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Transformative insights: A synthesis of threshold concept theory and graduate attributes

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Abstract

This theoretical study proposes a set of 'transformative insights' that transcend disciplinary boundaries and point to a common educational foundation at undergraduate level. It involved a review of disciplinary threshold concepts, followed by thematic analyses of institutional and programme level graduate profiles from New Zealand universities. Twelve common clusters of graduate attributes were identified, but their potential as cross-disciplinary threshold concepts was found to be problematic. This led to the alternative proposal that six transformative insights occur during undergraduate education: discernment of underlying beliefs, assumptions, values and expectations; epistemological positioning; linguistic nuance; engagement as a learner; thinking critically, analytically and creatively; and ethical awareness and integrity. Transformative insights reflect a synthesis of threshold concepts and graduate attributes, and support institution-wide approaches to teaching, learning and curriculum development. Further research to establish an empirical basis for the utility of transformative insights and explore their relationship to disciplinary threshold concepts is proposed.

Keywords

Threshold concepts; graduate attributes; transformative insights; transformative learning; undergraduate; higher education

Introduction

Threshold concept theory was developed by Jan (Erik) Meyer and Ray Land as a conceptual framework to account for variation in student performance and to explain why some students 'get stuck' at particular points in their studies (Land, Cousin, Meyer & Davies, 2005, 2006; Meyer & Land, 2003, 2005). Although it is generally accepted that core concepts exist within any subject or discipline that provide the foundation for further knowledge, skills and practices, threshold concept theory extends this idea in order to delineate between core concepts that constitute part of a body of knowledge and its cognitive organisation, and other core concepts that additionally "lead to a qualitatively different view of the subject matter" (Meyer & Land, 2003, p. 4). The acquisition of a threshold concept has been described as "akin to a portal, opening up a new and previously inaccessible way of thinking about something" (Meyer & Land, 2003, p. 1), or more simply as the point at which 'the penny drops' (Williams, 2014). This appears to have resonated with practitioners from a range of communities of practice because threshold concepts reflect essential disciplinary ideas

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that are frequently both challenging to learn and difficult to teach (Meyer & Land, 2003; O'Brien, 2008).

The genesis of threshold concept theory is anthropological research on *rites de passage* which explored how rituals, including initiation rites, transformed the status and position of individuals within societies by affecting changes in both knowing and being (Turner 1969, 1979; Van Gennep, 1960). Van Gennep (1960) proposed that *rites de passage* involved three successive and significant processes: separation, the symbolic detachment from a previous state; margin, an ambiguous phase during which the individual possesses neither the qualities of the previous nor the coming state; and reaggregation, in which the privileges and responsibilities of the new state are attained. Turner (1969, 1979) argued that the marginal phase consisted of a particularly marked liminal period during which initiands were 'betwixt and between' states. He observed that during *rites de passage* neophytes adopt temporary personae as *liminars* while they are supported through transition by experienced adepts and ancestral spirits, and found that liminars typically mimic behaviours associated with the new social position, and frequently oscillate between old and new identities.

The idea of liminality, along with the observation that students may initially mimic academic behaviours without the necessary conceptual understanding, has been incorporated into the threshold concepts framework, as have notions of repositioning status and identity, and peripheral participation in communities of practice (Baillie, 2008; Kiley, 2009; Land, Rattray, & Vivian, 2014; Lave & Wenger, 1991; Meyer & Land, 2006b; Peter et al., 2014; Wenger, 1999). Consequently, it has been recommended that educators focus on creating supportive liminal environments that facilitate students' threshold crossing (Fortune, Ennals, & Kennedy-Jones, 2014; Land et al., 2005), and utilise pedagogic strategies that provoke and manage liminality (Meyer, 2012).

Meyer and Land's (2003, 2005) initial research was in the field of economics, and their approach continues to shape the discussion and application of threshold concept theory. Subsequent research from a range of subjects and institutions reveals that threshold concepts are "not singular within a subject" (Zepke, 2013, p. 99), but instead are considered unifying concepts that enable new disciplinary insights to occur. While threshold concepts identified in individual subjects differ considerably (see Appendix 1), a common theme that emerges from research at the undergraduate level is that encounters with threshold concepts are important in signalling the ways academics and professionals think and practice within a discipline, so that students can begin to think and practice in similar ways (Baillie, Bowden & Meyer, 2013; Meyer & Land, 2005; Rountree & Rountree, 2009).

In order to distinguish threshold concepts from other core concepts in a discipline, Meyer and Land (2003, 2005) identified five characteristics that have become widely adopted as defining criteria:

1. Transformative: occasioning a significant shift in the perception of a subject, the construction of subjectivity and personal identity;
2. Irreversible: unlikely to be forgotten, or only able to be unlearned with difficulty;
3. Integrative: making connections between ideas within a subject and resulting in an understanding of the relationships between ideas and practices in a field;
4. Bounded: constituting a demarcation between disciplinary areas, which serves to delineate members of one academic community from another; and
5. Troublesome: appearing counter-intuitive, intellectually absurd or 'alien' when first encountered (Meyer & Land, 2006b; Perkins, 1999, 2006).

The practical application of this framework has led to considerable debate about the relative importance of these characteristics (Carmichael, 2012; Rowbottom, 2007). Some are now considered optional, rather than essential, such that threshold concepts may now be described as *probably* irreversible, *having the capacity* to be integrative, being *possibly* bounded, or as *potentially* troublesome (Barradell, 2013; Carmichael, 2012; Meyer & Land 2006a; Rowbottom, 2007); there does, however, appear to be fairly wide agreement that being transformative is an essential property of a threshold concept (Baillie et al., 2013; Carmichael, 2014; Meyer & Land, 2006a; Quinlan et al, 2013; Rowbottom, 2007). It has also been proposed that threshold conceptions (Land et al. 2005), threshold capabilities (Baillie et al., 2013), threshold skills (Thomas et al., 2014) or threshold experiences (Foley, 2014), rather than threshold concepts, might be more useful constructions.

Recently, additional characteristics have been added to Meyer and Land's original criteria:

6. Reconstitutive: involving a shift in learner subjectivity and a transfiguration of self;
7. Discursive: incorporating an extended use of natural, symbolic and artificial language characteristic of particular disciplinary discourses and thinking processes; and
8. Liminal: likening the internalisation of a threshold concept to a journey or rite of passage (Baillie et al., 2013; Barradell, 2013; Meyer, 2012; Quinlan et al., 2013).

These new properties allow for greater variation between individuals and reflect a stronger association with *rites de passage*. They also highlight a concern that threshold concept theory may endorse orthodox ways of thinking and practising within a community of practice, and risks becoming a form of disciplinary essentialism that privileges dominant views and inhibits alternative ways of knowing (Baillie et al., 2013; Quinlan et al., 2013).

The research approach

It is often claimed that threshold concepts provide a useful focus for teaching and learning both *within* and *across* disciplines (Cousin, 2006; Meyer & Land, 2005), but to date the majority of research in this field has focused on specific subjects at the undergraduate level, and research at postgraduate or doctoral level. This investigation, which eventuated in the formulation of transformative insights, sought first to identify threshold concepts common across undergraduate education in New Zealand by reviewing theoretical and research-based literature published prior to 2015. In selecting materials for inclusion, particular attention was paid to research conducted in bachelor degree programmes at New Zealand universities, although this was found to be fairly limited.

A preliminary literature review identified a wide range of threshold concepts in undergraduate subjects, but these tended to reflect disciplinary content and little similarity was found (see Appendix 1). This is consistent with Peter and colleagues' research, which failed to identify threshold concepts that span disciplines (Peter et al., 2014), but not consistent with research at the doctoral level, which proposes that similar thresholds are crossed by candidates engaged in research across a range of disciplines (Humphrey & Simpson, 2012; Kiley, 2009, 2015; Kiley & Wisker, 2009, 2010; Trafford & Leshem, 2009; Wisker, 2015).

When the threshold concepts literature failed to yield commonalities among undergraduate subjects, graduate attributes were investigated as an alternative source of shared understandings to inform the identification of cross-disciplinary threshold concepts. Graduate attributes describe the knowledge, skills, academic abilities and attitudinal qualities that are considered essential outcomes of undergraduate programmes and that are valued by universities (Chalmers & Partridge, 2012; Daniels & Brooker, 2014; de la Harpe & David, 2012). At the policy level, the assumption appears to be that graduate attributes are generic, transferable and transcend disciplinary contexts (Jones, 2013), which suggests they are more likely to be common across institutions and programmes of study than threshold concepts identified within the disciplines. Although threshold concepts would not necessarily be reflected in graduate attributes, like core concepts, graduate attributes were considered likely to constitute a useful starting point for the identification of conceptual thresholds that are typically encountered by students during their undergraduate studies.

Graduate attributes are often perceived to be connected with ideas of work-readiness and the knowledge economy (Daniels & Brooker, 2014; Green, Hammer, & Star, 2009), and also consistently refer to notions of "citizenship, social awareness or social responsibility" (Daniels & Brooker, 2014, p. 4). In Australia, where statements about graduate attributes are a condition of Government funding (Barrie, 2005), concerns have been expressed regarding a lack of agreement about how the acquisition of graduate attributes may be facilitated, as well as a lack of clarity about the relationship between generic graduate attributes and disciplinary knowledge (Barrie, 2004, 2005, 2012). However, despite these concerns, graduate attributes may be considered to reflect the expectations the academic community has of those who have attained graduate status within it.

For the purposes of this study, graduate profiles were sought from New Zealand's eight public state-funded universities. However, these were found to be inconsistent in terms of both comprehensiveness and approach; some institutions identified graduate attributes at the institution level, some at the

degree or programme level, some at the level of individual papers or courses, and others used a combination of approaches. At the time this research was conducted, Auckland University of Technology (AUT) and Massey University were in the process of undertaking major revisions of their graduate profiles, which limited the usefulness and availability of graduate attributes for these institutions. Institutional graduate profiles were obtained from the University of Auckland, the University of Canterbury, Lincoln University, the University of Otago, and Victoria University of Wellington; and programme level graduate profiles were obtained for the Bachelor of Laws at AUT, Mathematics majors at Massey University, the Bachelor of Teaching and the Bachelor of Electronic Commerce at the University of Waikato, and Victoria University's Bachelor of Engineering and Bachelor of Laws degrees. In addition, Lincoln University provided comprehensive graduate profiles for 11 of its undergraduate degrees and the University of Waikato similarly provided graduate profiles for 21 of its degrees. This yielded a total of 43 graduate profiles from a broad range of programmes and disciplines. Attributes at the individual paper/course level were excluded from this study, as its purpose was not to identify potential threshold concepts within particular subjects.

The first phase of the inquiry involved a thematic analysis of graduate profiles available online at the institution level, which yielded a provisional list of 10 clusters of graduate attributes common to undergraduate education in New Zealand. The second phase involved a similar analysis of a range of graduate profiles available online at the programme level, which led to minor revisions of these clusters (see Appendix 2, #1–10). In the third phase the 10 clusters were compared to analyses of the comprehensive programme level graduate attributes provided by Lincoln and Waikato universities to confirm their commonality across programmes and institutions. As a result of this final phase of the study the provisional 10 clusters were further refined and two additional clusters of graduate attributes were added (see Appendix 2, #11–12). These two clusters had been considered but omitted from the original list, and were subsequently incorporated when the Lincoln and Waikato analyses provided further evidence to warrant their inclusion. It should be noted that occurrences of the cluster "demonstrate creativity, originality, innovation and entrepreneurialism" (#11) were less frequent than the other clusters, and that "become life-long learners who are responsive to change, and who are able to undertake further education and training" (#8) was less consistently present in programme level graduate profiles.

Establishing a relationship between the clusters of graduate attributes that emerged and threshold concept theory proved problematic. This is consistent with the Australian experience that there is often a disconnection between generic graduate attributes and disciplinary knowledge (Barrie, 2004, 2005, 2012), whereas the disciplinary basis of threshold concepts is firmly embedded (Foley, 2014). Researchers who have sought to apply threshold concept theory have acknowledged that "the use of the word concept is often linked to a content-focused view of knowledge" (Baillie et al., 2013, p. 235). Since graduate attributes are not explicitly content-focused, it is difficult to see how they might function like threshold concepts as integrative elements within systems of knowledge (Carmichael, 2014).

In his critique of threshold concept theory, Rowbottom (2007) argues that "concepts are neither reducible to nor sufficient for abilities" (p. 267), yet the clusters of graduate attributes identified in Appendix 2 appear more like capabilities or dispositions than symbols of thought. This suggests they should not be considered core *concepts* within undergraduate education, as they neither unify a particular body of knowledge nor lead to a qualitatively different view of a specific subject (Meyer & Land, 2003). The first inconsistency between graduate attributes and threshold concepts that emerged, therefore, was that the clusters of graduate attributes do not appear to constitute discrete concepts or constructs, which would seem to exclude them from consideration as threshold concepts.

The second inconsistency arose in the attempt to interpret and apply Meyer and Land's (2003, 2005) original five characteristics of threshold concepts. While *prima facie* the 12 clusters of graduate attributes appear irreversible and may lead to transformations in learners' perceptions and identity, it seems difficult to establish whether or not they are bounded, and if they are, where their boundaries might lie. Wilson (2014) notes that for a threshold concept to be bounded means it has "inherent limits on its applicability" (p. 94), and Peter and colleagues similarly described boundedness as marking the edge of a discipline (Harlow & Peter, 2014; Peter et al., 2014), yet graduate attributes do not appear bounded, and are essentially generic. Finally, for any of the graduate attribute clusters to be considered threshold concepts, it would need to be established that the kind of troublesomeness involved in

threshold crossing occurs in their acquisition. However, most of the clusters of graduate attributes do not appear to involve the kind of epistemic adjustment or transformation in knowing and being that characterises threshold crossing.

A loose definition of threshold concepts, with a broad notion of what constitutes a concept, and which abandons the necessity of Meyer and Land's (2003, 2005) five criteria might permit some of the clusters of graduate attributes to be considered candidates for threshold concepts. However, such an approach seems inherently unsatisfactory and points to a lack of precision and clarity about the protocols for conducting research on threshold concepts (Quinlan et al., 2013). This outcome can be partially attributed to a lack of rigour and consistency in approaches to identifying threshold concepts in previous research (Barradell, 2013), which has resulted in considerable diversity in philosophical approaches and methodological applications of threshold concept theory within the disciplines. This lack of methodological standardisation created even greater uncertainty about how the theory ought to be applied across the disciplines where there is no established body of knowledge as a reference point. As it was unclear whether any of the clusters of graduate attributes could be considered concepts, and unlikely any would meet the additional criteria for threshold concepts, the identification of common conceptual thresholds within undergraduate education in New Zealand was considered unsuccessful.

Transformative insights

Threshold concept theory focuses on the importance of learning experiences and engagement with troublesome knowledge in identity transformation and status change. In contrast, the literature on graduate attributes typically omits reference to the agentic development of the student, and is primarily concerned with the role of the institution and its staff in ensuring particular educational outcomes are achieved (Daniels & Brooker, 2014). However, threshold concept theory's association with *rites de passage* highlights that when studying towards an undergraduate degree, students do more than acquire disciplinary knowledge with the support of experts in a field, they also undergo cognitive and affective transformations that lead to qualitative changes in the way they perceive themselves, knowledge, the world and the value of a university education.

Rather than proposing the existence of common threshold concepts across undergraduate programmes, what is suggested on the basis of this investigation is that six transformative insights may occur during undergraduate education:

1. Discernment of underlying beliefs, assumptions, values and expectations: the ability to critique a situation, task or problem and identify relevant ways of thinking and practising in order to respond appropriately.
2. Epistemological positioning: an understanding of how knowledge is created and legitimised in a particular field (or fields), and an awareness of the limits to and contestable nature of these knowledge claims.
3. Linguistic nuance: an increased active vocabulary and understanding of communication strategies, including an awareness of the subtleties of discipline-specific and everyday uses of terminology and communication media.
4. Engagement as a learner: the intellectual curiosity and self-motivation to continue learning throughout life, and the ability to connect learning from research, theory and practice with authentic situations and problems in the local, national and global context.
5. Thinking critically, analytically and creatively: the ability to critically examine one's own and other perspectives, and the adaptability to either apply established methods of organised inquiry or develop innovative techniques to solve problems.
6. Ethical awareness and integrity: the acquisition of a social, ethical and environmental consciousness that enables critique, action and intervention as an aware, engaged and responsible citizen.

These insights have been derived from both the transformational character of threshold concept theory and *rites de passage,* and the capabilities and dispositional qualities that graduates of New Zealand universities are expected to acquire, which emerged through the analysis of graduate attributes.

It is proposed that while transformative insights may be acquired within disciplinary contexts, they are unlikely to be 'bound' to them, meaning that rather than functioning to delineate and integrate a particular body of knowledge, they could produce significant epistemic changes that result in new and irreversible ways of thinking, practising, and interpreting the wider world. For example, a student who grasps the threshold concept of 'osmosis' in biology (Taylor, 2006) may not only come to understand diffusion and homeostasis more thoroughly, but may also come to appreciate the commonalities, complexities and interdependences that exists among living things. This insight may incline the student to become more aware of the implications of reductive approaches that compartmentalise aspects of ecological systems, and consequently to be more critical of simplistic explanations of other complex systems. The learning of a 'biological' or 'scientific' concept may thus have much broader implications for the student's future engagement with environmental, social, economic and political issues, as the encounter has provoked an epistemic adjustment. The student's deeper and more holistic awareness of interconnectedness in nature may thus transform his or her agentic decision-making affecting changes in both knowing and being.

Further research that focuses on how transformative insights may occur for students and to explore whether or not they are acquired as an outcome of crossing conceptual thresholds within particular disciplines is proposed. It seems theoretically plausible that encountering threshold concepts may not only lead to disciplinary ways of thinking and practising, but also to transformative cognitive and affective insights that may be common across disciplines. The transformative insights construct may thus provide the 'missing link' in terms of explaining how the acquisition of generic graduate attributes is facilitated across diverse programmes of study, and uncover the elusive relationship between graduate attributes and the disciplinary forms of knowledge that students explicitly encounter during their undergraduate studies. At a practical level, empirical evidence to support this hypothesis could have the potential to influence pedagogic approaches to teaching and learning at the undergraduate level, and inform the development of policies intended to provide a university-wide strategy for the design, development and delivery of undergraduate curricula.

Conclusions

At present, threshold concepts at the undergraduate level appear to be connected with disciplinary ways of thinking and practising, rather than being common across disciplines. This study failed to yield common threshold concepts associated with an undergraduate education in New Zealand, as the integrative and bounded nature of threshold concepts made their identification problematic. On the basis of this investigation, it is proposed that a synthesis of threshold concept theory and graduate attributes, in the form of transformative insights, may better reflect the common cognitive and affective outcomes of an undergraduate education in the New Zealand context. These insights appear to involve discernment of underlying beliefs, assumptions, values and expectations; epistemological positioning; linguistic nuance; engagement as a learner; thinking critically, analytically and creatively; and ethical awareness and integrity. The transformative insights construct is offered as a new way of thinking about the teaching, learning, and shifts in knowing and being that occur at the undergraduate level. Although it is tentatively suggested that threshold concepts within the disciplines may provide the foundation for transformative insights, further research is needed to establish an empirical basis for this hypothesis, and to investigate whether transformative insights can be taught, learned, assessed and integrated within undergraduate programmes. It is therefore proposed that the relationship between transformative insights and the crossing of conceptual thresholds within the disciplines now warrants further investigation.

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Appendix 1: Threshold concepts in undergraduate subjects

Subject	Threshold Concepts	Researchers
Accountancy	Cash, depreciation, profit, reconciliation	Lucas & Mladenovic, 2006 McGuigan & Weil, 2010 Weil & McGuigan, 2013
Art therapy	Professional identity, reflexivity, taboo	Sibbett & Thompson 2008
Biology	Complexity, conceptual change, dynamics, energy, equilibrium, evolution, homeostasis, hypothesis creation, osmosis, process and abstraction, probability, proportional reasoning, randomness and scales, variation	Ross et al., 2010 Taylor 2006, 2008 Taylor & Meyer, 2010
Business and commerce	Politics as power	Williams, 2014
Climate change	Uncertainty	Hall, 2014
Computing	Code reuse, complexity, data abstraction, design patterns memory/pointers, modularity, object-oriented programming, state, recursion	Flanagan & Smith, 2008 Rountree & Rountree, 2008 Shinners-Kennedy, 2008 Sorva, 2010 Thomas et al., 2010 Zander et al., 2008

Economics	Discretionary fiscal policy, economic modelling, efficiency, elasticity, equilibrium, incentives, interaction between markets, margin, opportunity cost, welfare	Davies, 2006 Davies & Mangan, 2008, 2010 Meyer & Land, 2003, 2005 Pang & Meyer, 2010 Reimann & Jackson, 2006 Shanahan, Foster & Meyer, 2008, 2010 Shanahan & Meyer, 2006
Electrical engineering	Dynamic resistance, feedback, holistic current flow, Thévenin's theorem	Harlow & Peter, 2014 Harlow, Peter, Scott, & Cowie, 2014 Peter et al., 2014 Scott, Harlow, Peter, & Cowie, 2010
Engineering	Bode plots, logical thinking, map sense, professionalism, response, social justice, transient critical flow, transmission lines	Baillie & Johnson 2008 Cartensen & Bernhard 2008 Flanagan, Taylor, & Meyer, 2010 Kabo & Baillie, 2010 Knight, Callaghan, Baldock, & Meyer, 2013 Scott, 2013a
Geography and geoscience	Data modelling, geologic/deep time, interoperability, map scale	Cheek, 2010 Srivastava, 2013
Humanities	Subjective interpretation	Moffat, 2013 Moffat & McKim, 2014
Information literacy	Authority, commodification of information, disciplinarily, format as process, metadata	Hofer, Townsend, & Brunetti, 2012 Townsend, Brunetti, & Hoffer, 2011
Leadership	Moral courage, risk, service, shared leadership, structural leadership, 'the job of leaders is to create leaders'	McKie, 2013a, 2013b Peter et al., 2014
Linguistics	Rank scale	Orsini-Jones, 2008, 2010
Philosophy	Personhood, representation	Booth, 2006 Cowart, 2010
Physics	Entropy, experimentation, 'physics is conceptual', 'physics is a science'	Scott, 2013b Wilson, 2013, 2014

Appendix 2: Graduate Attributes in Undergraduate Degrees at New Zealand Universities

Graduate attribute clusters	Phase of analysis				
	1. Institution level (5)	2. Programme level (6)	3a. Lincoln degrees (11)	3b. Waikato degrees (21)	**Total profiles N=43)**
1. Acquire specialist knowledge and skills of scholarship and research in one or more subject areas	5	6	11	21	43
2. Develop an awareness of the relationship between subject(s) of study and the local, national and global context	5	4	8	15	32
3. Be information/digitally literate	5	4	8	20	37
4. Be able to communicate effectively to suit a range of media, contexts and audiences	4	6	10	20	40
5. Be able to think critically and analytically, solve problems and use argument	5	6	11	21	43
6. Have initiative and be autonomous, independent, self-motivated and self-directed	5	3	5	18	31
7. Be able to work co-operatively and collaboratively in teams with others	4	5	6	19	34
8. Become life-long learners who are responsive to change, and who are able to undertake further education and training	5	1	5	10	21
9. Have acquired ethical understanding both of scholarship and specific considerations related to professional practice	5	5	11	21	42
10. Be culturally, socially and civically aware, engaged and responsible citizens (including having an awareness of the Treaty of Waitangi and its implications for bi-culturalism, as well as respect for gender, cultural and social diversity)	5	2	10	16	33
11. Demonstrate creativity, originality, innovation and entrepreneurialism	NA	NA	2	8	10
12. Be employable and demonstrate professionalism	NA	NA	10	21	31