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Rod O'Donnell

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A CRITIQUE OF THE THRESHOLD CONCEPT HYPOTHESIS AND ITS APPLICATION TO OPPORTUNITY COST IN ECONOMICS

Professor Rod O'Donnell
University of Technology, Sydney¹

ABSTRACT

In exploring the learning experiences of students, some educationalists have advanced the threshold concept hypothesis according to which certain concepts in various disciplines act as thresholds to understanding. Such concepts need to be mastered before further progress can be made in a discipline – they act like portals or entrances to be traversed before students can think like practitioners of that discipline and enter into membership of that community of practitioners. In economics, the concept of opportunity cost has been identified as a prime example of a threshold concept.

This paper is divided into two parts – in the first, the threshold concept hypothesis is subjected to critical scrutiny on a wide range of grounds, while in the second, its applicability to the economic concept of opportunity cost is investigated. The main conclusions are that the hypothesis has deep-seated conceptual problems, that it is subject to disturbingly elastic interpretations, that its claim to be an improvement over existing approaches is highly questionable, that some of its educational and social consequences are undesirable, and that the construal of opportunity cost as a threshold concept in economics is unsustainable on empirical, theoretical and conceptual grounds.

JEL Code: A10, A20, D00

Keywords: *Threshold concepts, teaching in disciplines, opportunity cost.*

Introduction

The threshold concept hypothesis (TCH) has been advanced by a group of educationalists with the laudable intention of exploring and improving the learning experiences of students. According to the hypothesis, there exists a class of concepts in many disciplines, mastery of which is essential to further progress in that discipline. These concepts are labelled 'threshold concepts', the metaphor being that of a doorway, portal or gateway through which learners must pass before they can think like practitioners of that discipline and enter fully into its domain and community. Pedagogically, the hypothesis has practical implications for teaching, course design and assessment since such concepts are viewed as the *sine qua non* of further progress in understanding and mastery. An economics project played a key role in the emergence of the TCH, with the concept of opportunity cost being adopted as a prime example of a threshold concept in economics.

This paper subjects the TCH to critical scrutiny, both in general terms and in the particular case of opportunity cost in economics. Logical analysis reveals that the definition of threshold concepts has deep-seated problems which make their identification impossible or arbitrary, this leading to troubling epistemological and ontological implications concerning the knowability of such concepts and the conditions under which they exist. Threshold concepts are also unusual in that their differences from other concepts are not harmless in terms of the coherency and robustness of the hypothesis. The analysis questions claims that the TCH is an improvement over earlier approaches, and reveals that some of the disciplinary, pedagogical and social consequences of the intended transformations are undesirable. It is also argued that

the growing literature on the hypothesis demonstrates alarming latitude in interpretation and slippage into arbitrariness and meaninglessness.

The paper then investigates the applicability of the hypothesis to opportunity cost, which is regularly advanced as a paradigmatic example of a threshold concept in economics. Here it is argued that it is difficult so to construe opportunity cost for three main reasons – empirical investigation reveals that it does not act as a portal to the economics community, it does not satisfy a moderate interpretation of the definitional requirements, and economic textbooks treat opportunity cost in ways that cannot serve as preconditions for deeper understanding.

Before proceeding, two general observations may be made. First, it is not always easy to be clear about the propositions and arguments advanced in the threshold concept literature – many issues are often discussed suggestively and too briefly, the structure of argumentation is sometimes idiosyncratic, the logic behind arguments is not always coherent or transparent, inconsistencies emerge between various treatments of the hypothesis, and some proffered examples are open to disputation. Distilling the core elements of the hypothesis can be troublesome and frustrating.

Second, the hypothesis now enjoys a following among academics across a wide range of disciplines and countries, the interest created by the initial contributions leading to ongoing biennial conferences, websites and publicly funded projects.² Remarkably, almost all participants in the conversation are enthusiasts or sympathisers, with firmly critical voices apparently non-existent, apart from that of Rowbottom (2007). Partial overlap exists between our respective critiques but this is not large, his being a deeper philosophical examination mainly based on a theory of concepts, while mine covers a wider range of issues, deploys a broader set of arguments, and focuses on an economic concept acting as an exemplar for the hypothesis.³

What is a Threshold Concept?

The notion originated with Jan Meyer in 2000 as a result of discussions with practitioners across a range of disciplines, with the discipline of economics being significant through an economics team within an Economic and Social Research Council project in the UK (Meyer and Land 2003: 412; 2006a: *viii*). The concept has since been embedded in a theoretical framework, the founding papers being Meyer and Land (2003) and Meyer and Land (2006a), the latter being a slightly updated but otherwise identical version of the former. Subsequently, the TCH has undergone further development but its foundations lie in the originating papers.

For a concept to qualify as a threshold concept, it must possess certain characteristics. Five attributes have been specified by Meyer and Land (2006a: 7-8) who advance the following definition. A threshold concept ‘is likely to be’:

(a) *Transformative*, because it causes a ‘significant shift’ in ways of understanding, interpreting, viewing or perceiving, ‘without which the learner cannot progress’. This property captures the gateway-like nature of threshold concepts as something through which the learner must pass in order to master the subject. As well as being intellectually transformative, it is also postulated that it is also psychologically transformative, thus altering the learner’s identity and self-perception.⁴

(b) ‘Probably *irreversible*’, because the transformation it engenders is ‘unlikely to be forgotten’ or will be ‘unlearned only by considerable effort’. Knowledge of the concept is so powerful that, once acquired, it produces (virtually) permanent changes in a person’s ways of interpreting the world and hence contributes to any transformation of that person’s identity.⁵

(c) *Integrative*, because it exposes ‘previously hidden interconnections’ or an inter-relatedness between ideas that was previously obscured. Areas of a discipline that seemed isolated or

separated from each other are now revealed to have common themes, conceptual connections and greater coherence.

(d) ‘Possibly often (though not necessarily always) *bounded*’, in that any conceptual space has ‘terminal frontiers’ bordering other conceptual spaces. Threshold concepts can thus be significant in demarcating the boundaries of disciplines or conceptual areas, and hence in defining communities of thought and practice.

(e) ‘Potentially (though not necessarily) *troublesome*’, in that learners find them difficult to understand and master for a variety of reasons, including ritual knowledge, inert knowledge, alien knowledge, tacit knowledge, and discipline language.⁶

As noted in the literature, the five properties are interdependent to a significant extent. For example, a concept that is transformative in altering perspectives, or integrative through bringing previously obscured relationships into view, is likely to be troublesome, and a concept that is irreversible is also likely to be transformative.

In coming to grips with threshold concepts, learners are viewed as moving for some time in a ‘liminal’ or transitional zone stretching between poor comprehension on the one side and fuller understanding on the other. The time spent in the liminal zone may be short or long depending on the concept, the learner and the teacher. But once the traverse has been made and the threshold successfully crossed, learners are transformed and ready to enter the relevant community of discipline practitioners.⁷

The property of boundedness differs from the other four properties in that while the latter refer to the experiences of learners, boundedness relates to conceptual frameworks which are independent of the learner experiences. This is possibly why accounts of the hypothesis sometimes omit or downplay this property.⁸

Definitional Problems

At least six fundamental problems with this definition may be detected.

1. How Many Characteristics are Required?

Must all five attributes be present for a concept to qualify, or only a subset? If the latter, how many are actually required, and should they constitute a majority? Such questions are critical for the identification of threshold concepts, but are not answered in the founding or subsequent literature. The section heading in the updated original paper, ‘Characteristics of a threshold concept’, suggests that all five are required, but this impression is undone by words such as ‘likely’ and ‘probably’ in the definition, and by the statement, in relation to one purported threshold concept (opportunity cost), that ‘it may not be integrative’ (Meyer and Land 2006a: 7).⁹ The absence of guidance on these matters injects the first of several elements of indeterminacy – we are not told what set of the specified characteristics need be present.

2. Can Probable Characteristics be Defining Characteristics?

Even if the above questions have clear answers, deeper problems derive from the incorporation of the words ‘likely to’ in the stem of the definition that covers all attributes, and the words ‘probably’, ‘possibly’ and ‘potentially’ within the descriptions of three attributes. These features create a semantic jungle. What sense is to be made of something that is ‘likely to be probably *x*’, or ‘likely to be possibly *y*’? Is it meaningful to say that it is likely to be probably raining, or likely to be possibly sunny? More fundamentally, can a characteristic which is only *probably* characteristic of something be a *defining* characteristic of that thing?

The purpose of a theoretical definition is to be definitive rather than conditional. If the attribute of a thing is merely likely, probably, possibly or potentially present, then it is *ipso facto* admitted that there may be instances of that thing *without* this attribute. How then are we to identify all instances of the thing? We cannot say it is this thing because it sometimes has

the characteristic z and sometimes not, for that makes z irrelevant – conditional words applied to attributes destroy the definitional power of these attributes. Put another way, it is possible on the above definition for some threshold concepts to have all five characteristics, for some to have between one and four characteristics, *and for some to have none of the characteristics at all*. This renders the attributes impotent as definitional criteria. The point is well made by Rowbottom (2007: 263-4): ‘it is necessary to understand what the essential properties of Xs are, in order to be able to determine if there are any Xs’, and since the Meyer-Land definition presents no essential properties, threshold concepts ‘are unidentifiable even in principle’. The proffered definition is thus a non-definition because it provides no criteria for identification. Any claimed identification is either completely arbitrary or using an undisclosed procedure.

3. How Important is Troublesomeness?

Taking the literature as a whole, it appears that troublesomeness is supremely important, but significant contrary statements muddy the waters. On the one hand, the founders strongly associate threshold concepts with Perkins’s (1999) notion of troublesome knowledge, the discussions of troublesomeness in Meyer and Land (2003; 2006a) dominate that of all other attributes, the main theme of Meyer and Land (2006b) is the troublesomeness-liminality link and how passages across thresholds are strewn with obstacles, and Land *et al* (2006: 204-5) claim that the significance of the threshold concepts framework lies partly its ‘potential to locate troublesome aspects of disciplinary knowledge’. Numerous other authors are likewise closely preoccupied with troublesomeness.

On the other hand, it is said more than once that threshold concepts ‘can’ or ‘may’ be troublesome, this theme being evident in the definition which views them as only potentially, but *not necessarily*, troublesome. Some of the implications of this view are intermittently noted in the literature – that troublesomeness may be present in some cases but not others; that, when present, it might vary in degree; and that a threshold concept may be troublesome for some and not others. Hence, despite its apparent importance, it is a less than vital attribute whose presence and significance varies with circumstances. Which of these contrasting views is ‘right’? The absence of an answer allows further slipperiness and arbitrariness to enter discussion.

Of the four experiential attributes, troublesomeness is the only ‘negative’ one from a TCH standpoint. But the improved teaching and learning sought by TCH advocates will presumably reduce this attribute significantly, possibly to zero. If an attribute is capable of disappearing in the future, can it still be an essential, defining characteristic?

4. Can Threshold Concepts Have all Five Characteristics Simultaneously?

One would expect troublesomeness to be strongly present in the early stages of learning, and to recede to zero as improvement in understanding gives way to mastery. By the time the learner has grasped the threshold concept properly and it has become transformative, irreversible, integrative and bounded, it ought to cease being troublesome. It is also possible for different characteristics to be present at different stages in learning; a person’s understanding could be transformative prior to its being integrative, for example. This implies that threshold concepts could possess changing subsets of characteristics during students’ learning journeys. Davies (2006: 75-6), however, argues that at the end of learning all five properties are simultaneously present, his (debatable) view being that the troublesomeness of threshold concepts follows from their integrativeness. In any case, we are again not given an answer.

5. How Many Learners Must Undergo the Specified Experiences?

Do all, a majority, or just a few, learners have to experience the specified impacts? Students vary widely in their abilities, purposes, motivations, experiences and contexts, with heterogeneity being far more common than homogeneity. Transformativeness, integrativeness, irreversibility and troublesomeness are agent-relative characteristics – in Rowbottom’s phrase

(2007: 267), ‘what is transformative for Mr A need not be so for Mrs B’ – so there is no guarantee that students will react in similar ways, or even that their reactions will be primarily due to the concept in question rather than other factors. The word ‘likely’ in the stem of the definition might suggest the majority of students, but again the issue is clouded.

6. How Many Threshold Concepts are There?

At the time of *first* learning, characteristics such as transformativeness, irreversibility and integrativeness are properties of many concepts, rather than being exclusive to certain discipline concepts. Rowbottom (2007: 266) gives the example of the concept of traffic lights – someone ignorant of their functions would, on receiving an explanation, have a transformed understanding of these objects that was also irreversible as well as integrative in the sense of making comprehensible many behaviours that were previously mysterious. All important concepts in social life would appear to have these properties, so that all such concepts become threshold concepts and hence portals to becoming social actors. Either the set of threshold concepts is extremely large and they are commonplace, or the set is much smaller and they have privileged roles.¹⁰

Both the original and subsequent literature provide no answers to any of these critical issues, which gives followers of the hypothesis extraordinary freedom in interpretation and application. But until the issues are addressed, the hypothesis is open to the charge that it exemplifies the kind of loose thinking which many academics would criticise if detected in student writing.¹¹

Extraordinary Elasticities

The degree of elasticity in interpretation of the hypothesis that followers have allowed themselves, and that the founding figures have sanctioned, is alarming in at least two respects.

1. Definitional Inconsistencies

Several writers, by eliminating some or all qualifiers, have converted the correct probabilistic formulation into a more definitive but incorrect formulation. The latter now states that threshold concepts *are*, in whole or in part, transformative, irreversible, integrative, bounded and troublesome. Davies and Mangan (2007: 712), for example, say that Meyer and Land define them ‘as transformative, irreversible, integrative, bounded and potentially troublesome’.¹² The founders themselves provide ongoing endorsement for the practice of omitting some qualifiers.

In attempting to characterise such conceptual gateways we have suggested in earlier work that they are *transformative...*, *integrative...* and, likely to be, in varying degrees, *irreversible...*, and frequently *troublesome...* (Land *et al*, 2008; x; Meyer *et al* 2010: ix)

This deviation from the original probabilistic formulation is not explained, and is an incorrect account of their own earlier work. Moving from correct to incorrect formulations by eliminating probabilistic qualifiers may be an advance in definitional terms but it only addresses one of the six problems noted above, makes the hypothesis easier to refute, and raises a host of other problems. Founders and followers blithely practise this troubling inconsistency, but one cannot simultaneously assert that a property is, and may be, a defining characteristic.

2. A Threshold Doth not a Threshold Concept Make

The literature displays an uncontrolled tendency to regard any threshold, barrier, obstacle or difficulty in learning as linked to the presence of a threshold concept. Baillie and Johnson (2008: 129) reflect this by suggesting that associated with every threshold is a threshold concept. The hypothesis has been applied to a multiplicity of ideas, but none of these

applications from an apparently limitless supply are conceptually anchored back to the original definition that constitutes the foundation of the approach.

Here, also, the founders uncritically accept, and even welcome, the practice of free application of the hypothesis to anything that can be conceived as having the property of threshold-likeness. Their subsequent writings have introduced alternative names that subtly permit the original conceptual underpinnings to be replaced by other (often unspecified) underpinnings. What was previously the threshold *concept* approach or theory is now reframed as ‘the thresholds approach’, ‘threshold framework’, or ‘threshold theory’, with a view to ‘extending’ the exploration of ‘thresholds’.¹³ Under this enlarged rubric, unrestrained applications are positively endorsed as ‘intriguing migratory instances of the application of threshold theory to other sectors of education, to doctoral education, to professional learning and even to *the social analysis of an entire nation in transition*’ (Land *et al* (2010: *ix, xi*; emphasis added). The scope for application is now limitless. From relatively humble beginnings as a particular kind of disciplinary concept, it has grown to embrace the social transformation of nation states, after which it can presumably expand to global challenges (climate change etc) as well as the origin of the universe (itself arguably transformative, irreversible, integrative and troublesome).

Perkins (2010: *xliii-xliv*) is gushingly enthusiastic about unconstrained application.

What is it that so many educators have found so alluring about threshold concepts? ... Another...reason seems to be the very fecundity of threshold concepts, the evolutionary proclivity of the idea towards adventurous and fruitful mutation. As an occasional participant in these conversations, I am always struck by how productively imprecise the notion is.

‘[T]hreshold concept’ itself seems to have the heart of a nomad.

He also engages in this practice in relation to ‘proactive knowledge’ which, even though it only has ‘something of a threshold character’, is nevertheless viewed ‘as a threshold concept’ (Perkins 2008: 13). This occurs despite his simultaneous recognition of the sliding that often occurs between threshold concepts and mere thresholds – ‘Many of these transformative ideas are not concepts in any strict sense but varied ways of thinking and practicing with a threshold-like nature’ (Perkins, 2010: *xliii*) – and his response to a question at the 2010 Threshold Concept Conference which accepted that thresholds by themselves do not generate threshold concepts. An alternative interpretation of the apparent fecundity of the approach is that it derives, not from deeper insights, but from a lack of clear foundations which allows practitioners to do as they please in accumulating instances under its umbrella.

This ‘anything goes’ attitude is disturbing in academia. Brainstorming and free association are essential to creative thinking but, in the subsequent stages (especially in relation to academic scholarship), creatively generated ideas need to be subject to logical and critical analysis. Good educational theory and practice require sound conceptual foundations which are internally logical, evidence-based and capable of addressing questions and criticisms.

Broader Conceptual and Methodological Issues

1. The Agent-Dependence of Threshold Concepts

Threshold concepts are unusual in their learner-dependence. Existing approaches deploy fundamental or core concepts which are defined in terms of other concepts in the given framework. Such concepts are ‘objective’ in Popper’s ‘third world’ sense (1972: chs 3-4) in that they exist *sui generis* in a conceptual realm *independent* of their psychological impact on humans. Within his three worlds of physical states, mental states, and ideas and theories, the third world is ontologically independent of the second. By contrast, the TCH makes the third

dependent on the second by defining threshold concepts in terms of the effects they have (or are supposed to have) on people via their learning experiences.

This peculiarity is not harmless, as it creates ontological and epistemological difficulties. Ontologically, threshold concepts must have the required impacts on the thoughts, perceptions and identities of subjects in order to exist. An alleged threshold concept that is not transformative, integrative, irreversible and troublesome (in sum or in part) for the learner cannot (presumably) be a threshold concept. Existence thus depends on specific subjective effects, something which is not true of other concepts, such as gravity or boiling points.

Epistemologically, to be identified as a threshold concept, the psychological impacts on learners need to be *verifiable* in convincing ways. However, verifiability of the required impacts generates difficult issues. Suppose a putative threshold concept is observed not to produce the desired effects on (the majority of) learners. How do we know correct identification has occurred? Presumably we have been previously informed by discipline experts, who might possibly admit error but are more likely to criticise teaching methods. Teachers could then respond positively, indifferently or negatively to such criticism; negative responses include doubting the expert view, rejecting the TCH altogether or, in a case reported by Meyer and Land (2006a: 8), dropping the concept from the curriculum! But only a positive commitment by teachers to teach in the ‘improved’ ways could create the possibility of the concept’s existence, and hence its verifiability, by releasing its latent powers to affect learners. We now have a situation where both existence and identification depend on a complicated set of relationships between three groups – experts, teachers and learners. Only if the first two do their work properly will the third respond in the required ways; all must behave ‘appropriately’ for the circle to close. This is a peculiar situation which does not arise with other concepts. Their existence and identification are entirely independent of how groups interact with each other, for they exist within conceptual frameworks and are identified by their positions in these frameworks.

2. An Excessive Load – Portal and Experiential Requirements

There is an unresolved tension between two requirements placed on threshold concepts – their role in acting as portals to communities of practitioners, and their definition in terms of their experiential effects on learners. These portal and experiential requirements are independent and hence not necessarily co-existent. On the one hand, it is the experts’ task to decide the portals to their communities, this presumably being done *without* regard to how learners experience these concepts. On the other, the definition requires that students experience the concepts in specified ways. However, it is quite possible for some students to gain mastery and pass through the portal without experiencing some or all the specified effects or for some neither to acquire mastery nor have the experiences and still pass into community membership (see below). Advocates, however, proceed as if there is always an indissoluble link between the two requirements. But since there is no necessary connection, the excessive load on the hypothesis causes it constantly to break down.

3. The Normative Trumps the Positive

At its core, the TCH contains a conflict between positive and normative issues in which persistent advocacy results in the normative winning out over the positive. Taking the definition in its correct (probabilistic) form, threshold concepts are unidentifiable. If advocates then state that a particular concept is definitely a threshold concept, then it can only be their desire (as teachers or researchers) that makes it so. Declaring things to exist in the absence of coherent definitions and identification criteria is a form of wish-fulfilment, a mark of faith not science.

Taking the definition in its incorrect (definitive) form avoids this problem (but not the others), and raises the issue of how to deal with clashes with reality. Suppose, for simplicity, that only two attributes are required to be present for the majority of students – transformativeness and troublesomenes – and that it is then found empirically, with good teaching, that a putative

threshold concept satisfies the latter but not the former. (An instance might be opportunity cost discussed below). Diagnoses of mis-identification might be expected but this rarely happens in practice because advocates continue to assert its threshold concept status regardless of the verdict of reality. This resolves the conflict in favour of the normative, with the desired taking precedence over the actual. Allowing the normative to trump the positive in this manner is the antithesis of analytical and scientific thinking.

Similar triumphs of the normative are evident in any conflicts between portal and experiential requirements, where the absence of the latter is not permitted to impinge upon the existence of the former. Portals and their associated threshold concepts need to be identified *in advance* in order to know how to induct learners into communities. But if the experiential requirements are not validated by reality, then candidate concepts are not threshold concepts and cannot define portals. If advocates continue to insist these are the right portals, then that which is desired is defining the portal rather than a respect for reality.

4. What Value is Added by the TCH?

Is the threshold concept hypothesis an advance on existing approaches, old wine in new bottles, or a retrograde step? Existing approaches recognise certain concepts as ‘foundational’, ‘fundamental’ or ‘core’ in the sense that they underpin and reappear in later thinking, this giving them essential roles in understanding and integrating material. They also accept that conceptual frameworks have boundaries, that certain key concepts can be ‘difficult’ for many students, and that students face various kinds of obstacles, barriers or thresholds in their learning journeys.

While the new terminology can be viewed as largely re-assembling existing ideas in new attire, advocates strenuously resist this. Meyer and Land (2003: 412, 415; 2006a: 6) claim that a threshold concept is ‘something distinct’ within core concepts, the difference being that while core (or ‘building block’) concepts facilitate progress in understanding, they are not threshold concepts because they are not *transformative*.¹⁴ Only one brief, inconclusive and context-dependent argument is provided in support – the concept of *gravity* is taken to be a threshold concept, but the concept of the *centre of gravity* is not, even though it is a core concept in applied science. The case is not well made, however – why should the idea that complex body problems can be simplified by using centres of gravity not be transformative for students in applied science? Distinctiveness is also stressed by Davies (2006) on the grounds that existing approaches only address ‘ways of thinking’ whereas the threshold concept approach focuses on ‘ways of thinking and practising’. The difference does not seem to be large, however, because it is accepted that ways of thinking ‘necessarily entail’ ways of practising. Cousin (2008) likewise asserts distinctiveness, but is willing to accept some overlap with previous thinking.

An alternative perspective is that the TCH unravels because it again attempts too much. It gathers together quite disparate agent-dependent aspects of learning that occur at different stages in students’ journeys and tries to weld these into an all-encompassing concept. It is then required that this notion exhibit all the relevant characteristics in some manner but, since there can be no certainties here, the definition is rendered flexible by probabilification (which then neuters it by eliminating all essential characteristics). Add on the portal requirements for community entry and the concept is required to be a ‘super-hero’ notion with extraordinary powers. In the absence of compelling argument, one is left with the impression that the claim to distinctiveness is merely asserted, that the TCH is closer to re-badging than innovation, and that it does not investigate issues that are inaccessible to other approaches.

To assess theoretical or empirical work presented in threshold concept terminology, the following test is suggested. In reading a paper or project description, either omit the adjective ‘threshold’ altogether, or substitute an alternative term such as ‘fundamental’, ‘core’ or ‘key’. If such changes make no material difference, the threshold concept language is redundant. My own finding is that most, if not all, accounts suffer no loss of significant meaning if TCH

terminology is omitted or more familiar concepts substituted. It then follows that the TCH is merely discussing other ideas, adding no unique value of its own, and unhelpfully obscuring the real topic by representing it as something else. One can explore numerous issues perfectly satisfactorily (student experiences, difficult concepts, transitions, barriers, liminality and so on) without dunking one's language in a strange conceptual soup.

Further Troubling Implications

Behind the TCH lies a large terrain of tacit, undiscussed assumptions. One key presumption is that a discipline has an established body of fundamental knowledge that is unlikely to change for some time. The aim is then to transform the intellectual perspective of learners in the discipline so that they 'think like an x ', or are 'transformed into' an x , where x is an economist, biologist, engineer, sociologist, doctor, accountant, historian etc. These assumptions have some worrying implications.

1. Negative Impacts on Critical, Contextual and Creative Thinking

'Thinking like an x ' means thinking in the conceptual categories foundational to the currently dominant discourse in x , and also practising x in the standard ways. It then becomes contrary to one's training to view the world through other lenses, or even to do x in ways which depart from professionally sanctioned frameworks. This is particularly notable in economics which is dominated by one school of thought (Neoclassical economics) that sees itself as the only scientific mode of economic analysis and regards alternative frameworks as wrong or misleading. But alternative perspectives are exactly what are required for critical reflection on the adequacy of the dominant categories, for contextual reflection that draws on history and social background, and for creative reflection on different ways of doing x . Critical, contextual and creative thinking are inhibited by monism (which easily slides into indoctrination), but are enhanced by pluralism. If we want creative thinkers and innovators, we need graduates capable of moving *outside* the x framework and operating with multiple frameworks.¹⁵

2. Silos and Inter-disciplinarity

Although some advocates pursue inter-disciplinary work, there are nevertheless forces within the approach which encourage silos. Currently, knowledge is not generally taught as a seamless web but is compartmentalised into domains of specialisation where most practitioners think and talk like x 's, y 's and z 's. Those who 'think like economists' will have different views on the analysis of social phenomena from those who 'think like sociologists' or 'cultural theorists'. Conflicts, incompatibilities and barriers to collaboration emerge – mainstream economists, for example, have long been disdainful of sociology. Students doing double majors will then be required to undergo transformative experiences that lead them to think like both an x and a y , but if these ways of thinking and practising are incompatible, the result could be personality disorders and an inability to think like anything. The psychological impact is then disintegrative, not integrative. But rather than training people to enter specialised communities of x 's, y 's or z 's, surely it is better to educate them to become members of a *broad community of rational, critical and creative thinkers* capable of understanding, improving and connecting disciplines?

3. Power and Control

The view that there is a single set of threshold concepts in a discipline typically reflects the view that a discipline only has one reputable school of thought. But many disciplines, especially in the social sciences, have multiple reputable schools of thought, each with a school-specific set of core concepts. This transforms the issue into one of power and control – which set is to prevail and who decides? Meyer and Land (2003: 422; 2006a: 16) raise the question – 'Whose threshold concepts?' – but sidestep further discussion. Clearly, the outcome depends on the institutions and exercise of power within disciplines. Most likely the dominant

school will define the threshold concepts, as in economics where Neoclassicism sets the agenda. Davies (2006: 72, 74, 78, 80) seeks a resolution by distinguishing between *school* threshold concepts and *discipline* threshold concepts. This, however, merely shifts the problem to another level. Who decides the higher order discipline threshold concepts? Would it not again be the dominant school convinced of its own correctness? Evidence for this occurs in economics with the inclusion of opportunity cost in the discipline threshold concepts (Davies and Mangan 2007: 715), and in the idea that nowadays economics is ‘defined in a very integrated manner with fairly sharp boundaries’ (Davies and Mangan 2008: 37). This view gives no recognition to the many contemporary schools of economic thought that have their own (non-Neoclassical) forms of integration and boundedness.

4. Medieval Craft Guilds

While *anthropological* influences on the hypothesis (rites of passage, transformative transitions, liminality etc) are acknowledged,¹⁶ an equally illuminating image is the *historical* one of a medieval guild. The TCH is structured on a community of practitioners of a discipline similar to the organisation of a craft guild. The learners are apprentices who, by learning prescribed ways of thinking and doing, traverse liminal zones, cross thresholds and set out on paths that lead (possibly via other stages) to becoming masters of their trade. The process is one of socialisation into institutions by absorption of its thinking and practising. Guilds are well known for acting as gate-keepers, for protecting the knowledge and practice of their crafts, for establishing monopolies against outsiders, and for resisting change unless arising from within. They tend to be static, tradition-bound institutions controlled by dominant groups resistant to critique, innovation and change unless it has their agreement. This is an arguably defensible model for *training*, but it is far from appropriate in *education*.

One undesirable possible outcome of the TCH is a value-laden redesign of education in its own image. Given the emphasis on ontological shifts in learners and changes in their subjectivity and identity (Land and Meyer, 2010: 72-5), a policy could emerge to transform education to impose transformativeness on learners so that they think like *x*s (as defined by those with influence in disciplines).

Empirical Investigations

Land *et al* (2010: *x*) confidently assert that ‘the empirical evidence for threshold concepts has been substantially increased’ in a multiplicity of disciplines in many countries. A great deal of empirical and applied work is undoubtedly occurring, but such work proceeds on the assumption that investigators have either identified a threshold concept or possess a sound methodology for doing so. Since neither assumption has any foundation, such work presupposes knowledge we do not have.

However, supposing that threshold concepts exist and are identifiable, how might identification occur? Two groups present themselves for questioning, with interrogation proceeding along portal lines, experiential lines, or both.

1. Discipline experts (top-down approach)

On this view, experts in the relevant community identify threshold concepts, whether on a portal or an experiential basis. However, most experts will start with older views about fundamental or core concepts, and will need induction to the new world of threshold concepts and persuasion as to credibility and identifiability. It is not easy, even for strong advocates, to deliver these things, so it is unlikely that groups of experts will be convinced and able to provide identifications.

2. The learners (bottom-up approach)

The alternative is to use student experiences to uncover threshold concepts. However, while students can be usefully surveyed as to their various experiences of learning, this data varies

from student to student and is affected by other factors, including teaching quality and local contexts. Merely describing the data in the terminology of the hypothesis (transformation, troublesomeness etc) does not amount to the uncovering of such concepts as no clear criteria of identification can be applied. In the end, it comes down to the preferred interpretations of researchers. The information may point (weakly or strongly) to transformativeness, for example, or it may point with equal force to a quite different interpretation. More fundamentally, finding that a particular concept is troublesome, as numerous advocates do, does not demonstrate that it is a threshold concept for the definition allows a concept to be a threshold concept *without* being troublesome. None of the attributes are essential, so evidence for any of them only demonstrates the presence of the attribute and nothing else. As Meyer *et al* (2008: 66) ingenuously note in relation to student studies, the presence of threshold concepts is simply assumed. Ultimately, learners are no more helpful than experts for identification.¹⁷

It seems, then, that only advocates can recognise threshold concept – many believers certainly display high self-confidence in their abilities. But since there is no possible procedure for identification, it is again a triumph of the normative over the positive.

Is Opportunity Cost a Threshold Concept?

In economics, opportunity cost has been declared a prime instance of a threshold concept by founders and followers alike; Entwistle (2008: 22) presents it as ‘a particularly clear example’, for example.¹⁸ It is not the only selected concept, but it is so prominent that it may be viewed as an exemplar of the entire genre. Advocates, however, merely constantly *assert* that it is a threshold concept, there never being any demonstration that it merits this status. In examining whether opportunity cost actually qualifies as a threshold concept, I shall use a mix of logical, experiential and empirical argument in a manner similar to that of Meyer and Land, though our respective mixes will be different. Three objections are entered.

1. Empirical Objections

At least two empirical arguments are relevant. The first is a revealing study by Ferraro and Taylor (2005) aimed at determining how well the concept of opportunity cost is understood by faculty, graduates and undergraduates. Their primary survey was of 199 graduates, of whom 67% had a PhD and 33% were PhD students, about 61% had taught introductory university economics, and 45 % were from ‘top 30’ economics departments in the US. This constituted a highly trained sample with considerable teaching experience. A single multiple choice question was used to assess understanding, this being relatively straightforward within the standard (Neoclassical) framework.

The results, however, were quite astonishing. The four alternatives attracted roughly *equal* percentages of respondents (25.1%, 21.6%, 25.6%, 27.6%), with the correct answer being chosen by the *least* number of respondents. The virtually flat distribution of responses was thus no different from that expected of lay people or any random selection process. Of those with experience in teaching economics principles courses, only 22.5% responded correctly. A second survey based on the same question was administered to 358 undergraduate students in the first week of introductory microeconomics before opportunity cost had been covered. Again the results were quite remarkable. Of the 24% of the class who had *not* taken economics before, 17.2% answered correctly, while of the 76% who had previously taken economics, only 7.4% were correct. No statistically significant difference was found, moreover, between the 21.6% of *graduates* who were correct in the first survey and the 17.2% of *undergraduates* who had *not* studied economics before and who were correct in this survey. This implies that 3 to 7 years of economics study has *no* overall impact on the ability to answer a relatively straightforward question on opportunity cost.

The second empirical argument addresses the contention that opportunity cost is a portal to membership of the economics profession. Two observations may be made, one concerning the general population of economists, the other concerning famous individual economists. Given

the above findings, teachers' poor understandings of opportunity cost will pass into graduates' understandings. But many graduates have successful careers in the economics profession, including those entering academia. This undermines the claim that mastery of this concept is essential to being, and thinking like, an economist. Such a situation could not arise in physics, engineering or medicine where failure to have adequate understandings of fundamental concepts such as energy, force or cells respectively, would lead to failed careers.¹⁹

The second observation relates to acclaimed individuals widely acknowledged to be masters of economic thinking. As an example, consider Paul Samuelson, winner of the 1947 JB Clark Medal, the 1970 Swedish Bank Prize, and the 1996 US National Medal of Science, and the recipient of 35 honorary degrees who has been labelled 'the economist's economist'.

Opportunity cost, however, plays *no* role in the thinking that led to these accolades. It is almost invisible in his seminal *Foundations of Economic Analysis* (1947/1983) which only contains two brief reference (one neutral and one dismissive), and it has a zero or minor role in the first 11 editions (1948-80) of his famous textbook, *Economics*, which educated millions of students worldwide. If the TCH is correct, this doyen of economists never crossed the threshold into the profession and never thought like an economist. But who would dare claim that Samuelson was not a proper (mainstream) economist?

A good knowledge of opportunity cost is thus not a requirement of graduation, community membership and successful careers inside or outside academia. In reality, thinking and practising as an economist does not require a good understanding of opportunity cost, which consequently does not define any threshold or portal. We return here to the underlying normative element in the TCH. Empirical reality indicates that opportunity cost is not a portal, so the insistence of TCH advocates to the contrary derives from some other source, namely, their desire that it should be. A normative vision of what is required replaces what is actually required.

2. Theoretical Objections

I now examine the extent to which opportunity cost meets the five entry criteria for being a threshold concept, with each attribute mainly being discussed, for simplicity, in its incorrect definitive form, rather than the correct but useless probabilistic form.

(a) Transformative

How do we know opportunity cost is transformative for students? There is no reason whatsoever to suppose that it will have this attribute for all students, or even a majority of them. It may or it may not. But if this attribute is absent, the learner does not have an intellectually transformative experience, cannot progress in understanding, and cannot attain mastery of the subject.

Some context will assist discussion. Opportunity cost is predominantly taught in first year economics courses where enrolments can be very large, the courses perform service functions for the majority of students (non-majors in accounting, marketing, business etc), and there can be significant numbers of non-native English speakers. Consider a range of situations where 'transformativeness' is *absent*. Firstly, there are students (possibly/probably a majority) who only attain inadequate or mediocre understandings of opportunity cost which are insufficient for transformation but nevertheless sufficient for passing and successful graduation. Secondly, there are students who develop good to excellent comprehension but who do *not* have transformative experiences because (i) they are not economics majors so thinking like an economist is largely irrelevant, (ii) they are majoring in economics because they want to understand how economists think and work without necessarily wanting to practise as economists e.g. those pursuing careers in law, politics, philosophy, social policy, or even in economics (as academics) or (iii) they are economics majors reacting against the Neoclassical theory of cost, either through agnosticism or because they find some non-Neoclassical theory of cost more relevant; these students could also become professional or academic economists.

The empirical evidence discussed above strongly supports the above reasoning – the surveyed

PhD-holding faculty and PhD students achieved high levels of progress, and presumably significant mastery of economics and membership of the profession. Yet their understanding of opportunity cost was abysmal, from which it follows that it was not illuminating and hence not transformative.

Of course, opportunity cost may well be transformative for some students, but the above arguments suggest that such students and graduates constitute a minority. If so, the likelihood required by the correct definition is *reversed* – opportunity cost is actually *unlikely* to be transformative, thus disqualifying it from possessing this crucial characteristic.

(b) Irreversible

How do we know opportunity cost is irreversible for students?²⁰ Irreversibility means unlikely to be forgotten, or unlearned only by considerable effort, which means that knowledge needs to be (i) well understood at the end of learning, and (ii) embedded and retained in memory as a result of continued usage or application. Each condition is far from guaranteed. Here again it helps to have some contextual knowledge about the profile of opportunity cost in economics education. Students receive their greatest exposure to the concept at the introductory level, with its discussion in subsequent years rapidly declining to zero. At this level, moreover, it is given only comparatively short treatment relative to that of other topics. Mention in intermediate texts is sparse and light, it is almost always absent in advanced texts, and graduate texts are completely silent. None of this enhances or deepens learning. Nor do many practising economists necessarily have opportunity cost at the forefront of their minds in their daily work. In all these cases, one's understanding of the concept can easily degrade over time, so producing unlearning because hard-won knowledge without use is rapidly forgotten. The empirical results also point to *reversibility* among the highly trained. Even faculty who taught opportunity cost in principles courses (possibly every year or semester) did poorly in answering the question. In other words, what is actually happening is some initial learning (whether partial or full) followed by much subsequent unlearning, which undermines the irreversibility postulate.

(c) Integrative

Is opportunity cost a key integrative concept in economics? This cannot be true of the way it is taught in thousands of standard degree programs worldwide where it is given little or no integrative role. It is typically taught/applied in separate modules with no discussion of any over-arching role it may have in drawing basic themes together. In introductory courses, it is defined and then applied to topics such as production possibility frontiers, comparative advantage, economic costs and profits and a few other areas depending on the preferences of the author, but it would hardly strike the reader as a central integrating theme. In second and third year texts, it crops up occasionally but is given no real work in integrating different parts of the curriculum or uncovering obscured relationships between disparate phenomena. In graduate texts it vanishes completely. Whether this is a true reflection of its role in economics, or poverty in the way the way it is taught, it is nevertheless the case that almost all students in the world are brought up on textbooks modelled on these templates. There is nothing here to suggest that opportunity cost is integrative for students. The empirical evidence in this case also strongly undermines the general claim that threshold concepts contribute, in the words of Davies (2006: 74-75), integration, 'coherence' and 'shape and structure' to student understanding.

(d) Bounded

The mainstream (Neoclassical) view is that opportunity cost is an essential concept in economics.²¹ Like all essential concepts in other theories or disciplines, opportunity cost then has the property of boundedness because it helps demarcate the framework in which it is deployed from other frameworks using different concepts to theorise economic phenomena. This makes it a bounded concept for Neoclassical (and Austrian) economics, but not a bounded concept for economics as a whole. Hence for those schools of economic thought in which

opportunity cost is an essential concept, it will also have the property of boundedness, but not for other schools.

(e) Troublesome

I have no quarrel with the proposition that opportunity cost, as currently taught, is a difficult or tricky concept, both for students and teachers. Here I agree with the threshold concept literature, although this runs counter to those mainstream economists who regard it as relatively simple and straightforward.²² The troublesomeness of opportunity cost has two sources. One is the nature of the concept itself – when first encountered, the idea is quite different from lay ideas of cost, it is not immediately intuitive and hence not easily retained in the mind, and it introduces problematic issues in application. The second is the way it is taught. It is not given sufficient coverage in the curriculum relative to its alleged importance and, as discussed below, its treatment in almost all textbooks is analytically confused and hence confusing.

Is opportunity cost a threshold concept, then, on the basis of the above arguments? This returns us to the issue of indeterminacy in the number of criteria needed for qualification. On my account, opportunity cost does not satisfy the first three criteria (transformative, irreversible, integrative); it satisfies the fourth (bounded) in a specific sense; and it satisfies the last (troublesome). Assuming that 1.5 or 2 out of 5 is not a pass, I conclude that opportunity cost does not qualify as a threshold concept and, as such, cannot be a portal to becoming an economist, Neoclassical or otherwise. Curiously, this indeterminacy is implicitly admitted, but passed over in complete silence, in Shanahan and Meyer (2006: 102) – after noting that ‘threshold concepts possess a number of attributes’, they remark without further elaboration that ‘opportunity cost would *appear* to possess *some* of these characteristics’ (emphases added). But we are not told why this is so, or what it implies for the claim that opportunity cost *is* a threshold concept. Given the evidence that a key group of graduates and faculty have abysmal understandings yet go on to enjoy successful careers, one is entitled to draw the conclusion that the liminal state can last longer than a lifetime without causing any trouble to members of the economics community.

3. Conceptual Objections

There is a further, independent argument against the construal of opportunity cost as a threshold concept. The hypothesis assumes that threshold concepts are well defined and understood by the experts. Unfortunately, this is not the case with opportunity cost. It can be shown that the economics profession is deeply confused about opportunity cost as a result of treating two *contrary* definitions as equivalent, this confusion then being transmitted to students and graduates through textbooks and lectures.²³ In this situation, opportunity cost cannot play its putative roles of providing transformation, integration, coherence and structure, although it is capable of being extremely troublesome and tacitly teaching highly undesirable ways of thinking. If a confused concept is a portal to a discipline, then one of the things that is being (unconsciously) mastered during transformation is the art of confused thinking.

Conclusion

The conclusions of the above analysis may be summarised as follows:

- (i) There are grave shortcomings in the definition of threshold concepts which prevent their identification and render the hypothesis untestable.
- (ii) The TCH generates serious methodological and conceptual issues which further undermine its applicability and relevance.
- (iii) The elasticity and looseness of interpretation and application of the hypothesis are alarming.
- (iv) A good case for the superiority of the threshold concept approach over existing approaches is not made.

(vi) Some of the disciplinary, pedagogical and social consequences of the hypothesis are undesirable.

(vii) In economics, it is difficult to accept that opportunity cost could qualify, now or in the past, as a threshold concept, and hence function as a portal to becoming an economist (Neoclassical or otherwise).

Shanahan *et al* (2006:29) find that ‘the threshold concepts framework is highly appealing on a theoretical level’. This paper begs to differ. Deeper examination discloses that the threshold concepts approach derives from an incoherent framework that leads to nonsense or false conclusions. That cannot be appealing, theoretically, empirically or pedagogically, to those interested in soundly based frameworks rather than novel but unsustainable ideas.

Reflexively, Meyer and Land (2005: 386) hope that the new notion of a threshold concept will itself be a threshold concept. The suggestion is that it could act as a new lens through which learning and teaching can be viewed, such that the new understanding is (likely to be?) transformative, irreversible, integrative, bounded and troublesome. However, given its lack of clarity and its logical, methodological and pedagogical problems, it might be more appropriate to view the threshold concept hypothesis as neither transformative, irreversible nor integrative, but as merely bounded and highly troublesome. While the hypothesis is grappling with the same important issues as existing approaches, its capacity to provide sound, coherent foundations for improved teaching and learning is non-existent.

In economics, similar conclusions can be drawn regarding opportunity cost. While many students may experience the concept as troublesome, for most it is neither transformative, nor irreversible nor integrative. Combining this with the confused understanding in the textbooks and the conclusion that many highly regarded economists would be excluded from the profession, it is difficult to see how it could qualify as a threshold concept and an exemplar of the genre.

However, while the threshold concept hypothesis/approach itself has been found wanting, it is certainly *not* argued here that all the work done under its rubric is valueless. If the unnecessary terminology it wears as a cloak is discarded and the arguments re-expressed in unencumbered language, many valuable lines of thought and insights remain to assist the vital goal of improving teaching and learning.

References

- Baillie C. and Johnson A. (2008) ‘A Threshold Concept Model for Attitudes in First Year Engineering Students’, in Land *et al* (2008).
- Cousin G. (2006) ‘Threshold Concepts, Troublesome Knowledge and Emotional Capital’, in Meyer and Land (2006c).
- Cousin G. (2008) ‘Threshold Concepts: Old Wine in New Bottles or a New Form of Transactional Curriculum Enquiry’, in Land *et al* (2008).
- Case K.E. and Fair R.C.(2002) *Principles of Economics*, Prentice Hall, New Jersey.
- Council for Economic Education (1997) *Voluntary National Content Standards in Economics*. Available at <http://www.ncee.net/ea/standards/standards.pdf>
- Davies P. (2006) ‘Threshold Concepts: How can we Recognise Them?’, in Meyer and Land (2006c).
- Davies P. and Mangan J. (2007) ‘Threshold Concepts and the Integration of Understanding in Economics’, *Studies in Higher Education*, 32 (6), 711-26.
- Davies P. and Mangan J. (2010) ‘Assessing Progression in Students’ Economic Understanding: The Role of Threshold Concepts’, in Meyer *et al* (2010)
- Entwistle N. (2008) ‘Threshold Concepts and Transformative Ways of Thinking within

- Research into Higher Education', in Land *et al* (2008).
- Ferraro P.J. and Taylor L.O. (2005) 'Do Economists Recognize an Opportunity Cost When They See One? A Dismal Performance from the Dismal Science', *Contributions to Economic Analysis and Policy*, 4(1), Article 7.
- Frank R.H. (2002) 'The Economic Naturalist: Teaching Introductory Students How to Speak Economics', *American Economic Review Papers and Proceedings*, 92 (2), 459-62.
- Garnett R., Olsen E., & Starr M. (2009) (eds), *Economic Pluralism*, Routledge: London.
- Gennep A. van (1908/1960) *The Rites of Passage*, University of Chicago press, Chicago.
- Hansen W.L., Salemi M.K. and Siegfried J.J. (2002) 'Use it or Lose it: Teaching Literacy in the Economics Principles Course', *American Economic Review Papers and Proceedings*, 92 (2), 463-72.
- Kiley M. and Wisker G. (2009) 'Threshold Concepts in Research Education and Evidence of Threshold Crossing', *Higher Education Research and Development*, 28(4), 431-41.
- Land R. and Meyer J. (2010) 'Threshold Concepts and Troublesome Knowledge (5)', in Meyer *et al* (2010).
- Land R., Cousin G., Meyer J. and Davies P. (2006) 'Implications of Threshold Concepts for Course Design and Evaluation', in Meyer and Land (2006c).
- Land R., Meyer J. and Smith J. (2008) (eds) *Threshold Concepts within the Disciplines*, Sense Publishers, Rotterdam.
- McCormick R. (2008) 'Threshold Concepts and Troublesome Knowledge', in Land *et al* (2008).
- Meyer J. and Land R. (2003) 'Threshold Concepts and Troublesome Knowledge: Linkages to Ways of Thinking and Practising within the Disciplines', in Rust (2003).
- Meyer J. and Land R. (2005) 'Threshold Concepts and Troublesome Knowledge (2): Epistemological Considerations and a Conceptual framework for Teaching and Learning', *Higher Education*, 49, 373-88.
- Meyer J. and Land R. (2006a) 'Threshold Concepts and Troublesome Knowledge: An Introduction', in Meyer and Land (2006c).
- Meyer J. and Land R. (2006b) 'Threshold Concepts and Troublesome Knowledge: Issues of Liminality', in Meyer and Land (2006c).
- Meyer J. and Land R. (2006c) (eds) *Overcoming Barriers to Student Understanding, Threshold Concepts and Troublesome Knowledge*, London and New York: Routledge.
- Meyer J., Land R. and Baillie C. (2010) (eds) *Threshold Concepts and Transformational Learning*, Sense Publishers, Rotterdam.
- Meyer J., Land R. and Davies P. (2008) 'Threshold Concepts and Troublesome Knowledge (4)', in Land *et al* (2008).
- Ming F.P. and Meyer J.F. (2010) 'Modes of Variation in Pupils' Apprehension of a threshold Concept in Economics', in Meyer *et al* (2010).
- O'Donnell R. (2009) 'The Concept of Opportunity Cost: Is it Simple, Fundamental or Necessary?', *Australasian Journal of Economics Education*, 6(1), 21-37.
- O'Donnell, R. (2010a) 'Economic Pluralism and Skill Formation: Adding Value to Students, Economics and Societies', in Garnett *et al* (2010).
- O'Donnell R (2010b) 'Opportunities Lost and Regained in the Land of Opportunity Cost, UTS School of Finance and Economics Working Paper No 163.
- Perkins D. (2008) 'Beyond Understanding', in Land *et al* (2008).
- Popper K. (1972) *Objective Knowledge*, Oxford: Oxford University Press.
- Reimann N. and Jackson I. (2006) 'Threshold Concepts in Economics', in Meyer and Land (2006b).
- Rickerts A. 2010) 'Threshold Concepts: 'Loaded Knowledge' or Critical Education', in Meyer *et al* (2010).
- Rowbottom D.P. (2007) 'Demystifying Threshold Concepts', *Journal of Philosophy of Education*, 41(2), 263-70.
- Rust C. (2003) (ed.) *Improving Student Learning Theory and Practice – 10 Years on*, Oxford:

- Oxford Centre for Staff & Learning Development.
- Samuelson P. (1947/1983) *Foundations of Economic Analysis*, Cambridge: Harvard University Press.
- Samuelson P. (1948-1983) *Economics*, 11 editions, New York: McGraw Hill.
- Schwartzman L. (2010) 'Transcending Disciplinary Boundaries', in Meyer *et al* (2010).
- Shanahan M. and Meyer J. (2006) 'The Troublesome Nature of a Threshold Concept in Economics', in Meyer and Land (2006c).
- Shanahan, M., Foster, G. and Meyer, J. (2006) "Operationalising a Threshold Concept in Economics: A Pilot Study Using Multiple Choice Questions on Opportunity Cost", *International Review of Economics Education*, 5(2), 29-57.
- Shanahan M., Foster G., and Meyer J. (2008) 'Associations among Prior Acquisition of Threshold Concepts, Learning Dimensions, and Examination Performance in First Year Economics', in Land *et al* (2008).
- Shanahan M., Foster G., and Meyer J. (2010) 'Threshold Concepts and Attrition in First Year Economics', in Meyer *et al* (2010).
- Shinners-Kennedy D. (2008) 'The Everydayness of Threshold Concepts', in Land *et al* (2008).
- Taylor C. (2006) 'Threshold Concepts in Biology: Do they fit the Definition?', in Meyer and Land (2006c).
- Turner V. (1967) *The Forest of Symbols: Aspects of Ndembu Ritual*, Cornell University Press, Ithaca.

Endnotes

¹ Revised version of a paper first presented to the 2009 Australasian Teaching Economics Conference.

² For the respective proceedings of the 2006 and 2008 conferences, see Land *et al* (2008) and Meyer *et al* (2010). No book is planned for the 2010 conference. For websites, see <http://www.ee.ucl.ac.uk/~mflanaga/thresholds.html>, and <http://www.staffs.ac.uk/schools/business/iepr/etc/index.htm>

³ A small minority of advocates have raised criticisms on some points. While remaining within the framework, McCormick (2008), for example, raises issues that resonate with my critique, and Schwartzman (2010: 40) acknowledges the absence of consensus on 'intellectually rigorous, definitive criteria' for identification.

⁴ As Davies (2006: 71) puts it, 'The act of learning is an act of identity formation' in which learners join a community and acquire its way of seeing the world. This, however, is a contestable view.

⁵ Davies (2006: 74) makes an even stronger claim here: 'The irreversibility of a threshold concept makes it *inconceivable* that they [the learners] would return to viewing not only the world around them, but also a subject community and themselves, in a way they did before' (emphasis added).

⁶ For an extended discussion of these reasons, see Meyer and Land (2006a: 9-15) and Shanahan and Meyer (2006: 102, 106-112).

⁷ The term, liminal, was used by early 20th century anthropologists to describe, within rites of passage, the period of transition through which the person became integrated into a new identity. See Gennep (1908/1960) and Turner (1967).

⁸ See, for example, Shanahan and Meyer (2006: 102). Boundedness could presumably be brought within the fold by relating it to student *awareness* of the boundary-creating role of threshold concepts, but this point is not made in the literature.

⁹ No logical explanation of why opportunity cost may not be integrative is given. The paragraph intended to provide insight into the remark appears to be a non-sequitur – it deals with other matters, and actually implies that the concept is integrative. Of the first three characteristics (transformative, integrative, irreversible), Davies (2006: 75) suggests that the presence of one implies that of the other two: 'It is difficult to imagine how a concept could

possess one of these characteristics without the others'. My own view is that it is far from difficult.

¹⁰ Shinnars-Kennedy (2088: 119-20) implicitly supports the former with his thesis of the 'everydayness of threshold concepts'.

¹¹ Although Davies (2006; 70-1) poses the highly relevant question, 'How can we recognise threshold concepts?' and promises an account of 'the processes by which [they] may be identified', the promise remains unfilled since no answers are provided that relate to the above definition because a different way of conceptualising threshold concepts is advanced.

¹² See also the various contributions in Land *et al* (2008: 22, 119, 236-7) and Meyer *et al* (2010: 21-3, 46, 61, 81-2, 131-5, 194, 207, 260, 276), as well as Cousin (2006: 135-6) and Kiley and Wisker (2009: 432).

¹³ See Land *et al* (2008: xviii), Meyer *et al* (2008: 66), and Meyer *et al* (2010: ix-xi, xv). Schwartzman's (2010: 23) distinction between 'the frame of Threshold Concepts (TC)' and 'threshold concepts (tc)' is also relevant.

¹⁴ It may be noted that this argument introduces an inconsistency – it makes transformative a necessary attribute of a threshold concept whereas the definition merely requires likelihood. If transformativeness is not mandatory, some core concepts could be threshold concepts, thus contradicting the original claim.

¹⁵ See O'Donnell (2010a) and Rickerts (2010) for further discussion.

¹⁶ See Gennep (1908/1960), Turner (1967) and Meyer and Land (2005: 375-7; 2006b: 22). However, Kimball appears to have been the first to note in 1960 that Gennep's analysis holds 'implications for learning theory that have yet to be explored' (Gennep 1908/1960: x).

¹⁷ The remark by Davies (2006) that learners identify threshold concepts as well as the experts should not be taken at face value; his ensuing discussion implies that what is meant is not that learners identify them, but that learners need help in *recognising* the threshold concepts previously identified by the experts.

¹⁸ See, for example, Meyer and Land (2003: 414-5; 2006a: 5-6), Reimann and Jackson (2006: 116), Shanahan and Meyer (2006: 100), Shanahan *et al* (2006: 29-31), Davies and Mangan (2007: 722), Entwistle N. (2008: 22-3), Perkins (2008:12-13), Shanahan *et al* (2008: 156-8), Davies and Mangan (2010: 194), Ming and Meyer (2010: 365-79), and Shanahan *et al* (2010: 212, 218).

¹⁹ This argument is outlined in more detail in O'Donnell (2009).

²⁰ To the extent that irreversibility is associated with transformativeness, the arguments in (a) apply here as well.

²¹ See, for example Frank (2002: 460), Case and Fair (2002: 2), Hansen *et al* (2002) and Council for Economic Education (1997).

²² See O'Donnell (2009).

²³ For the full argument concerning the deep-seated confusion of the economics profession, see O'Donnell (2010b).