

# Overcoming Barriers to Student Understanding

Threshold concepts and  
troublesome knowledge

Edited by Jan H. F. Meyer and Ray Land



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*Overcoming Barriers to Student Learning* explores why certain students ‘get stuck’ at particular points in the curriculum whilst others grasp concepts with comparative ease. It proposes a ‘threshold concepts’ approach to the curriculum, arguing that in certain disciplines there are ‘conceptual gateways’ or ‘portals’ that lead to previously inaccessible, and initially perhaps ‘troublesome’, ways of thinking about something. A new way of understanding, interpreting, or viewing a topic may thus emerge – having a transformative effect on internal views of subject matter, subject landscape, or even world view.

While maintaining that knowledge should indeed be ‘troubling’ in order for it to be transformative, this book provides new perspectives on helping students through such conceptual difficulty in order to enhance learning and teaching environments in higher education, and in other educational sectors. It discusses:

- ways of dealing with the kinds of anxiety, self-doubt and frustration that learning can evoke in students;
- how we might help our students not to avoid the troublesomeness, but to feel more confident in coping with it, resolving it and moving on with confidence;
- what might account for variation in student performance when dealing with concepts;
- what teachers might do in relation to the design and teaching of their courses that could help students overcome such barriers to their learning;
- what makes particular areas of knowledge more troublesome than others.

The illustrative case studies presented here will help teachers analyse their own practice. *Overcoming Barriers to Student Learning* will serve the needs of educational researchers and developers, and academics within various disciplines who wish to learn more about threshold concepts and troublesome knowledge.

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# Foreword

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It's always interesting to observe, amid the great volume of educational research and development that is now taking place in higher education around the world, how every so often one particular idea or perspective will emerge that, for whatever reason, seems to fire the imagination of teachers and researchers and which is seen as having immediate relevance to issues within their own practice.

This quality – David Perkins of Harvard has characterised it nicely as ‘action poetry’ – seems to arise from conceptual ideas that are essentially both simple and memorable and yet which are also highly generative, in that they contain richly layered implications for all kinds of educational contexts. It seems to me that the theoretical framework of threshold concepts that Jan Meyer, Ray Land with Glynis Cousin and others have been developing in recent years has just this quality of action poetry. Their innovative model presents refreshingly different insights into the way that certain conceptual understandings can have a powerfully transformative effect. As we now find ourselves, across the globe, working within the new environments of mass higher education systems, and with greatly widened student participation, this helpful approach allows us to think anew why certain students ‘get stuck’ and find difficulty in negotiating particular conceptual transitions. How might we explain the variation in student experience and performance in encountering threshold concepts and how might we better help them through difficult conceptual and affective transitions? What is it in the nature of the knowledge they are encountering that might give rise to this difficulty? How are shifts in understanding caught up inextricably with affective factors and with shifts in the learner’s identity? The threshold concepts approach offers a valuable approach to addressing these matters.

The approach had its origins in the ETL project, Enhancing Teaching–Learning Environments in Undergraduate Courses, funded by the Teaching and Learning Research Programme of the UK Economic and Social Research Council. Threshold concepts might be seen as a conceptual gateway to the ‘ways of thinking and practising’ within disciplines that the ETL project explored. The thresholds approach subsequently became a project in its

own right, Embedding Threshold Concepts, funded by the Higher Education Funding Council for England (HEFCE) as part of its Fund for the Development of Teaching and Learning (FDTL5). It has since then also been adopted as the pedagogical framework for at least two of the new Centres for Excellence in Teaching and Learning that HEFCE has established. And it is well established as an informing perspective across the national Subject Centres co-ordinated by the UK Higher Education Academy. It provides a means of thinking and talking about learning within the disciplines which practitioners in those disciplines can use and develop themselves in relation to their own subject. From philosophy to automotive design, from economics to engineering, academics are using the idea of threshold concepts to inform their pedagogy in ways that make sense within their own communities of practice, and for their own students.

The broad international scope of this book is testimony to the speed with which the notion of threshold concepts has taken hold through many disciplines in universities around the world. Threshold concepts is thus now moving from a position of being a leading edge new perspective to one which is catching the interests of academics and educational researchers in a growing number of countries. The approach is already being cited in Australia, Hong Kong, Sweden, Greece, Scandinavia, South Africa, Canada, New Zealand and the USA. This seems a timely juncture to provide a scholarly but accessible foundational text to serve the needs of educational researchers and developers, and academic colleagues within various disciplines, who have expressed a wish to learn more about threshold concepts and troublesome knowledge. The book combines chapters which open up the theoretical aspects of these new perspectives with practical instances of how academics in specific disciplinary contexts have sought to design their courses around notions of threshold concepts.

This book reports on early beginnings to scope out the power of this concept to understand the difficulties in interactions between learners and their teachers. In my previous life as an educational researcher I was involved in exploring the concept of *deep and surface approaches to study* first coined by Ferenc Marton and his colleagues in Sweden in the late 1970s (Marton *et al.* 1997). I witnessed the power of this concept to help teachers understand how their students learn. That example of *action poetry* has enhanced the development of learning and teaching for the past 25 years and is still influential. Recently our focus of attention has become more sensitive to differences between individual learners and in the different pedagogies within disciplines. Thus threshold concepts is action poetry for our time and I will enjoy observing its influence over the next 25 years as its power is explored in more contexts.

I am delighted that this volume is now available for academics in all disciplines to encounter this intriguing field of enquiry. I heartily commend the book also to teachers and researchers in other educational sectors. I hope

they will use it to enhance their own approaches to teaching and course design, and to support the learning and development of their students.

Liz Beaty  
Director of Learning and Teaching  
Higher Education Funding Council for England  
Bristol, November 2005

## Reference

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## Editors' preface

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In the Brothers Limbourg's depiction of *The Fall and Expulsion from Paradise* (1415), a serpent with a human face passes the fruit of the tree of knowledge to a curious Eve. The consequences of this acceptance of a knowledge which proves to be troublesome are arrayed sequentially in the tableau that this painting presents. What appears is that as Eve, and then Adam, gain access to this troubling knowledge, their world changes around them. They can no longer stay where they are, in a comfortable and familiar place, much as they might wish to. They are unceremoniously moved on by a rather forbidding scarlet angel and ushered firmly through an imposing gateway, a threshold, into a different kind of space. The expressions on these medieval faces suggests that this new space, this transformed landscape, no longer feels like home. They wish to return. The new space feels, to use Freud's famous phrase, *unheimlich* – unhomely or strange. However the scarlet angel covers their means of retreat. This new state is irreversible. Adam and Eve have in fact learned. They see the landscape now very differently. They have gained a new understanding and their identity has shifted, as signified by the fig leaves with which they are adorned in the final section of the tableau. They have grown up. They have become adult and have left a world of innocence. However, their gain feels like loss. Their new knowledge is troublesome.

As all teachers know, teaching is a complex and often challenging process, because learning is a complex and challenging process. Nor, we wish to say at the outset, would we really wish for it to be otherwise. When knowledge ceases to be troublesome, when students sail through the years of a degree programme without encountering challenge or experiencing conceptual difficulty, then it is likely that something valuable will have been lost. If knowledge is to have a transformative effect it probably *should* be troublesome, or at least troubling, but that does not mean it should be stressful or should provoke the kinds of anxiety, self-doubt and frustration that can lead students to give up.

It has long been a matter of concern to teachers in higher education why certain students 'get stuck' at particular points in the curriculum whilst others grasp concepts with comparative ease. What might account for this

variation in student performance and, more importantly, what might teachers do in relation to the design and teaching of their courses that might help students overcome such barriers to their learning? As students from a much wider range of educational backgrounds now enter higher education these issues are becoming of increasing importance across all disciplines. A further and related concern is why certain concepts within disciplinary fields appear particularly 'troublesome' to students. What makes particular areas of knowledge more troublesome than others, and how might we help our students not to avoid the troublesomeness, but to feel more confident in coping with it, resolving it and moving on, with the confidence of expectation that there will be further troublesome episodes of learning along the way, but that they will survive them, and maybe even come to enjoy the challenge?

This book discusses these concerns from the new perspective of 'threshold concepts'. It can be read, and probably will be read, we hope, in a number of ways depending of course on what suits the interests and purposes of the reader. The first five chapters in Part I attempt to outline a conceptual framework linking the idea of threshold concepts with notions of troublesome knowledge and liminality. Chapters 6–13 in Part II offer insights into how this might come into view within the perspectives of specific disciplines. The concluding chapter tentatively opens up considerations and implications of this conceptual framework for curriculum design. We hope others will engage in this process and take up these curriculum issues in new ways in their own fields.

The opening chapter presents the original seminal paper by Jan Meyer and Ray Land which introduced the notion that there might be concepts in any discipline that have a particularly transformative effect on student learning. The notion of a *threshold concept* was originally introduced into discussions on learning outcomes as a particular basis for differentiating between core learning outcomes that represent 'seeing things in a new way' and those that do not. A threshold concept is thus seen as something distinct within what university teachers would typically describe as 'core concepts'. Furthermore, threshold concepts may represent, or lead to, what Perkins (1999) described as 'troublesome knowledge' – knowledge that is conceptually difficult, counter-intuitive or 'alien'. Within all subject areas there seem to be particular concepts that can be considered as akin to a portal, opening up a new and previously inaccessible way of thinking about something. A threshold concept 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, and the student can move on. However, such transformation, though necessary for progress within the subject, may prove troublesome to certain learners for a variety of reasons, not the least of which is that such transformation entails a letting go of earlier, comfortable positions and encountering less familiar and sometimes disconcerting new territory.

Such transformation can also entail a shift in the learner's identity. The result may be that the student remains stuck in an 'in-between' state in which they oscillate between earlier, less sophisticated understandings, and the fuller appreciation of a concept that their tutors require from them. In Chapter 2 Meyer and Land look more closely at the nature of this in-between state which they term a state of 'liminality', from the Latin meaning 'within the threshold'. One outcome is that students present a partial, limited or superficial understanding of the concept to be learned which the authors characterise as a form of 'mimicry'. This characterisation is without negative intent, as the mimicry might be a purposive coping strategy in the wrestle for understanding and clarity. A more serious outcome is that students can become frustrated, lose confidence and give up that particular course. It is the hope of the contributors to this volume that within our various subject areas we can devise ways of helping students to overcome such obstacles – to create 'holding environments' to support students through such conceptual difficulty – that they may move on and succeed.

To complicate matters further, in some instances students may grasp concepts but the barrier to their learning appears to lie at a deeper level of understanding, where the student finds difficulty in appreciating what David Perkins, in Chapter 3, has termed 'the underlying game', or an 'epistemic game'. He defines an episteme as 'a system of ideas or way of understanding that allows us to establish knowledge'. It might also be seen as a 'way of knowing'. Epistemes are 'manners of justifying, explaining, solving problems, conducting enquiries, and designing and validating various kinds of products or outcomes'. However as Perkins goes on to show, through his rather endearing student character Betty Fable, learners often encounter difficulties playing these games. This is partly because concepts, in his analysis, can often make 'double trouble', on the one hand functioning as 'categorisers' and on the other functioning as 'elements in activity systems of problem solving and enquiry'. To help students like Betty cope better with this he advocates a constructivist approach that he terms 'surfacing and animating', to help them 'not simply to know about the game but to play the game knowingly'. It's high time, he argues, 'that we got pragmatic about constructivism'.

Get those tacit presumptions out on the table at least for a while, both the teacher's and the learners'. When Betty had to discuss her ideas about falling objects or simplification, this surfaced her tacit presumptions and allowed her teachers to examine them with her. And not just as objects of discursive analysis but as systems of activity to engage. The idea is not simply to know about the game but to play the game knowingly.

Playing the game knowingly can be seen as, and indeed requires, a form of metacognition. Anastasia Efklides, in Chapter 4, makes the case from the

perspective of cognitive psychology, that metacognition cannot be reduced to metacognitive knowledge and metacognitive skills only. Another facet of metacognition is metacognitive *experiences*, that is, online feelings, judgments or estimates, as well as task-related knowledge. Metacognitive experiences, she argues, monitor cognitive processing and trigger control decisions. They also feed back on the person's self-concept and causal attributions regarding performance outcome. Thus, metacognitive experiences influence self-regulated learning in the short and long run. The ways through which metacognitive experiences influence the learning of threshold concepts are multiple. They offer online awareness of task-specific cognitive procedures, of cognitive load, of the effort demanded, and of features of task processing – whether it runs smoothly or is interrupted. Finally, they offer awareness of the evaluation process of the outcome of task processing. This awareness triggers control decisions supporting or undermining the person's engagement with learning tasks. Metacognitive experiences can convey accurate information about task-processing demands but they can be flawed, as in cases where the person has no previous knowledge or experience with a concept or a task. She discusses the factors influencing the accuracy of metacognitive experiences and goes on to propose possible ways in which teachers might overcome the disadvantages of flawed metacognitive experiences.

In Chapter 5 Peter Davies examines particular issues in the application of threshold concepts to learning and teaching. One difficulty that he identifies lies in identifying *which* concepts in a subject should be regarded as 'threshold concepts'. If 'threshold concepts', as mentioned earlier, are to be distinguished from previous ideas such as 'core concepts' should they be identified by a distinctive procedure? The argument he develops in his chapter suggests an affirmative answer to this question. He follows this argument with an exemplification of a possible way forward in the context of teaching and learning Economics. A second difficulty, he suggests, lies in identifying *when* learners have internalised a threshold concept. How can learners and teachers recognise the difference between a deeply embedded and a superficial understanding of a threshold concept?

Charlotte Taylor, a biologist, observes how troublesome knowledge in her discipline often appears to be associated with processes. This might, she suggests in Chapter 6, reflect the dynamic nature of the discipline, as Biology works with knowledge 'which incorporates change as an integral component'. But she is concerned that the clear distinction between process concepts and abstract concepts in Biology are often encompassed in the same threshold concept. Her 'dissection' of the troublesome nature or threshold experience pertaining to biological concepts has led her to conclude that many of these troublesome elements seem to derive from teaching approaches adopted in early undergraduate Biology courses, in which 'a traditional approach to these concepts has relied on an exposition of the facts as a necessary grounding in the topic'. However, she goes on to suggest, it may be that conceptual

thresholds might be more easily surmounted if a different approach to the concept – a holistic approach – is adopted. ‘Using a more abstract manifestation’ Taylor argues ‘allows a holistic view of the concept and its context in a larger picture of living systems.’ In this way, she claims, students will be better able to make linkages between what she characterises as ‘islands of isolated knowledge’.

If we are to accommodate such patterns of learning in Biology we will need to construct learning experiences which clearly identify the threshold experience before moulding a variety of learning experiences and opportunities around this core.

In Chapter 7 Martin Shanahan and Jan Meyer focus on a specific concept in order better to identify how discipline specific ways of thinking can alter the learner’s view of the world. They consider ‘opportunity cost’ as an example of a threshold concept in the discipline of Economics. Opportunity cost is the value placed on the best rejected alternative when an individual makes choices. In this chapter they argue that the categories of knowledge that underlie, and to some extent create, ‘troublesome knowledge’ may be used as a framework, or as ‘markers’ by which to examine students’ articulation of a threshold concept. The authors present analyses of the variation in introductory *students’* articulation of ‘opportunity cost’ over the course of one semester. The study that forms the basis of this chapter provides a practical example of how variation in students’ initial understanding of a threshold concept can be externalised and examined, and in a manner that can inform university teaching. Issues of measurement, articulation and learner development are also identified. There appear to be important implications for the manner in which students are initially introduced to threshold concepts. A key conclusion presented by Shanahan and Meyer is that, in the learning of threshold concepts, ‘first impressions matter’. Efforts to make threshold concepts ‘easier’ by simplifying their initial expression and application may, in fact, set students onto a path of ‘ritualised’ knowledge that actually creates a barrier that results in some students being prevented from crossing the ‘threshold’ of a concept.

Nicola Reimann and Ian Jackson also explore aspects of threshold concepts in Economics. In the case study that they present in Chapter 8, they explore students’ developing understanding of two threshold concepts within the context of a small first year Microeconomics module. Like the authors of Chapter 7, they also choose to consider opportunity cost, with the notion of elasticity as a second example. They employed questions about authentic scenarios, set in students’ everyday lives, to investigate whether students’ thinking had changed as a consequence of learning and teaching about the two threshold concepts. The authors collected data in three stages consisting of (repeated) written responses to these questions, as well as interviews with

students and staff. The chapter discusses the usefulness of such questions as diagnostic tools as well as the impact of the teaching–learning environment on students' understanding of the two threshold concepts. The use of the questions seems to have provided the lecturer in charge of the particular module with a clearer focus for his teaching and helped him to connect his teaching more explicitly to the student perspective. Distinct differences between the two threshold concepts emerged, both in relation to the teaching and the students' answers to the questions. Previous knowledge of the concepts acquired elsewhere and a curriculum which deals with a sequence of a large number of concepts appeared to have an impact on the level of effort and engagement students displayed in relation to the threshold concepts investigated. While in interviews conducted after having been taught about the two concepts students did not change their minds about their initial answers to the two questions, the second answers elicited at the end of the module seemed to suggest that some students' economic reasoning had become somewhat more sophisticated. The insights gained in this case study seem to suggest that threshold concepts can provide a novel and useful perspective for investigating and enhancing teaching–learning environments, though the authors, cautiously, advocate that further research of this kind that investigates the student perspective is required.

Within the field of cultural studies Glynis Cousin proposes 'Otherness' as a threshold concept, and draws on illuminative evidence gathered from a number of teachers and students of cultural studies in UK universities in order to expose issues associated with its teaching and learning. As she points out, this concept has troublesomeness more-or-less built-in, because of its inherent stability as a concept:

There is no settled view about the meanings of Otherness. The instability of the concept is part of its territory. Indeed it would undermine the teaching and learning of Otherness were it to be treated as a truth to be unpacked since mastery includes a grasp of the debate about its explanatory scope and limitations.

These issues apply to a range of social science and humanity subjects where explorations of Otherness are made in relation to ethics, social difference and exclusion, democracy, equality, identity formation, representation and oppression. Her discussion centres on the distinctive ways in which Otherness qualifies as a threshold concept and on the strong affective dimension involved in its learning. In particular, she suggests that students with greater experiential proximity to the aspects of Otherness under examination *may* bring more emotional capital to their understandings of them. While there are no easy laws of causation to explain the distribution of emotional experiences, her conversations with teachers raise interesting questions about the emotional positioning of their students, and the bearing this has on their