Threshold concepts and student engagement: Revisiting pedagogical content knowledge

Nick Zepke

Active Learning in Higher Education 2013 14: 97 originally published online 15 April 2013
DOI: 10.1177/1469787413481127

Article

active learning in higher education

Active Learning in Higher Education
14(2) 97–107

DOI: 10.1177/1469787413481127
alh.sagepub.com
SAGE

Threshold concepts and student engagement: Revisiting pedagogical content knowledge

Nick Zepke
Massey University, New Zealand

Abstract

This article revisits the notion that to facilitate quality learning requires teachers in higher education to have pedagogical content knowledge. It constructs pedagogical content knowledge as a teaching and learning space that brings content and pedagogy together. On the content knowledge side, it suggests that threshold concepts, akin to a portal that opens up a new and previously inaccessible way of thinking about a subject, are useful in quality learning. On the pedagogy side, it employs student engagement as a useful proxy for identifying what happens in a learning environment to achieve quality learning. This article asks *what fresh insights might this particular conceptualization of pedagogical content knowledge afford teacher education and teacher development in achieving quality learning in higher education.* After outlining characteristics of threshold concepts and student engagement, it brings together the contributions these concepts make to pedagogical content knowledge before detailing some fresh insights afforded by the synthesis.

Keywords

Higher education, pedagogical content knowledge, quality learning, student engagement, threshold concepts

Pedagogical content knowledge: where content and pedagogy interact

Teaching well in higher education is a complex business. It involves a variety of interacting variables – teachers, learners, subject matter (content) and learning–teaching processes (pedagogy) – operating in dynamic yet connected networks. Consequently, what can be defined as quality teaching varies and depends on how such variables interact (Mishra and Koehler, 2006). Which variables are considered most important when thinking about learning and teaching changes from time to time. Mishra and Koehler (2006) argue that historically, knowledge of content was considered most important, whereas knowledge of and skills in pedagogy were secondary. Shulman (1986, 1987) challenged both the dominance of content in teaching and the separation of content and pedagogy into separate domains. He argued that such separation was counter-productive to

Corresponding author:
Nick Zepke, Institute of Education, Massey University, Private Bag 11222, Palmerston North, New Zealand.
Email: n.zepke@massey.ac.nz

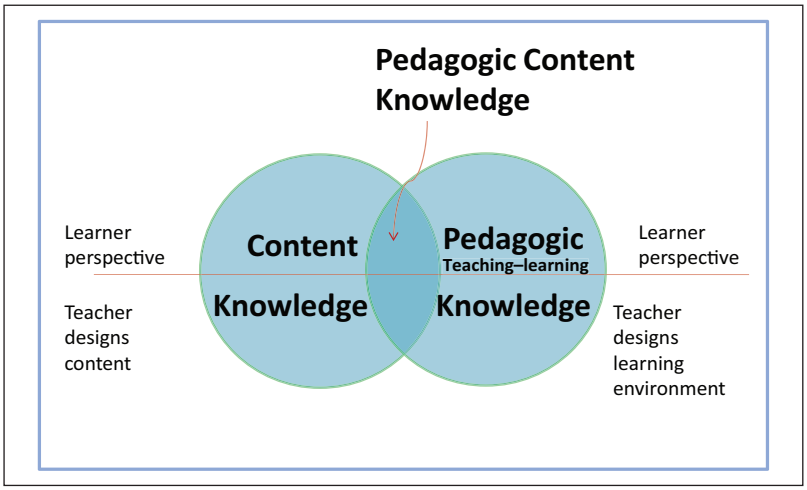

Figure 1. Revisiting pedagogical content knowledge.

good teaching. Educators should focus on the knowledge that emerges at the intersection of pedagogy and content; labelling this amalgam pedagogical content knowledge (PCK). Shulman (1987: 8) identified many different features of the educational process as belonging to PCK. But in his own view, he was not consistent in his views of PCK and his writings on it lacked 'great cross-article consistency'.

Somewhat later, Entwistle (2003) offered another conceptual framework bringing content and pedagogy together to achieve quality learning. He pictures content selection, organization and assessment as one side of the teaching and learning process. On the other side is pedagogy – involving the design and use of the learning environment. But his framework also acknowledges the distinct contributions of both teachers and learners to quality learning. The teachers teach content and co-ordinate learning environments, whereas the learners engage with the content and the learning environment. This framework suggests that quality learning is achieved when teachers and learners together deal with content in pedagogically suitable ways. In short, to achieve quality learning requires a form of PCK. This article revisits PCK to investigate its characteristics in the light of 21st-century research. It adopts Shulman's (1987) view that a special kind of practice emerges at the intersection of content and pedagogy, accepts Mishra and Koehler's (2006) visualization of the relationship between content and learning–teaching, and adds Entwistle's (2003) proposal that both teachers and learners contribute to quality learning. Figure 1 pictures this relationship between knowledge about teaching–learning, content and PCK to enhance quality learning.

This article asks what fresh insights might this particular conceptualization of PCK afford teachers in achieving quality learning in higher education. On the content knowledge side, it employs threshold concepts that are 'akin to a portal, opening up a new and previously inaccessible way of thinking about something'(Meyer and Land, 2003: 1). A threshold concept is discipline specific, focuses on understanding of the subject and, indeed, has the ability to transform learners' views of the content. The threshold concepts are useful here because in their own way they acknowledge the close link between content and learning–teaching. On the pedagogy (teaching–learning) knowledge side, this article turns to student engagement – students' cognitive investment in, active participation in and emotional commitment to their learning (Fredricks et al., 2004). But

student engagement is more than just a student's commitment to learning. 'Engagement is simultaneously about students' investment in educational activities and also about the intentional structuring and facilitation of students' involvement in enriching learning experiences' (Kinzie, 2010: 140). In short, student engagement is a useful proxy for what happens in the learning environment. After outlining features of threshold concepts and student engagement, this article brings together the contributions these concepts make to PCK before suggesting some fresh insights afforded by the synthesis.

Threshold concepts

Students enrol in higher education to gain subject or discipline knowledge to achieve life goals. To help them achieve these requires 'a teaching approach which begins to satisfy simultaneously a tacit demand for content, for understanding of content, for relevance and applicability of that content …' (Walker in Entwistle, 2010: 68). Students need conceptual gateways to gain such understanding. Once through the gateway, a new way of understanding, interpreting or viewing a subject may emerge. According to Åkerlind et al. (2010), threshold concepts are transformative and integrative. They transform students' views of the subject because they help them integrate previously unrelated aspects of content by enabling new ways of thinking about it. New understandings, however, can be highly variable. Learning moves students through the gateway offered by the threshold concept in varied ways. For some, the threshold concept enables a state of mastery, an induction into ways of understanding the subject that is shared with a community of scholars (Davies, 2006). For others, it gains a superficial view of the subject that is similar to mimicry (Cousin, 2006). Åkerlind et al. (2010) illuminate this variation in understanding threshold concepts by showing how a threshold concept identified for law – *legal reasoning* – showed quite different levels of sophistication in how students constructed the concept.

Examples of threshold concepts abound and cover many disciplines ranging from hard science to cultural studies. In mathematics, the concepts of a *complex number* and *limit* have been proposed as threshold concepts (Meyer and Land, 2003). Irvine and Carmichael (2009) describe a number of projects identifying threshold concepts in different subjects. One, in sports science, identified the *static paddle*, as a threshold concept; a second, in English literature, saw *ethical reading in the learning of tragedy* in this way; a third, in engineering, recognized spinning objects or just *spin* as a threshold concept for his subject. Townsend et al. (2011: 856) surveyed a variety of possible threshold concepts in information literacy. They suggested that '*information research* is itself a threshold concept' and identified *authority, primary sources* and *information as a commodity* as others. In teacher education, Blackie et al. (2010) offer *student centredness* as a threshold concept. Such examples suggest a number of understandings about threshold concepts. One is that threshold concepts are not singular within a subject. A number of the disciplines identified multiple concepts suitable for teaching and learning. Another is that the concepts are constructions by subject teachers, colleagues and sometimes students. Each report outlined some kind of formal or informal research process to develop the concepts. A third insight suggests that threshold concepts often address troublesome knowledge in a subject, knowledge that is often counter-intuitive, originates in another culture, is complex and even lacking an organizing principle.

Although threshold concepts are constructions, building blocks and not necessarily stable or core concepts in a discipline, they do have a number of common features. Some emerged from early research by Meyer and Land (2003) in economics. They identified five key characteristics. A threshold concept is transformative in that once understood, it leads to a significant change in

students' understanding of the subject. It is likely to be irreversible as once a student has crossed the threshold, the concept is difficult to unlearn. A threshold concept is also integrative. Once understood, it enables students to knit dissimilar elements of a subject together. Davies (2006) suggests that threshold concepts enable learners and teachers to enter a subject community. A threshold concept is also limited in that students will encounter new and different threshold concepts that will propel them into new conceptual spaces. Finally, according to Meyer and Land (2003), threshold concepts are likely to be troublesome to understand. Lucas and Mladenovic (2007) expand on these features. They suggest that threshold concepts are not always obvious, they are developed by dialogue among subject teachers, between teachers and their students and teachers and educational developers. This enables discussions that may not otherwise take place. Dialogue about threshold concepts enables content experts to explore ways of helping students understand a difficult subject; discussion between teachers and students about such concepts helps build teachers' and students' existing views of subject matter. This building process helps both teachers and students to integrate content and pedagogy in PCK.

Student engagement

Student engagement helps teachers and learners to actively involve themselves in learning experiences. Student engagement in higher education is seen as a partnership to which learners, teachers and institutions contribute to achieve quality learning. Research on student engagement focuses on generic learning and teaching processes that render content issues largely invisible. In their stock-taking syntheses of research into how post-school education affects student learning, Pascarella and Terenzini (2005) identified two orientations that underpin this research. One orientation contains theories that focus on personal growth generated from within learners. Factors such as cognitive development, motivation and identity formation are examples of what interests this family of researchers. The other orientation focuses more on how environmental factors such as teaching, institutional practices and non-institutional influences impact on student learning. The two orientations overlap. Pascarella and Terenzini (2005) acknowledge this when they discuss, for example, research into the impact on learning of students' family and other background factors. Such influences draw on both person and environmental orientations. Kuh et al. (2006) see engagement as an overarching portrait of learning–teaching environments viewed from sociological, social network, organizational, psychological, cultural, pedagogical and economic perspectives. Researchers have addressed engagement from this whole range of perspectives: for example, student agency and motivation, the way educators teach and relate to their students, the roles of institutional structures and cultures, the socio-political context in which education and engagement take place and the impact on students of environmental factors such as family background and economic status (Zepke and Leach, 2010).

Influences on quality learning are therefore many. Three such influences connect to classroom environments and offer pedagogical knowledge to enhance quality learning and teaching. The first focuses on student effort, the depth of learning and motivation. Hockings et al. (2008) found that deep learners were more likely to be engaged than surface learners. Of the many motivational theories available, Schuetz (2008) argued that self-determination theory (Deci and Ryan, 2000) with its emphasis on students feeling competent, autonomous and belonging were crucial to engagement. Moran and Gonyea (2003) found that peer interaction had the strongest predictive capacity for engagement and outcomes. A second influence comes from teachers and teaching. According to Mearns et al. (2007), if the teacher is perceived to be approachable, knowledgeable, well prepared and sensitive to student needs, the students are committed to work harder. Bryson and Hand (2007)

concluded that students are more likely to engage if they are supported by teachers who establish inviting learning environments, demand high standards, challenge and make themselves freely available to discuss academic progress. The nature and quality of institutional support for learning is a third influence. An overview of what engaging institutions do is provided by Kuh et al. (2005) who researched the practices of 20 successful universities in the United States. They found that practices were likely to engage students if they focussed on student success, fore-grounded learning, established high expectations, aimed for continuous improvement, invested money in support services, asserted the importance of diversity and difference and prepared students for learning in higher education.

But it is not only what happens inside the formal learning environment that impacts engagement and quality learning. Engaging pedagogy includes knowing ways of accommodating outside influences. This is a fourth influence on engagement. It emerged from a relatively new reality in higher education with students increasingly studying part time (McInnis, 2003). In Australia, for example, James et al. (2010) found that more than half the students surveyed thought that paid work interfered with their engagement. Such students expected study to fit their lives, not fit their lives around study. McInnis (2003) suggests that engagement can no longer be assumed; it must be negotiated with students. Yorke and Longden (2008) found that of seven factors explaining disengagement, five related mainly to institutional issues such as poor quality teaching, and to personal considerations such as choosing the wrong course, but two factors originated outside the institution with employment and money issues and problems with social integration into the institution due to background. James et al. (2010) found that half of the students in part-time employment offered family reasons for seeking employment. Some wanted to gain greater financial independence from their family; others, and this was particularly so for aboriginal students, were supporting their families. Together, these studies suggest that non-institutional, external factors are important influences on engagement.

Revisiting PCK

PCK, then, refers to the marriage of content and pedagogy in specific learning environments (Entwistle, 2003; Mishra and Koehler, 2006; Shulman, 1986, 1987). This article argues that PCK features both threshold concepts and student engagement. Threshold concepts offer a view of the content of a course or programme that is transforming and integrating, and while possibly troublesome, offers teachers and learners a gateway to access understanding of a subject that is not otherwise available. Fredricks et al. (2004) and Kuh et al. (2006) suggest that student engagement is a meta-construct, an overarching view of what happens in learning–teaching environments. While the extensive engagement literature tends to emphasize generic ways for engaging learners, this literature can also offer specific approaches to achieving quality learning for specific teachers in specific subjects engaging specific learners in specific contexts. This article now turns to investigate how threshold concepts and student engagement together can help profile key characteristics of PCK.

The proposed connection between threshold concepts and student engagement in achieving quality learning is not new. Land et al. (2006), for example, suggest that student engagement is one of nine key considerations in course design using threshold concepts. To enable learners to work effectively with threshold concepts, these authors propose that teachers must engage learners. They use active learning as one application of engagement. Most of their chapter, however, deals with eight other considerations. Engagement is seen as just one of nine considerations when designing a curriculum around threshold concepts. In revisiting PCK, this article argues that

engagement is a primary consideration in course design, indeed an equal partner with threshold concepts within PCK. So when considering how threshold concepts might be taught and learnt, teachers plan for active in-class interactions, but also wider relationships with students such as their availability in out-of-class discussions and challenging learners beyond their comfort zone in-class (Bryson and Hand, 2007). But they also consider how students might be motivated and how their sense of competence, autonomy and belonging might be enhanced. Another consideration will be how the institution influences engagement and develops quality learning (Kuh et al., 2005). Increasingly important to students' engagement are external factors in their lives and backgrounds (McInnis, 2003). The teachers need to consider how such influences impact on their engagement with threshold concepts.

Another characteristic of PCK is that it does not offer generic knowledge. The threshold concepts are specific to subjects and, by the way they are developed, to a teacher or members of a community of scholars (Davies, 2006). The *static paddle* in sports science (Irvine and Carmichael, 2009), or *legal reasoning* in law (Åkerlind et al., 2010), for example, are unlikely to be applicable to other subjects. While some threshold concepts in a subject are uncontested by members of a community of scholars, like for example, *legal reasoning*, others, like *information research* may only be one among a number of candidates. But even where a community of scholars agree through dialogue on a threshold concept, the contexts within which it is taught are different. Institutions and classrooms offer different resources, cultures, facilities and therefore different ways for students to engage. Hu and Kuh (2003), for example, found that similar students spending similar effort engaging in similar activities while attending different institutions report making different kinds and amounts of gains. It seems that institutional values and practices make a difference to the kind of pedagogical knowledge needed in different settings. Learners too are unique. They ensure variability in PCK. Different learners are motivated differently. For example, some are motivated by a desire to learn for learning's sake, whereas others seek external rewards; some want to be more autonomous than others, and there are differences in how closely they want to belong to a classroom or institution (Deci and Ryan, 2000). How to engage students in navigating threshold concepts is thus not open to generalization. PCK tends to be context-specific.

A further characteristic of PCK is that of *variation* both in learners' level of understanding of threshold concepts and how they engage with them. A number of threshold concept researchers, Åkerlind et al. (2010), for example, have commented on the variation of students' understanding of threshold concepts. Such variation might be explained by the depth with which students engage with threshold concepts. Indeed, variation in how deeply learners engage is an important characteristic of PCK. An Australian Council for Educational Research report (2008) found that students' attitudes to learning varied greatly: that those who engaged in deeper forms of learning such as analysing, synthesizing and evaluating tended to be most engaged. Hockings et al. (2008) found that teachers played a major part in how deeply students engaged. They found that students who are expected by teachers to reflect, question, conjecture, evaluate and make connections between ideas while drawing on the ideas, experiences and knowledge of others are most deeply engaged. Learners engaged only superficially do no more than mimic understanding of threshold concepts (Cousin, 2006). Variation also applies to the degree teachers consider the interests and needs of learners. The very notion of threshold concepts suggests that teachers working with such concepts are interested in avoiding mimicry and achieving deep learning through transformation and integration, for example. Such teachers tend to see students being engaged as central to the teaching process. Engaging learners with threshold concepts means that teachers are focused on learners and are keen to have students construct meanings for themselves by reflecting, questioning, conjecturing, evaluating and making connections with threshold concepts.

Variation in engagement, differences in threshold concepts and uniqueness in make-up of learners, teachers and learning environments contribute to creating singular spaces for PCK. Yet, paradoxically perhaps, such differences cannot be overemphasized. These spaces also share ideas and practices because much connects threshold concepts and student engagement. This connection enables conjoint approaches to achieving quality learning. In short, the conceptual architecture of PCK is complex. Relationships among threshold concepts, student engagement, teachers and learners are dynamic in their variation and connection. Davis and Sumara (2008) apply the metaphor of a dynamic network to describe the relationships in a complex system like PCK. McDaniel and Jordan (2009) discuss some features of such a network. They visualize an interdependent relationship between variation and connection to create emergent order in networked systems. This idea of dynamic variation and connection seems as a good fit for the dynamic relationships between content and pedagogy, threshold concepts and student engagement, and learners and teachers. In such a complex network, threshold concepts and student engagement are both separate and intertwined. The distinction between content and pedagogy were made clear by Shulman (1987) as was the nonsense of such separation. In any teaching–learning environment, content is intertwined with teaching and learning, whereas threshold concepts are connected to pedagogy by promising learning transformations, integration of diverse ideas and problematic knowledge. This close connection is further reinforced by the effect of student engagement. Variations in student motivation and external influences, teaching practices and institutional cultures influence engagement and, consequently, the nature of PCK. Similarly, teachers and learners are distinct with their different roles and purposes while connected by a shared desire to achieve success through quality learning and teaching.

PCK: an example

This article could be disappointing to readers looking for practical answers to the question ‘how should I teach?’ If PCK has multiple meanings and characteristics, what use is it to the individual teacher seeking to be effective in the classroom or the laboratory? While the framework described in this article contains a treasure chest of ideas for quality teaching and learning, these are connected to specific contexts. They offer no universal checklist for effective practice. The answer to ‘how should I teach’ would be ‘it depends’. This is an unhelpful answer for teachers whose mission and passion is to improve their knowledge of teaching and learning. In this situation, examples might stimulate teachers (and learners) to develop PCK tailored to their own context. Just one example may assist the emergence of practical ideas from the complex network of ideas (Mason, 2008), that is, PCK.

The context for this example of combining a threshold concept with ideas for engaging learners is in academic development. It involves a group of university teachers learning how to plan for teaching in their specific content areas. Blackie et al. (2010) suggest that *student centredness* is a potent threshold concept for such a context. As many university teachers consider their identity as academics to be wrapped in their subject expertise, *student centredness* may be a troubling concept for them. So changing their focus from content centredness could be transformative and integrative too as they begin thinking about teaching in new ways by amalgamating content and pedagogy in PCK. Once thinking in terms of *student centredness*, it may be difficult for them to reverse their planning to refocus on content alone. But *student centredness* is a beginning, not the end of a journey. Being student centred could lead them into exploring quality learning and teaching in new domains.

Blackie et al. (2010) outline examples of content that could take learners to the threshold of *student centredness*. They recommend that Rogers' (1983) work on human potential should be included. Rogers suggested that the student is the centre of the teaching–learning process. In order to centre the student in their teaching, the teacher needs three key attributes: congruence between their teaching and non-teaching persona, unconditional positive regard for and valuing of their students regardless of background or ability and empathy with their students' stage of development and position in life. Blackie et al. (2010) also propose that Barnett's (2008) work on ontological and epistemological knowing provide content for the *student centredness* threshold concept. The former focuses on the learner's sense of being human and of their intellectual and emotional development and growth. The latter concerns itself with practical knowledge and skills useful in the labour market. Blackie et al. (2010) conclude that for Rogers (1983) and Barnett (2008), *student centredness* enables students 'to evaluate their own performance and to appreciate their own giftedness' (p. 641). In short, the content of the threshold concept is carefully scaffolded to take teachers to the threshold of a new way of seeing teaching and learning.

But to enable possibly reluctant university teachers to cross the threshold into *student centredness* requires academic developers to engage them in learning. The developer can, and perhaps should, discuss with learners the approach to the content and assessment to be taken. They are dealing with academics that have won their spurs and would appreciate a part in planning. Certainly teachers can find out whether a didactic or inquiry approach is preferred by the group. They can encourage feelings of autonomy by enabling learners to plan for their specific classes or groups of students. By involving learners in planning for student-centred learning, they help them feel adult and competent and they model a student-centred approach to teaching. Discussing the process with students gives them a sense of belonging to the group of learners. While very important in engaging these particular learners, collaborative planning is not all there is to student engagement. It is a part of the developer's duty of care to prepare inviting learning environments for active learning, to expect and communicate high standards, to encourage deep learning by asking learners to use higher order skills such as analysing, synthesizing and evaluating, and to care about and empathize with their students.

Fresh insights?

This article has presented PCK as a complex network consisting of content, pedagogy, the work of teachers and the perceptions of learners. Mason (2008) observed that such complexity can foster the emergence of new constructs, ideas and perspectives. *Emergence* happens at the margins of a complex network and is not usually predictable. PCK – the conjunction of a threshold concept and student engagement – does not provide a generic checklist of answers to the question 'how should I teach'. It does, however, enable the emergence of more useful answers than 'it depends'. This article concludes with some tentative propositions about PCK:

- Threshold concepts and student engagement together offer a useful framework for thinking about PCK. The former enable communities of scholars and students to shape content in a way that transforms learners' understanding and enables them to integrate troublesome knowledge into content that is shaped for learning. The latter's concern with learners such as their motivation and experiences outside the classroom, effective teaching processes and facilitative institutional cultures are vital for achieving quality learning. Conceived in this way, PCK springs from a partnership of accessible and transforming content, engaging teaching and active learners.

- This framework does not envisage that there is just a single version of PCK. With its assumptions that there are many ways to conceptualize content even within single subjects, that teachers and learners are individuals, and that institutional learning environments are unique, it is likely that there will be many conceptions of PCK. However, widespread agreement about teaching and learning environments that engage learners might suggest a more generic view for achieving quality learning. But this is a mirage. What engages students and how teachers teach for engagement are just as variable as threshold concepts.
- The notion of transformation is a powerful one. Both threshold concepts and student engagement assume that grappling with troublesome knowledge leads to transformations. It is a basic given in the threshold concept literature (Meyer and Land, 2005). In a more indirect way, it is also an understanding in the engagement literature, which emphasizes achieving success through cognitive investment in, active participation in and emotional commitment to their learning (Fredricks et al., 2004).
- Transformations though are unpredictable, neither teachers nor learners can know what spaces transformations will lead to. This provides an opening to question the current fashions of prescribing what students should have learnt by the end of a course. Such prescriptions could place unnecessary limits on learning.

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

Åkerlind G, Carr-Gregg S, Field R, et al. (2010) A threshold concepts focus to first year law curriculum design: Supporting student learning using variation theory. In: *Presentation at 13th Pacific Rim First Year in Higher Education (FYHE) Conference,* 27-30 June, Adelaide, SA, Australia.

Australian Council for Educational Research (2008) *Attracting, engaging and retaining: New conversations about learning*. Australasian student engagement report. Camberwell, VIC, Australia: Australian Council for Educational Research.

Barnett R (2008) *A Will to Learn: Being a Student in an Age of Uncertainty*. Maidenhead: Open University Press.

Blackie M, Case M and Jawitz J (2010) Student centeredness: The link between transforming students and transforming ourselves. *Teaching in Higher Education* 15(6): 637–46.

Bryson C and Hand L (2007) The role of engagement in inspiring teaching and learning. *Innovations in Education and Teaching International* 44(4): 349–62.

Cousin G (2006) An introduction to threshold concepts. *Planet* 17: 4–5.

Davies P (2006) Threshold concepts: How can we recognize them? In: Meyer J and Land R (eds) *Overcoming Barriers to Student Understanding: Threshold Concepts and Troublesome Knowledge*. London: Routledge, pp. 70–84.

Davis B and Sumara D (2008) *Complexity and Education: Inquiries into Learning, Teaching and Research*. London: Routledge.

Deci E and Ryan R (2000) The 'what' and 'why' of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry* 11(4): 227–68.

Entwistle N (2003) *Concepts and conceptual frameworks underpinning the ETL project*. Occasional Report 3, Enhancing teaching–learning environment in undergraduate courses. Available at: http://www.etl.tla.ed.ac.uk/docs/ETLreport3.pdf

Entwistle N (2010) Taking stock: An overview of key research findings. In: Hughes JC and Mighty J (eds) *Taking Stock: Research on Teaching and Learning in Higher Education*. Montreal, QC, Canada and Kingston, ON, Canada: McGill-Queens's University Press, pp. 45–81.

Fredricks J, Blumenfeld P and Paris A (2004) School engagement: Potential of the concept, state of the evidence. *Review of Educational Research* 74(1): 59–109.

Hockings C, Cooke S, Yamashita H, et al. (2008) Switched off? A study of disengagement among computing students at two universities. *Research Papers in Education* 23(2): 191–201.

Hu S and Kuh G (2003) Maximizing what students get out of college: Testing a learning productivity model. *Journal of College Student Development* 44(2): 185–203.

Irvine N and Carmichael P (2009) Threshold concepts: A point of focus for practitioner research. *Active Learning in Higher Education* 10(2): 103–19.

James R, Krause K-L and Jennings C (2010) *The First Year Experience in Australian Universities: Findings from 1994 to 2009*. Melbourne, VIC, Australia: Centre for the Study of Higher Education.

Kinzie J (2010) Student engagement and learning experiences that matter. In: Hughes JC and Mighty J (eds) *Taking Stock: Research on Teaching and Learning in Higher Education*. Montreal, QC, Canada and Kingston, ON, Canada: McGill-Queens's University Press, pp. 139–54.

Kuh G, Kinzie J, Buckley J, et al. (2006) *What matters to student success: A review of the literature*. Commissioned Report. Available at: http://nces.ed.gov/IPEDS/research/pdf/Kuh_Team_Report.pdf

Kuh G, Kinzie J, Schuh J, et al. (2005) *Student Success in College: Creating Conditions that Matter*. San Francisco, CA: Jossey-Bass.

Land R, Cousin G, Meyer J, et al. (2006) Conclusion: Implications of threshold concepts for course design and evaluation. In: Meyer J and Land R (eds) *Overcoming Barriers to Student Understanding: Threshold Concepts and Troublesome Knowledge*. London: Routledge, pp. 195–207.

Lucas U and Mladenovic R (2007) The potential of threshold concepts: An emerging framework for educational research and practice. *London Review of Education* 5(3): 237–48.

Mason M (2008) What is complexity theory and what are its implications for educational change? *Educational Philosophy and Theory* 40(1): 35–49.

McDaniel R Jr and Jordan M (2009) Complexity and postmodern theory. In: Johnson J (ed.) *Health Organizations: Theory, Behavior, and Development*. Sudbury, MA: Jones & Bartlett Publishers, pp. 63–84.

McInnis C (2003) *New realities of the student experience: How should universities respond?* Paper presented at the European Association for Institutional Research 25th Annual Conference, Limerick.

Mearns K, Meyer J and Bharadwaj A (2007) Student engagement in human biology practical sessions. In: Refereed paper presented at the Teaching and Learning Forum, 30–31 January, Curtin University of Technology. Available at: http://otl.curtin.edu.au/tlf/tlf2007/refereed/mearns.html

Meyer J and Land R (2003) *Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within disciplines*. Occasional Report 4, Enhancing teaching–learning environment in undergraduate courses. Available at: http://www.etl.tla.ed.ac.uk/docs/ETLreport4.pdf

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(3): 373–88.

Mishra P and Koehler M (2006) Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record* 108(6): 1017–54.

Moran E and Gonyea T (2003) *The influence of academically-focused peer interaction on college students' development*. *British Journal of Educational Psychology* 75(3): 373–390.

Pascarella E and Terenzini P (2005) *How College Affects Students: A Third Decade of Research*. San Francisco, CA: Jossey-Bass.

Rogers C (1983) *Freedom to Learn for the 80s*. Columbus, OH: Charles E. Merrill.

Schuetz P (2008) A theory-driven model of community college student engagement. *Community College Journal of Research and Practice* 32: 305–24.

Shulman L (1986) Those who understand: Knowledge growth in teaching. *Educational Researcher* 15(2): 4–14.

Shulman L (1987) Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review* 57(1): 1–22.

Townsend L, Brunetti K and Hofer A (2011) Threshold concepts and information literacy. *Portal: Libraries and the Academy* 11(3): 853–69.

Yorke M and Longden B (2008) The first year experience of higher education in the UK. Final report. Available at: http://www.heacademy.ac.uk/assets/York/documents/resources/publications/FYEFinalReport.pdf

Zepke N and Leach L (2010) Improving student engagement: Ten proposals for action. *Active Learning in Higher Education* 11(3): 167–77.

Author biography

Nick Zepke, an Associate Professor of adult education, works with undergraduate and postgraduate teachers of adults. His research interests are divided between learning and teaching in higher and further education and taking a critical approach to futures and policy studies. *Address*: Nick Zepke, School of Educational Studies, Massey University, Private Bag 11222, Palmerston North, New Zealand. [email: n.zepke@massey.ac.nz]