

Reflecting on threshold concepts: an introductory tool

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1. Overview

Threshold concepts are ideas or ways of looking at things that enable a deep grasp of something in the world; the phrase 'threshold' signifies the crossing that a learner is able to make between superficial knowledge and a deeper and irreversible understanding.

The Threshold concepts introductory tool is for anyone wishing to understand and apply a cluster of ideas around threshold concepts and the learning that occurs when students encounter troublesome ideas that transform their understanding of a particular discipline, or part of it. This transformation can be in terms of new knowledge, new methods, a new identity, or new practices, and it is most often characterised as a portal or threshold through which the learner must pass. The tool is designed for those new to teaching, and experienced teachers and lecturers who would like quick access to threshold concepts and the related pedagogy. It provides an overview and definitions, examples and applications, critical responses and resources.

Threshold concepts are important for retention because they are the points in a student's learning where success or failure in transformation in thinking or practice will determine whether a student moves deeper into their chosen discipline. Without that transformation students will find the discipline becomes extremely difficult, or lacking in interest for them. Additionally, how threshold concepts are handled in teaching can present a retention challenge for supporting those students who find that the expected transformation touches on matters of personal identity, personal belief or ethical concerns in unexpected ways. Students whose backgrounds, either educational or cultural, have not included deep transformational challenges or dialogue may find such a learning journey liberating, but it need not be a universal experience and needs careful consideration. Through an understanding of how threshold concepts work, and with an outline of some of the underlying theory, you should be better equipped to face these issues in your teaching practice after using this introductory tool.

2. Introduction

Threshold concepts, threshold knowledge, troublesome knowledge. These are all ideas that crop up across different areas of academic and educational development and in all disciplines; they regularly feature in conference discussions and in the literature of higher education development and pedagogy. And they are used by many in developing new courses, modules and programmes of study for both undergraduate and postgraduate students. There are conferences dedicated to academic practice using threshold

knowledge and concepts,¹ and even a Facebook page for the community.² As will be discussed below, they can be used for mapping transformation, progression and success. They arise from an understanding of higher education as an opportunity for challenge, growth, and exploration of new ways of thinking, doing and being, and depend on the idea that in the process of learning, ambiguity and uncertainty are to be encouraged and tolerated.

This tool sets out some ways in which the central ideas around threshold concepts have been developed, and illustrates them with applications in a range of disciplines. Additionally, some of the critical discussions of threshold concepts are outlined, including issues of definition, and whether they present dominant models and theories in areas that are actually fraught with contested knowledge, together with suggestions on how these issues might be addressed in the future.

Threshold concepts are also at the core nature of *learning gain*,³ measurement of the points at which students' understanding and application of their learning is transformed irreversibly in ways that open up the possibility of a wider, better-informed, interconnected and articulated view of their field of study. The idea has been applied to learning activities, curriculum development, and assessment of learning outcomes. Looking at threshold concepts can provide "a strategic and effective approach to understanding the ways in which students are intellectually challenged and engaged in the curriculum and their learning"(BIS 2015). This is because threshold concepts lie at precisely the points in learning where students feel the *most* intellectually challenged. They may also play a role in the identification of discipline-specific causes of the differences between retention and success, and non-completion (Mossley 2016).

3. Background

The idea of a concern for threshold concepts in higher education has been around for more than a decade, and has been defined and explored through the pioneering work of Jan Meyer and Ray Land, together with their collaborators and other scholars, who have adapted and developed specific themes (Meyer and Land 2005). A wide range of theoretical materials have been explored (Meyer and Land 2006), applications across a large number of disciplines developed (Land *et al.* 2008), and links to theories of transformational learning mapped out (Meyer *et al.* 2010). The development of the idea continues to enrich

¹ For example: http://www.dal.ca/dept/cit/events-news/Threshold_Concepts.html [Accessed 28 February 2017]

² <https://www.facebook.com/groups/265003370204301/> [Accessed 28 February 2017]

³ <http://www.hefce.ac.uk/lt/lg/> [Accessed 28 February 2017]

the process of identification and enhancement of threshold concepts and threshold knowledge in real practice (Land *et al.* 2016).

The original idea began with concerns in economics education. In her paper for the Higher Education Academy (HEA) in 2006, Glynis Cousins noted:

The idea of threshold concepts emerged from a UK national research project into the possible characteristics of strong teaching and learning environments in the disciplines for undergraduate education (Enhancing Teaching-Learning Environments in Undergraduate Courses ...) In pursuing this research in the field of economics, it became clear to Erik Meyer and Ray Land (2003, 2005, 2006), that certain concepts were held by economists to be central to the mastery of their subject. These concepts, Meyer and Land argued, could be described as 'threshold' ones because they have certain features in common. (Cousins 2006)

This insight (that shifts in perspective, in interpretation, and in the depth of understanding can occur in learning) is not new, and the work of Meyer and Land relates to other work in wider conceptual development, which they highlight. For example, they drew on the idea that there is a number of different ways students acquire and relate to discipline knowledge, which generates a *range* of problems for student understanding of that discipline knowledge (Perkins 1999). Let us look briefly at two key theoretical themes in threshold concepts, knowledge and transformative learning.

3.1 Knowledge

A key resource in beginning to read around threshold concepts is the work of David Perkins, who has argued that the notion of knowledge as either simply something *possessed* or *performed* is not rich enough (Perkins 2008). For example, we might possess the knowledge of a partner's mobile telephone number and know how to drive a car, neither of which requires that we have particularly deep knowledge of phone systems or cars. Perkins, therefore, adds a deeper level of knowledge use. He presents a three-level model of knowledge use that stresses the importance of *proactive* learning, and the application of knowledge in innovative ways, as crucial to a demonstration of the deepest learning.

We may be familiar with the critique of knowledge as simply something to be possessed (e.g. being able to regurgitate a fixed formula in an examination is a poor test of

understanding), and the idea that students should be able to apply knowledge analytically, critically⁴ and creatively,⁵ to show their competency in performing at a level of mastery of that knowledge. However, Perkins argues there is a deeper learning⁶ that comes when a student is able to see the wider significance of a way of thinking that leads to *proactive*, appropriate and novel applications of that knowledge (Perkins gives the example of the use of Ohm's Law about electrical resistance to resolve a puzzle about hot-air heating ducts). Each level of learning requires the "shallower" form to be in place. The model may be represented as follows:

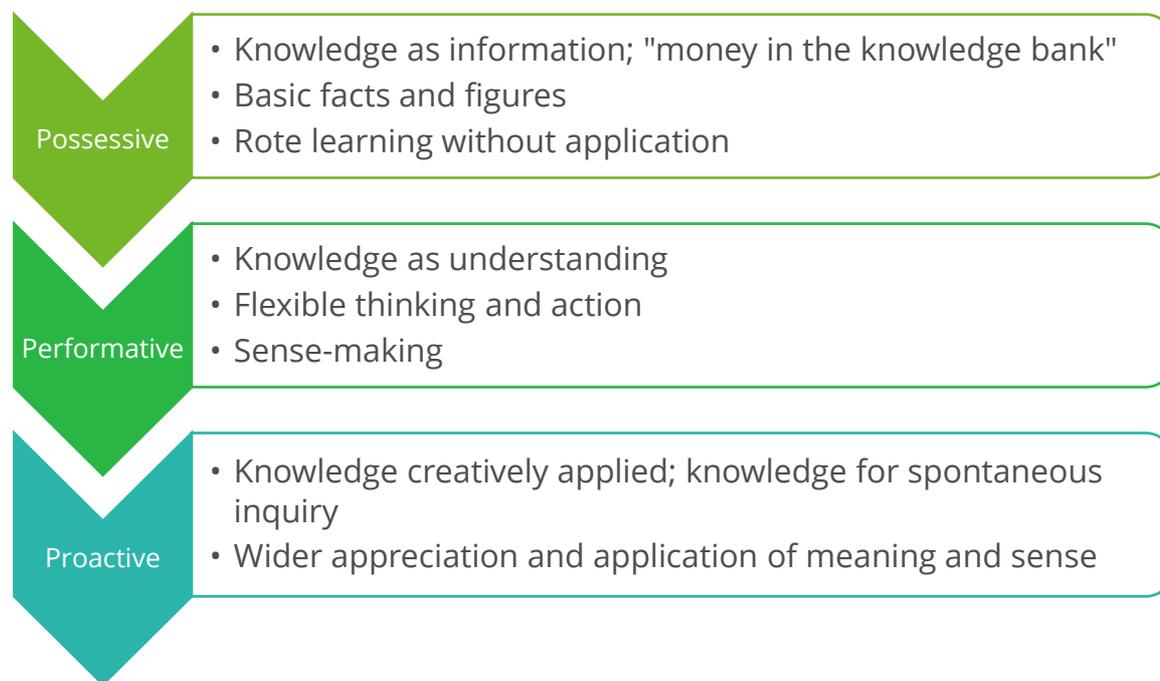


FIGURE 1: PERKINS TYPOLOGY OF KNOWLEDGE USE (PERKINS 2008)

Elsewhere he has talked about the *epistemes* that underlie disciplines: the deeper networks of understanding practices that constitute a discipline and make proactive knowledge use possible. To extend the car example, if a deeper understanding of the control of fuel and oxygen to the engine through the use of the accelerator pedal is reached, and connected with the concept of gearing, internal combustion, etc., experimentation and finer control of other engines and engine proxies becomes possible.

⁴ <https://www.heacademy.ac.uk/resource/critical-thinking-what-question> [Accessed 28 February 2017]

⁵ <https://www.heacademy.ac.uk/resource/how-can-creativity-be-caught-personal-accounts-teaching-promote-students-creativity> [Accessed 28 February 2017]

⁶ <https://www.heacademy.ac.uk/enhancement/definitions/deep-learning> [Accessed 28 February 2017]

Knowledge as practical application is also discussed by Jan Derry in the context of technology enhanced learning (Derry 2008); grasping what is meant by concepts such as *episteme* is a significant part of strengthening the interface between knowledge and practice in the learning process.

While there is an extensive literature around the theoretical concerns with knowledge, there are also multiple applications across threshold concept examples and studies that make plain how different frameworks should be used. It is not necessary to go too deeply into the psychology and philosophy of education here, but it is important to appreciate that there are particular ways of thinking about knowledge in the background of threshold concepts. As Julie Timmermans puts it:

the purpose of education is much less about fostering growth in what learners know than facilitating development of the ways in which they know. (Timmermans 2010, p. 14)

- **Reflective question:** Developing the how, rather than the what, of knowledge requires careful consideration of your own students, and the opportunities they are given for proactive application of their learning, beyond the context of learning for assessment or professional qualifications. What practices are explicitly taught? Which aspects of becoming a member of the community of practice that constitutes your discipline are not explicitly taught? In relation to threshold concepts, which concepts or practices in your discipline would be crucial to becoming a full practitioner? Which ideas open up the creative application of knowledge within your discipline in an informed way

3.2 Transformational learning

A second core component, which is discussed in more detail below, is that of transformational learning. The theory of *transformative learning* was developed by Jack Mezirow (see e.g. Mezirow and Taylor 2009) who argued that there are three component parts in such learning:

Psychological: changes in thinking about the self and identity

Convictional: changes in beliefs about the wider world

Behavioural: changes in how life is lived with others

Mezirow developed a comprehensive and complex theory of how these occur that highlighted the need for critical reflection on a “disorienting dilemma” to bring about a

significant and deep shift in perspective, followed by a reintegration of the new way of thinking into a wider understanding. In particular, there is recognition in the threshold concept literature that transformation is rarely sudden, but much more often a longer-term constructive, constitutive change as the learning brings about a shift of being over time. In the presentation in the Resources section below Ray Land uses the examples of evolution through natural selection and feminism, both of which can have multiple effects on thinking in an ongoing way as the knowledge of these theories are applied to all sorts of areas of thinking and life.

Often transformation is not easy. It may come about because of challenges to what is already accepted and may result in discomfort and uncertainty for a time. Transformation at a psychological and convictional level results in changes of ontology, of how one *is*. This is important in education. Turning student medics into doctors and student physicists into nuclear scientists, for example, requires more than just the transference of the knowledge they need to possess.

Aspects of this theory are found throughout the literature of threshold concepts and it is worth looking into some of the themes from this work. A good place to start is the collection of essays in *Contemporary theories of education* (Illeris 2009), which explore not just transformational/transformational learning, but a range of related theories that support and challenge it.

3.3 Core definitions and theory

Meyer and Land begin their original seminal paper on 'Threshold concepts and troublesome knowledge: an introduction' (reprinted in Meyer and Land 2006) as follows:

A threshold concept can be considered as akin to a portal, opening up a new and previously inaccessible way of thinking about something. It represents a transformed way of understanding, or interpreting, or viewing something without which the learner cannot progress. As a consequence of comprehending a threshold concept there may thus be a transformed internal view of subject matter, subject landscape, or even world view. (Meyer and Land 2006, p. 3)

They state that this learning can be sudden or take time, and is around ideas that the student initially finds 'troublesome' or difficult.

The important thing to note is that the kind of learning that occurs when students acquire threshold concepts is of a different *quality* compared to more general, cumulative concept learning. For example, in ethics the basic idea of consequentialism – that an ethical position can be generated from consideration of the outcomes for others of one's actions – is necessary as a building block for understanding, if a student is to progress; but it is not a

troublesome idea requiring a deep shift of perspective (for the vast majority at least). However, this may not be so for Kant's categorical imperative – where right actions are determined by the application of a rule of potential universalizability to all contexts – an idea that may strike many as counterintuitive on first encounter; this may well be a threshold concept for ethics.

Threshold concept learning involves *liminality* – the experience of passage from one state to another and that this can be epistemic (what is known), ontological (involving states of being) or both. To continue the example, learning a different way of thinking about ethics might trigger a shift of perspective about who one is and how one is connected to the rest of society. In a different context, acquisition of threshold knowledge in engineering may bring about a profound shift in understanding of stress in materials (Baillie and Goodhew 2006), for example, in such a way that a student begins to regard themselves *as* an engineer because they can think differently about that idea.

In looking more specifically at the details, over the last decade a number of slightly different characterisations of threshold concepts have emerged but all of which include a core set of ideas around this kind of transformation and liminality – the portal or doorway aspects of this kind of learning.

The following are the basic central features that are often listed as likely to be present in threshold concepts:



FIGURE 2: FROM MEYER AND LAND (2006, PP. 7–8), COUSINS (2006) AND OTHER RELATED RESEARCH

Each of these characteristics can be unpacked further; they are presented here with brief examples and tips for application.

3.3.1 Transformative

As already noted, this is at the heart of all threshold-concept learning and teaching. The literature on this aspect of threshold concepts is extensive and case studies can be found in almost all disciplines (see Resources section). That fact that students are transformed by deeper learning is not always made explicit to them, and it is worth considering whether this needs discussing with them from the outset – more on this later.

Examples of transformation (from Meyer *et al.* 2010) include:

- the concept of the *testable hypothesis* in biology and its role in the development of other biological concepts;
- Meyer and Land's own work on the ontological transformations in economics that follow from the conceptual threshold of *opportunity cost*.

3.3.2 Troublesome Knowledge

In looking at the nature of challenges faced by students in disciplines the importance of grasping that different forms of knowledge present different problems becomes apparent. For example, while it may be difficult to learn the basic equations of quantum theory to a limited degree, grasping their correct application requires an understanding of what they *mean*, while genuinely placing them in a wider interpretation takes a student to a deep level of learning and radically transformed worldview. That is why not all *difficult* knowledge is necessarily a point where threshold concepts are concerned. Furthermore, some apparently difficult ideas may be only superficially retained and remain unused; as such there is no deep learning involved. Knowledge that challenges the student to 'let go' of previous learning that is no longer adequate, or where counter-intuitive ideas are involved, or where there is a new view of a large number of other ideas, is more likely to be knowledge at the points where the students will become stuck.

One of the results of troublesome knowledge, which many will recognise, is that students employ 'mimicry', copying, without real understanding of texts, concepts or practices they are stuck with. When mimicry occurs, it is exposed by applications and assessment of the understanding of the knowledge beyond the context in which it was initially taught and encountered. It is also a factor in the problem of plagiarism (Hersey 2014).

Examples include (also from Meyer *et al.* 2010):

- *transmission lines* in electrical engineering where there is a compounding of the threshold concepts of *characteristic impedance* and *reactive power*, both of which are troublesome knowledge for students that appear counter to accepted 'common sense' notions of power;
- understanding of *geologic time* by geology students, where there is a requirement to abandon aspects of conventional, everyday time scales.
- **Reflective question:** In your experiences as a lecturer or tutor, at which points in the curriculum do students most struggle, or become stuck? Does it surprise you? Consider the concepts in the teaching at that point and whether they have features of troublesome knowledge.

3.3.3 Irreversible

The irreversibility of certain forms of learning touches deeply on the nature of the knowledge concerned, as discussed above. Only knowledge that tends to restructure or integrate other ideas will be retained in an irreversible way. Simple factual knowledge, or 'key concepts' that are not in themselves transformative will not have this feature: they need to be refreshed and rehearsed through use and application. And in terms of threshold concepts, the journey the student undertakes in their learning is rarely simple and linear. There is often (though not always) *a messiness* involved where students move between old and new ways of thinking. This means that although some thresholds may carry a more obvious 'eureka' moment, others will require iterations of the journey to be completed.

- **Reflective question:** How might you better support this aspect of the 'journey'? Could you increase success and retention by giving students the opportunity to recognise this aspect of their learning to demonstrate how far their learning has progressed?

3.3.4 Integrative

From what has been discussed so far, this feature of threshold concepts and knowledge should be apparent: it refers to the connection of previously apparently unrelated learning. Because many threshold concepts require learners to build up knowledge of concepts or practices that may not have liminality as a feature, discovering how they all fit together significantly deepens them. This is often for students a very useful point for self-reflection. As with other features of threshold concepts, the integration that occurs is usually not immediate or a smooth transition, although this need not be ruled out. It can however, be one of the keys to transformation itself. Assessment that builds in aspects of reflective learning (see below) can be very useful in embedding integration of this sort (see also Meyer and Timmermans 2016).

- **Reflective question:** What role does reflective learning play in your current module and course designs? Is enough time given to helping students to become aware of the integration points in their learning?

3.3.5 Bounded

The *boundedness* of threshold concepts and troublesome knowledge refers to the fact that liminal learning experiences require mastery of technical or new language uses, which in turn open up specific conceptual spaces where that language has meaning. While this is obviously true of the sciences it occurs across all disciplines. Not all threshold concepts will have this feature, but many do.

- **Reflective question:** When introducing new terms and technical language, it is possible that these are either components of threshold concepts, or represent them on their own. Look out for these and consider how you might provide opportunities for students to see how the technical landscape of their understanding changes.

3.3.6 Discursive

This feature of threshold concepts refers to the extension of language that follows mastery of them. Related to boundedness, threshold concept can open up the possible technical language available to students, providing new pathways through their discipline landscape. This occurs in higher education as a matter of course; combined with the other features of threshold concepts and troublesome knowledge, deeper learning of the new vocabulary is likely, if thresholds are supported and the uncertainty in acquiring expertise in new technical language use is acknowledged.

For example:

- *deconstruction* (a favourite example of Ray Land) opens up a very different form of conceptual space in cultural and literary studies, presenting new ways of understanding *meaning* and *reference* in quite specific ways.
- **Reflective question:** A useful diagnostic here might be a consistent misuse of language in a cluster of related terms that points to a missing threshold or compounded threshold concepts. Observation of peer-reflection can be useful. How effectively might you test the meanings of students' language understand and use through peer discussion?

4. Applications and examples in some key areas of practice

4.1 Assessment

Assessment of this kind of learning, and the development of strategies for formative assessment processes that can support it, require careful consideration, given the characteristics we have explored. Many of the studies that have looked at assessment with and of threshold concepts have used non-traditional approaches, or more active and engaged forms of assessment. It is beyond the scope of this tool to work through these in

any detail, but a good example can be found in a case study by Marina Orsini-Jones that explores assessment design in grammar learning (Orsini-Jones 2010). Over two years she studied the use of action-research “aimed at helping undergraduate language students with troublesome grammar knowledge” (p. 283). The threshold concept the students were struggling with was the overarching structure of a sentence, the “rank, scale concept” in linguistics. In order to grasp this concept a number of building-block, core concepts need to be studied and understood first, including *sentences, clauses, phrases, words, and morphemes*. The multiple “analyse into” and “build from” relationships between these different levels together form the overall “rank, scale concept”. In order to assess the students’ progress a multi-strand approach was used to encourage increasing levels of reflection. Firstly, students were given formative multi-choice questions as a basic diagnostic of core concepts and definitions. Then, working in groups, students were asked to construct a webpage that analysed a sentence appropriately, using various interactive web tools. They then had to make a presentation of their findings to the rest of their class and, crucially, reflected on the process of analysis itself. At various stages aspects of self-assessment and peer-assessment were used, resulting in a final individual reflective report (pp. 286–7). The relevance of this approach to assessment is that it results in support and feedback from peers and tutors throughout the liminality of learning, with increasing levels of reflection on that learning, to allow a deeper understanding of the threshold that has been crossed. Noting that usually school-based notions of grammar are often hard to ‘undo’, Orsini-Jones found that:

in the cases in which students started to understand how to analyse a sentence, the impact of action-research-led curricular intervention ... proved to be very beneficial and wide-ranging, also improving grammar performance and understanding in related modules (Orsini-Jones, p. 293)

This is what would be expected with threshold concepts and a deeper shift of understanding.

- **Reflective question:** As noted, assessment is a large topic⁷; development of more engaged forms of assessment can have significant impact on learning around threshold concepts. Additionally, identification of which concepts are more troublesome can help focus assessment appropriately to reach higher levels of

⁷ <https://www.heacademy.ac.uk/enhancement/frameworks/framework-transforming-assessment-higher-education> [Accessed 28 February 2017]

attainment.⁸ What steps could you take to build formative and summative assessment into your teaching that is more supportive for liminality and uncertainty?

4.2 Success and retention

Transformation may not be welcomed by all initially; not because the students concerned do not want challenges, or growth through education, but because they are unused to dialogue, discussion and interactions with learning that results in deep uncertainty and ontological shifts. For example, both Philosophy and Religious Studies present multiple threshold concepts that have the potential to transform views of the self and the world that deeply challenge metaphysical, ethical and religious cornerstones. Where a student comes from a background that is used to liberal, middle-class, western fluidity around such notions, uncertainty in this context may be less troublesome – although there is no guarantee of that where students regard knowledge as something to be consumed, or acquired superficially. However, where a student is less confident with intellectual uncertainty it is important that education intended to challenge, carries with it *permissions* for that uncertainty and ambiguity. It may be necessary to explicitly state that study of a particular topic is likely to be transformative; that for some time – even after the end of the module, or the degree programme – rethinking and the restructuring of ideas will continue and may be unresolved, *and that this is all right*. Of course, this needs to be done with care to avoid confusion when there is no real conceptual threshold present, but the materials present other sorts of cognitive challenges, such as learning a new set of transformation rules in mathematics.

- **Reflective question:** Consider where raising the problems that could arise from uncertainty, liminality and restructuring of concepts, knowledge and/or identity might become a component in your own teaching. How, effectively and practically, could you make it clear that uncertainty at different levels is acceptable during learning? Would it be by explicitly acknowledging that learning may not be an instantaneous process and may well involve some disorientation to achieve deeper understanding? Or is a more indirect approach more appropriate for your discipline? Does the diversity of your student cohort present a challenge for issues around identity?

⁸ <https://www.heacademy.ac.uk/enhancement/frameworks/framework-student-access-retention-attainment-and-progression-higher>
[Accessed 28 February 2017]

4.3 Postgraduate study and beyond

Of course, the understanding of learning through threshold concepts can be applied beyond undergraduate study. Alongside the identification of content-specific topics within disciplines, the notion of 'doctorateness' has been explored as, in part, a coming to terms with and mastery of the function of a conceptual framework for research. In exploring this idea Vernon Trafford (2008) states:

Explicit conceptualisation is ... necessary to give coherence to ideas, clarify relationships between research components and provide shape to research conclusions. By connecting theory with practice, conceptual frameworks integrate linkages between ideas and so clarify the issues under investigation. Those linkages exhibit differing levels of abstraction which often represent intellectual challenges and potential difficulties for candidates. (Trafford 2008, p. 275)

From this, Trafford argues that there are two potential portals where the uncertainty of the liminal processes of learning might prevail: grasping conceptualisation of a topic beyond mere descriptions, and doctorateness itself as the synthesis of conceptualisation with high quality research. As with undergraduate study these threshold points are likely to lead to doubt and uncertainty in the crossing of the portal, with the potential for real disruption of learning if not recognised. In collecting evidence from doctoral candidates, supervisors and examiners, Trafford identified two practical implications:

The first concerns social mediation via engagement with various others through explanations by supervisors, discussions with other researchers and membership of communities of practice. In these instances, intervention by others provided coping strategies, scaffolding support, and encouragement once candidates had recognised their deficiencies and accepted the need to learn ... The second practical implication concerns cognitive action that was self-initiated and acted on without help from others. This comes through: reading, thinking and reflecting; thinking at a deeper and higher level; visualisation of concepts and relationships; drawing on prior professional conceptualisation which was then applied and used; being acquisitive to gain skills and knowledge that were absent or low. (Trafford 2008, p. 284)

Both of these are mutually reinforcing: cognitive action improves how the social mediation is used by deepening the content of interactions through exchange of new knowledge and practically refining new skills, while the social structures provide motivation, direction and

structure to that cognitive action. All of these lead to the need for a strategic approach to postgraduate learning at doctoral level with a keen awareness of threshold concepts in doctorateness itself. Educating high-quality researchers to be much more aware of their own processes of learning might also address the well-known phenomenon of the 'imposter syndrome' that many new academics experience, provided that uncertainty and self-doubt is clearly acknowledged as necessarily part of the process (see also part four of Land *et al.* 2016).

All of these issues apply beyond postgraduate study, to our self-development as academics, writers and researchers. Continuing professional development, and our engagement with communities of practice present us with threshold concepts, particularly when we consider our role as educators. Mia O'Brien has produced a study of troublesome knowledge and transformative thinking within the teaching of the idea of threshold concepts itself (O'Brien 2008). She raises some important points about the difficulties of practically applying the critically challenging ideas we have been exploring in a context that presses new epistemological and ontological frameworks to the forefront of student learning – something that runs counter to prevailing models of higher education provision. Grappling with this, as educators, presents its own portal for us. Threshold concepts as an educational idea is itself troublesome, as some of the discussion on assessment, for example, suggests.

4.4 Learning gain

All these examples can be taken to be of learning gain. Strictly speaking, the Higher Education Funding Council for England (HEFCE) accounts of learning gain refer broadly to "an attempt to measure the improvement in knowledge, skills, work-readiness and personal development made by students during their time spent in higher education".⁹ This has become a key concern for the development of higher education and the implementation of policies and frameworks to support higher education. In the responses to the Government consultation of 2015, 58% of respondents thought it right that this should be a focus for improvements in teaching excellence, social mobility and student choice included with teaching quality, learning environment and student outcomes (BIS 2016). At the time of writing, work is ongoing to refine the meaning of learning gain, and to test out some of its possible applications as a practical measure of quality, through several projects. However, whatever the outputs and outcomes of these projects, it is certain that the development of intellectually challenging learning opportunities and curriculums will be at the heart of whatever frameworks emerge as central to future policy; mapping how it

⁹ <http://www.hefce.ac.uk/lt/lg/> [Accessed 28 February 2017]

can be assessed is likely to include threshold concepts, or some proxy for them. The central features of threshold concepts are precisely those that sit at the heart of the most challenging aspect of learning within disciplines. This is particularly true of the transformative, troublesome and discursive aspects of threshold concept.

5. Consideration of some challenges to threshold concepts

As with all educational theories, the idea that there are threshold concepts and that they can be specifically identified and taught is not without critics. Chief among the problems with the current work concerns finding essential characteristics for the central idea itself. As already noted, Land and Meyer's own accounts set out features of threshold concepts that are only *usually* or *typically* present, such as their integrative or bounded nature, outlined above. However, they do not claim that any of those features that need to be necessarily present, so it is difficult to find a core feature for threshold concepts that will hold in all cases. Even the idea of liminality, the sense of passing through a portal, is not clearly defined since it can be sudden or gradual, sharp or fuzzy edged in form, and involve aspects of continuity or rupture. This problem was explored, in a philosophical context, by Darrell Rowbottom, based on the first few papers of Meyer and Land; he also pointed out that they do not offer a clear account of their preferred understanding for what a *concept* is either (Rowbottom 2007).

While it is certainly true that essential definitions cannot be obtained from analysis of the core papers, there is now such a significant body of secondary literature of applications of the idea of threshold concepts to actual practice in disciplines that, within the constructivist paradigm of learning, they can be taken to have acquired genuine value in their use.

Perhaps a different approach to definition here would help, one that moved beyond the desire to pin down essential properties. An alternative view that might be considered can be found in Ludwig Wittgenstein's theory of family resemblances (Wittgenstein *et al.* 2009/1953), where something that occurs over many examples may not have a single essential property, but several separate overlapping ones that hold the idea together collectively. The most famous example is that of the term 'game', meaning the diversions that include chess, poker, solitaire, rugby, badminton, pin the tail on the donkey, and Dungeons and Dragons™. To explore this idea further would lead us into deeper philosophical waters, but even if one did not want to take a purely constructivist approach, an awareness of knowledge practices and context *within* disciplines would suggest that different frameworks for understanding core knowledge are real (Derry 2008). Such troublesome ideas have to be taught with respect to a bounded, existent domain that contains knowledge the students have to acquire to be regarded as having mastered their discipline, but which may be troublesome and require integration into a wider set of understanding (Mossley and Saunders 2013). While different disciplines may have different

criteria for the successful learning of such concepts, the point is that they can be identified *within* each discipline and the family resemblance of their properties mapped from within that context.

In any case, it could well be argued that *transformation* is indeed a core component of any learning that involves threshold concepts – as is set out in the early part of this tool. The development of the scholarship in threshold concepts very strongly suggests this too: *Threshold concepts and transformational learning*, one of the major collections of papers dedicated to threshold concepts, makes this clear (Meyer *et al.* 2010).

A different criticism of threshold concepts can be generated from the perspective of the student. It might be argued that since each student brings their own interests and engagement with their learning to bear then they will have individual points of difficulty; what is troublesome will be specific to their individual context, and picking out threshold concepts that apply to a whole cohort, even engaged on a particular programme of study, is impossible.

While it is certainly true that individual students will find learning within a discipline presents different points of challenge for them compared with their peers, the same counter-argument from above applies with regard core threshold concepts. Disciplines already have a body of accepted knowledge; practices and procedures; and cultures and values that define them. Mastery of them is not simply a matter of students constructing their own understanding of the materials they encounter: there are actual conceptual and practice frameworks that constitute the disciplines and domains they are working in that have to be mastered. And within each of those frameworks there will be concepts and practices that have generated troublesome knowledge for the vast majority of students as matter of real experience. Which concepts and practices these are will be understood in context, and, again, the body of literature on threshold concepts bears this out. Of course, this is not to say that once mastered concepts may not be applied in novel settings, even beyond their formal origin: recall Perkin's account of knowledge *use* as proactive in its most developed form.

This brings us to a central message of this introductory tool:

Threshold concepts and threshold knowledge are deeply embedded in, and fundamentally tied to, the disciplinary contexts that generate them. There is a *pragmatic* aspect to understanding and applying disciplinary threshold concepts that should not be overlooked. It is vital that you investigate your own students' learning to identify the threshold concepts within your own teaching.

As already noted above, it can be hard to recall the actual threshold points in one's own learning, and so simple recall will not be a sufficient guide to current troublesome knowledge.

6. Resources and next steps

Detailed reading from this introductory tool is listed in the 'References' section. This final section sets out key resources and next steps for readers to take.

1. Set up a threshold concepts discussion in your department or school. Use the reflective questions highlighted through this tool to learn collaboratively with colleagues and students.
2. Explore the UCL threshold concept website for an overview covering some of the information from this tool together with an up-to-date bibliography:
<http://www.ee.ucl.ac.uk/~mflanaga/thresholds.html> [Accessed 28 February 2017];
and make use of the site's resources and discipline-specific information
<http://www.ee.ucl.ac.uk/~mflanaga/thresholdsA.html> [Accessed 28 February 2017].
3. Share and discuss with students, Ray Land's conference presentation discussing troublesome knowledge, transformation and threshold concepts as they have been applied to information literacy in the US to help clarify how they should be understood:
<https://campus.recap.ncl.ac.uk/Panopto/Pages/Viewer.aspx?id=fb2c8875-f382-4242-9e95-c4b5138fdc37> [Accessed 28 February 2017].
4. View David Perkins video talking about his work and the uses of knowledge in learning and teaching, here called 'knowledge destinies' and the relationship to transformation and liminality. There is also more on some of the theoretical and research background to threshold concepts:
<https://thebox.unsw.edu.au/video/professor-david-perkins> [Accessed 28 February 2017].
5. Use the search function on the HEA resources page to find reports, articles and conference outputs that deal with threshold concepts
<https://www.heacademy.ac.uk/search/site/%22Threshold%20concepts%22>
[Accessed 28 February 2017]
6. Relate your learning on the pedagogy of threshold concepts to the key principles and practice set out in the HEA Retention framework
<https://www.heacademy.ac.uk/enhancement/frameworks/framework-student-access-retention-attainment-and-progression-higher> [Accessed 28 February 2017]

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