audio-engineering students may be surprised by the appearance of waveforms and equations in theirs.

The foregoing examples reinforce the idea that teachers and course designers need to pay as much attention to the potentially transformative ideas that will challenge students, as to the 'foundational' knowledge they need as prerequisites. In fact, in both of these examples (essay writing and the physics of audio engineering), an overemphasis on the formal prerequisites *without* an articulation of the fact that higher education will challenge prior knowledge may actually contribute to problems and disillusionment - and to students remaining in a liminal state throughout their time in higher education. Particularly in vocational courses, student expectations and their reasons for enrolment may be shaped by popular media representations of the expert professional, rather than an understanding of the conceptual challenges that a course of study might involve³. This represents an interesting challenge for teachers, administrators and course designers (in both academic and vocational courses): how accurately to convey expectations, success criteria and critical threshold concepts, while not dissuading potential and beginning students with partial views of what their experience of higher education might involve.

Even in the context of a short seminar, the potential of the idea of threshold concepts to stimulate not only consideration of teaching and learning 'in the disciplines' but across disciplines was demonstrated. Discussion of the examples described above extended into a wider consideration of common elements and challenges across a range of institutional and disciplinary settings in Gulf region colleges and universities.

LEARNING AS A THRESHOLD CONCEPT?

Participants in the seminar suggested that the most critical threshold concept they had to address in Gulf region institutions – and which effectively acted as a portal not only to new learning but to subsequent engagement with more challenging, troublesome ideas - was that of *learning* as an active process of knowledge construction. Without this transformation in student thinking, any attempts to introduce further threshold concepts and to promote a view of learning as conceptual change might well fail. This identification of ‘learning’ as a threshold concept echoes the concern of some of the ‘Transforming Perspectives’ participants to identify broad concepts with the potential not only to transform understanding of conceptual domains but also the students’ self-image of themselves as learners.

The view that a transition into higher education involves substantive change in views of learning and of oneself as a learner is not new; it is highlighted by Kember (2001) and has been described in terms of students ‘learning how to learn’ (e.g. Wingate, 2007). However the lens of threshold concepts has not been turned on learners in this way to any great extent: perhaps the most explicit being art and design students reported by Atherton, Hadfield and Meyers (2008) as identifying ‘studentship’ as the most significant conceptual change they had encountered.

The idea that this transition can be thought of as a transformation or series of transformative events, rather than a ‘foundational’ process of induction and inculcation, raises some interesting opportunities for further investigation, and pedagogical and institutional development. Participants described a range of scenarios whereby for some, but far from all, students, higher education represented an environment within which they could experiment and engage in learning activities, which would support their transition into independent ‘lifelong learners’ (see Figure 11). The challenge, according to this interpretation, is to move students on from a view of learning (and of themselves as learners) still rooted in their prior experience of highly structured and teacher-directed schooling.

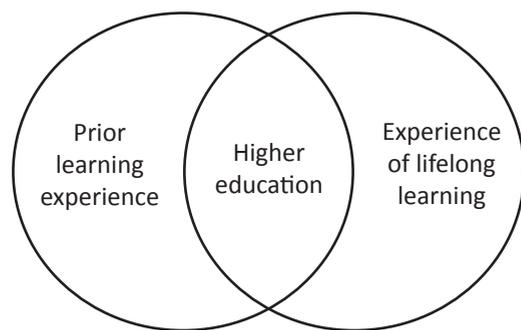


Figure 11: Higher Education as a liminal space between formal schooling and lifelong learning.

The ‘threshold’ nature of learning is even more evident in teacher education courses, about which several seminar participants reported their experiences as teachers and tutors. Here, the transformation demanded of students involves not only a reconsideration of their own experience as learners, but a difficult reconceptualisation of this experience in such a way that it allows them to enter educational professions with views of learners and learning which draw on an extended repertoire of theory and practice (Figure 12).

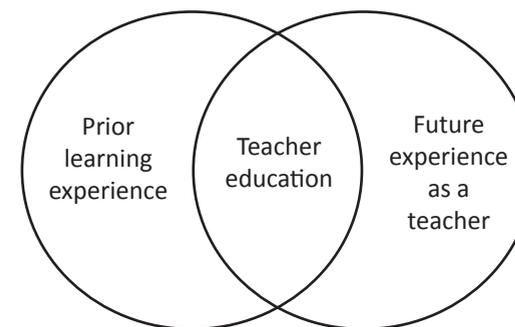


Figure 12: Teacher Education as a liminal space between own learning in formal schooling and supporting the learning of others

In this situation, the challenge for university teachers is to support a critical reflection on schooling and the concept of learning. This may require students (to borrow Carey’s terms, once again) to abandon or reassess concepts, motivations, influences and experiences from their early childhood onwards – including those which may have shaped the very decisions that brought them into initial teacher education courses.

Threshold concepts, then, have the potential to initiate and frame a range of types of enquiry into teaching and learning. While they may have initially been envisaged and used in order to inform studies of conceptual change within specific disciplinary settings, their real power may lie in their role in cross-disciplinary discussions and, as we have seen in the final section of this paper, in relating pedagogical practice to learner identities and institutional strategies. We have seen how their role as ‘boundary objects’ supports dialogues ‘in the disciplines’ between teachers and students; between teachers from different disciplinary backgrounds; and between subject specialists and educational researchers. Findings from the ‘Transforming Perspectives’ project and the Zayed University seminar suggest that the ‘concept of thresholds’ may also provide a useful basis for broader discussions about the nature of learning in schools, higher education and professional settings and how these are interrelated, both in society at large and as aspects of individual learning journeys.

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NOTES

¹ 'Mohr's circle' is a graphical method of showing stresses and strains within objects subject to loading. It is interesting as an example of a threshold concept (it is a good example of an 'integrative' concept) but also because it involves not only a conceptual model but also a process (of deriving Mohr's circle for the object in question) and a specific kind of representation whereby the stresses and strains within complex 3-dimensional objects are reduced to a particular kind of inscription which is widely recognised by engineers.

² "The [30 degree rule] aims to emphasize the motivation for the cut by giving a substantially different view of the action. The transition between two shots less than 30 degrees apart might be perceived as unnecessary or discontinuous." (Corrigan and White, 2004, 130)

³ Consider, for example Forensic Science, where levels of enrolment in higher education courses have steadily increased and student expectations have been shaped at least in part as a result of popular television series such as 'Crime Scene Investigators' (CSI) - from the USA and 'Silent Witness' and 'Waking the Dead' (in the UK).

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