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Threshold Concepts in Academic Practice: Engagement with the Scholarship of Teaching and Learning

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Abstract

This paper investigates the existence and nature of threshold concepts as experienced by a group of twenty-one teaching-focused academics, from life science departments in UK universities. Individuals were invited to take part in the study and asked to fill in a survey about their roles as academics. Participants in the study were interviewed about their experiences with the scholarship of teaching and learning (SoTL), using a graph generated from their responses to the survey as a mediating artefact. Interview transcripts were analysed and comments categorized according to Trigwell, Martin, Benjamin & Prosser's (2000) Model of Scholarship. Threshold Concepts were identified in three out of four of Trigwell et al's dimensions of scholarship, mainly at the level moving from the disciplinary to the mainstream context of education. In addition, other threshold concepts were identified that were outside Trigwell et al's (2000) model of scholarship. These findings have implications for academics engaging with SoTL, their audiences, and academic developers delivering postgraduate teaching qualifications in higher education.

Keywords: scholarship, teaching-focused academics, threshold concepts

Introduction

This paper looks at engagement with the Scholarship of Teaching and Learning (SoTL) in the context of a group of UK Life Sciences teaching-focused academics. SoTL is increasingly becoming a requirement for UK academics, and includes a range of

activities such as reflection on practice (Kreber, 2005; Kreber & Castleden, 2009) systematic study of learning and teaching through practitioner research (Allen & Field, 2005), and dissemination of results among the wider community (Hutchings & Shulman, 1999). Engagement with SoTL may also take the form of a formal qualification in teaching in higher education, or may be a continuing professional development (CPD) requirement, notably for the increasing numbers of "Teaching-only" academics employed by UK institutions to cover undergraduate teaching and course administration. However, engagement with SoTL may be confusing, and present a number of challenges, in addition to those already present in the career of an academic. For Life Scientists in particular, engagement with SoTL may offer particular challenges as individuals tackle material outside their disciplinary expertise. Language, research methodology, confidence in data gathering, sense of identity may present barriers to engagement with SoTL to academics who are more comfortable within a positivist, quantitative paradigm. While Threshold Concepts (Meyer & Land, 2003) are generally associated with student learning within the discipline, if we look on engagement with SoTL and CPD as lifelong learning, and the academic as learner, we can broaden our application of threshold concepts. Indeed, for academics considered to be expert in their field, taking on the role of the learner may be troublesome in itself, with the individual being required to acknowledge their lack of expertise in the area of educational research, whilst simultaneously being an expert in their own discipline.

Taking a mixed methods approach of initial questionnaire and subsequent interviews, UK Life Science academics were asked about their understanding of, and engagement with SoTL. The questionnaire and interviews revealed a range of attitudes towards engagement with SoTL, and a number of concepts which could be considered to be Threshold Concepts in nature. These concepts, and the extent to which they can be categorized as Threshold Concepts is explored in this study. The findings are significant in that they indicate the difficulties and challenges faced by academics attempting to engage with a paradigm outside their disciplinary expertise, the effort expended in successful engagement, and the transformations that occur, showing the development of engagement by reading literature, to actively carrying out research projects and writing papers, in comparison to the findings of Vajoczki et al (2011) who found a relationship between good teaching, scholarly teaching and the scholarship of teaching and learning. In terms of Threshold Concepts, those found in this study agree with Threshold Concepts uncovered by Webb (2014) in her study of mid-career academics

engaging in a Faculty SoTL Leadership Certificate course. The study also points towards areas where support can be given to academics engaging in SoTL to help encourage this development.

Threshold Concepts in SoTL

Meyer and Land (2003) have argued that the identification of Threshold Concepts in learning is vital in developing student understanding. The characteristics of a Threshold Concept are that it should be transformative, irreversible, integrative, bounded, and that the knowledge is in some way troublesome. Individuals wrestling with Threshold Concepts may find themselves in a state of liminality, that is, uncertainty, and within that uncertainty there is the opportunity to embrace the new and move on, or to reject it. There is a wealth of work which has been done to identify Threshold Concepts within disciplines. For example, within Life Sciences, which is my discipline, Threshold Concepts have been identified in first year courses (Smith, 2012) and to investigate student understanding of hypothesis generation (Taylor, Tzoumis, Meyer, & Ross, 2012). In addition, work has been done in the context of educational developers (Timmermans, 2013), as a way to initiate interest in SoTL (McLean, 2009), and to develop scholarly teaching (Bunnell & Bernstein, 2012).

For academic staff in the UK context, it is becoming increasingly common for engagement with the Scholarship of Teaching and Learning (Boyer, 1990) to be a contractual obligation, and with an estimated one in four academic staff on a "teaching and scholarship" career path (Times Higher Education, 2008), identifying ways in which to support staff is both necessary and timely. The definition of SoTL is contested by scholars such as Boshier (2009). However, there are models of SoTL which serve as a useful guide, such as Glassick, Huber and Maeroff's suggested standards of scholarship (1997) which concentrates on scholarship as a research process, Kreber's Reflective Practitioner (2002), Antman and Olsson's two dimensional theory-practice matrix model (2007) which looks at the relationship between theory and practice, and Trigwell, Martin, Benjamin and Prosser's four dimensional model of scholarship (2000) which combines theory, dissemination of research, reflective practice and conception of learning (see Table 3 for more detail).

Methodology

Life Science academics at UK universities were invited to take part in a survey. Individuals were approached via the JISC mailing list for Bioscience Pedagogic Research, and through the Society for Experimental Biology's Education and Public Affairs mailing list. Responses were obtained from individuals working in institutions in England, Scotland and Wales, from research-intensive to post-1992 institutions. Participants were asked to complete a survey which employed Semantic Differential (Osgood & Suci, 1969; Osgood, Suci, & Tannenbaum, 1957) to look at how individuals conceptualized their academic role. Fifteen concepts of Academic Identity (Table 1) were measured by asking participants to compare each concept to a set of bipolar adjectives (Table 2), representing three axes, Evaluation, Potency and Activity. Each bipolar adjective pair was given a score from one to seven (with four as the mid-point), and an average value for each dimension was calculated for each individual. A three dimensional conceptual map was generated from this data, and was used as a mediating artefact to promote discussion during the interviews. Forty-three academics completed the survey.

Table 1. Concepts identified as facets of Academic Identity

Bioscience	SoTL	Community	Lifelong Learning	Career
Research	Pedagogy	Collaboration	Teaching	Identity
Discovery	Education	Competition	Students	Administration

Table 2. Bipolar adjective pairs used to measure meaning of Academic Identity concepts

Evaluation	
valuable	worthless
pleasant	unpleasant
relaxed	tense
clear	hazy
sociable	unsociable
Potency	
dominant	submissive
masculine	feminine
alive	dead
deep	shallow
large	small
Activity	
complex	simple
active	passive
emotional	unemotional
severe	lenient
dynamic	static

Participants were asked to indicate willingness to take part in an interview during completion of the survey. Twenty one academics were interviewed. Interviews were fully transcribed and the transcripts were interrogated to determine the level at which interviewees operated for each of Trigwell, Martin, Benjamin and Prosser's (2000) dimensions proposed in their Model of Scholarship (Table 3), (*Informed, Reflection, Communication, Conception*).

Table 3. Four dimensions of scholarship of teaching (Trigwell et al., 2000, p. 163)

Level	Informed (ID)	Reflection (RD)	Communication (ComD)	Conception (ConD)
1	Uses informal theories of teaching and learning	Effectively none, or unfocused reflection	none	Sees teaching in a teacher-focused way
2	Engages with the literature of teaching and learning generally		Communicates with departmental/faculty peers (tearoom conversations; departmental seminars)	
3	Engages with the literature; particularly the discipline literature	Reflection-in-action	Reports work at local and national conferences	
4	Conducts action research, has synoptic capacity and pedagogic content knowledge	Reflection focused on asking what do I need to know about x here, and how will I find out about it?	Publishes in international scholarly journals	sees teaching in a student-focused way

Each interviewee was given a score from 1-4 for each of the dimensions based on their interviews, and the average scores for each dimension were calculated to determine areas where interviewees were not fully engaging, or where development may have been lagging. Having determined that there were differences in the level of engagement of the four dimensions, the transcripts were reassessed to look for evidence of potential threshold concepts situated within them. The criteria *Transformative, Irreversible, Integrated* and *Bounded* (Meyer & Land, 2003) were used to identify potential Threshold Concepts, followed by an interrogation of the transcripts to discover instances of

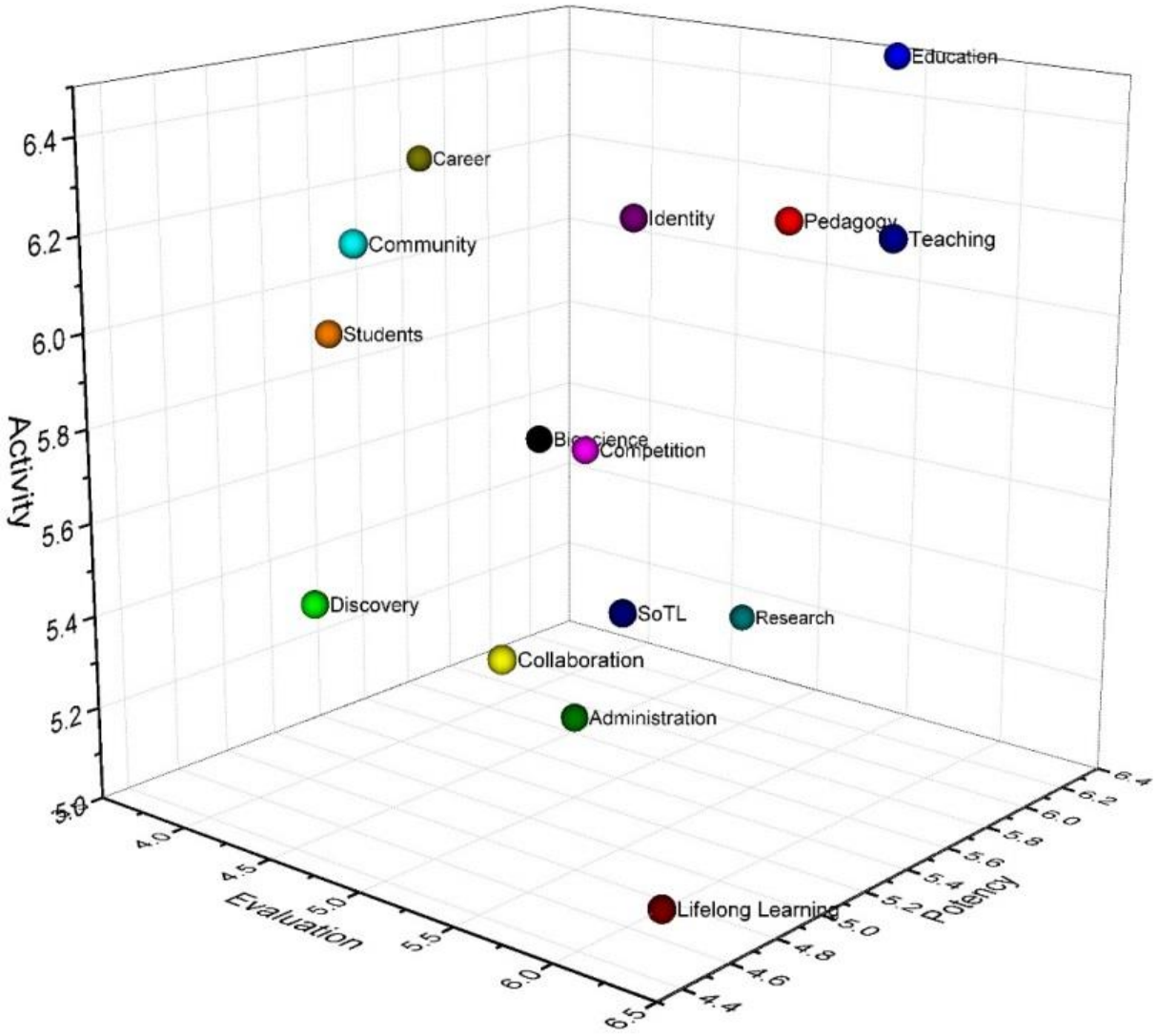
"troublesome knowledge" (*Ritual, Inert, Conceptually difficult, Alien, Tacit, Troublesome language*) (Perkins, 1999). The outcomes were then analysed for common themes and possible bottlenecks where threshold concepts could occur.

Findings

Conceptualisation of academic role

A three dimensional conceptual map was generated for each individual who agreed to be interviewed. The map was sent to them prior to the interview, and was used to facilitate the early part of the discussion. Using the three axes of Evaluation, Potency and Activity, the relationships between the fifteen concepts of academic identity could be seen for each individual (Figure 1). The interviewer used this artefact with participants in the interviews as a starting point to talk about how they viewed their academic role and the place SoTL inhabited within that role.

Figure 1. An example of a three dimensional concept map generated from an individual's survey responses

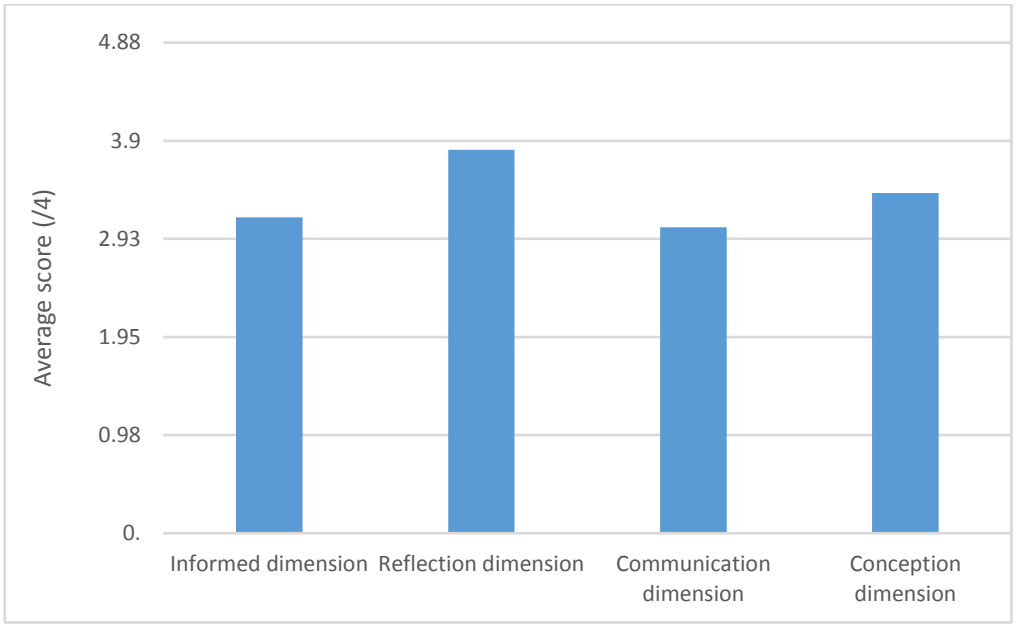


Variation in engagement

Using a simple scale of 1-4 for each of Trigwell et al's (2000) dimensions of scholarship, and scoring what I determined to be the highest level at which each interviewee engaged with each of the dimensions, I was able to illustrate that interviewees do not engage with all four dimensions to the same degree (Figure 2). While all of the interviewees, from academics new to teaching to senior academics, showed evidence of reflection in terms of teaching and learning, this was not matched with evidence of engagement with literature and theory (informed dimension), evidence of publications (communication dimension), and, to a lesser extent, evidence of a student-centred conception of learning

(conception dimension). This illustration (Figure 2) is a useful indication of the dimensions where potential Threshold Concepts might exist.

Figure 2. Average score for engagement with Trigwell et al's (2000) dimensions of scholarship



Having determined that there were potential differences in level of engagement, I returned to the interview transcripts to look for evidence of what kind of difficulties there were for interviewees, and where they were located, when they attempted to engage in SoTL. In particular I wanted to look at interviewees' engagement with pedagogical literature and theory, their ability to produce communications for the wider community, and their conceptual model of learning, and find the extent to which these could be framed in terms of Threshold Concepts.

Identification of Threshold Concepts

I interrogated interview transcripts, and looked for instances of possible Threshold Concepts (Meyer & Land, 2003). In the initial round of analysis I was interested in

identifying instances of engagement with SoTL which were *Transformative, Irreversible, Integrated* and *Bounded*, the findings of which are illustrated in Table 4.

Table 4. Identification of potential Threshold Concepts associated with Engagement with SoTL (after Trigwell et al, 2000)

Dimension of scholarship	Level	Threshold Concept Dimension
Informed	Informal theories of learning	Transformative Irreversible Integrative
Informed	Engaging with the literature in general terms	Transformative Irreversible
Informed	Engages with the literature; particularly the discipline literature	Transformative Irreversible Bounded
Communication*(Informed)	Communicating with colleagues	Transformative
Communication*(Informed)	Writing papers	Transformative Irreversible Integrative Bounded
Conception	Student-centred	Transformative Irreversible

This exercise brought to light a number of factors. Instances of the Informed Dimension (ID) appear more often than either Communication or Conception dimensions. This indicates a particular difficulty for this group with pedagogic literature and theory. Leading on from this, interviewees' examples of engagement with the Informed Dimension rarely extend beyond ID3 – "Engages with the literature; particularly the discipline literature". Typically, interviewees concentrated on discipline-specific pedagogical journals, rather than mainstream educational journals. Identifying oneself within the discipline is an ontological issue typical of Threshold Concepts, and indicates a pre-threshold state.

> *things like Bioscience Education, fantastic, and I will sort of drop into that occasionally and have a look and pick up some good ideas. The more sort of heavy duty pedagogic literature, I find pretty heavy going myself*

There is a reticence on the part of interviewees, even those with a great deal of experience with pedagogic research within Life Sciences, to engage with mainstream educational literature, and particularly with education theory. This is viewed as being outside their boundary of disciplinary pedagogic expertise, and so is seen as being distant. In contrast, there is a feeling of familiarity engaging with discipline-specific pedagogic research. In addition, a distinction should be made between pedagogic research which describes and promotes practice, with research that advances or proposes new theory. Engagement with education theory presents as a barrier because of the troublesome nature of the discourse, the language, and the alien nature of the concepts. Therefore, the Life Scientists prefer to engage with literature which concentrates on practice, and with which they are more familiar.

Instances of the Communication Dimension are bound up with reference to the Informed Dimension. This is to be expected, as Glassick, Huber & Maeroff (1997) identify adequate preparation by engaging in appropriate literature as an essential part of scholarly activity. Despite this connection between engagement with literature and communication, there is somewhat of a paradox between the Informed Dimension and Communication Dimension, given that interviewees may be involved with dissemination without evidence of a high level of engagement with mainstream literature or theory. This is a constant tension in practitioner-based pedagogic research (Hutchings, 2007), and one which deserves continued attention, as there is a tendency for practitioners to write narratives of their practice, rather than underpin their analysis with appropriate theory. The following interview extract illustrates the discursive element of Threshold Concepts identified by Meyer and Land (2005):

> *I find the writing of some of these papers quite hard, they don't come naturally to me, in a different way to how writing a research paper – that didn't come naturally to me either but I guess I should, I guess I recognise that I need to do more reading around the subject area that I'm actually looking into, and I know that I can be a little bit lax when it comes to actually reading the literature*.

Finally, examples of the Conception Dimension appear unrelated to either the Informed Dimension or Communication Dimension, but appear instead to be a product of the individual's practical experience:

> *when I started teaching, I thought I was there to actually tell them stuff and tell them things that they didn't know or couldn't find out, anything other than me, and it took me a good few years to realise that I was there to help them to understand stuff and sort of curate knowledge for them in a way that made sense… I try to talk to staff, and tell them, this is, if I could give you one thing it would be that insight, into what your role as a teacher is. But I don't think it's possible, people kind of have to learn it themselves*.

This participant highlights the importance of one's own experience as a teacher in coming to terms with a student-centred paradigm. While one may read about it, or be told about it by others, the real ontological shift requires a personal transformation which is irreversible.

The approach of using Trigwell et al's (2000) Model of Scholarship as a framework was useful in identifying areas where potential threshold concepts exist. While it could be argued that there are threshold concepts at each of the stages of the model, the first of these areas where there a real barrier exists is in the Informed Dimension, moving from a general use of pedagogical literature especially that of the discipline, to synoptic capacity and pedagogic content knowledge (ID3 to ID4). The second area is the relationship between the Informed Dimension and Communication Dimension, where public dissemination may take place with scant reference to educational theory. The third area is the ontological shift required for a student-centred Conception Dimension, which may be related to a lack of experience, and held back by a lack of knowledge of education theory which results in a more teacher-centred conception of teaching. These Threshold Concepts are bound up with the ontological dissonance of scientist/pedagogical researcher and the lack of experience with pedagogic discourse.

Troublesome knowledge

In a second round of transcript interrogation, I investigated instances of "Troublesome knowledge". Table 5 illustrates categories of Troublesome Knowledge and the levels of dimensions offered by Trigwell et al (2000) to which they relate.

Table 5. Identification of potential Threshold Concepts associated with Engagement with SoTL with Troublesome Knowledge

Dimension of Scholarship	Level	Troublesome knowledge
Informed	Engaging with the literature	Alien knowledge Conceptually difficult knowledge Troublesome language
Communication	Writing journal papers/publishing	Troublesome language
Conception	Teacher-centred to student-centred	Conceptually difficult knowledge Tacit knowledge
Analytical	How to approach/handle data	Alien knowledge Ritual knowledge Tacit knowledge
Analytical	Understanding research methods	Alien knowledge Tacit knowledge
Paradigm	Definition of SoTL	Conceptually difficult knowledge
Paradigm	Understanding pedagogy	Alien knowledge Inert knowledge
Paradigm	Understanding paradigm	Alien knowledge Conceptually difficult knowledge

As I identified the instances of Troublesome Knowledge, I became aware that while there was Troublesome Knowledge associated with all three dimensions. Engaging with the literature is fraught with troublesome knowledge, summed up in this extract from an interview:

> *With terror, I think, is the answer. Things like Bioscience Education, fantastic, and I will sort of drop into that occasionally and have a look and pick up some good ideas. The more sort of heavy duty pedagogic literature, I find pretty heavy going myself… and I think this was sort of reflected when we did the introduction to teaching and learning type course that everybody has to do, and to my mind there was a definite split between the sciences and the humanities, you know, for the humanities, Ped-R speak came very naturally, because I suppose it's qualitative rather than quantitative research and a lot of the terminology was familiar to them.*

Interviewees identified language as causing difficulties when writing journal papers. Implicit in that is a discursive dimension of difficulty (Meyer & Land, 2005), although interviewees did not express that explicitly.

> *But I think I'm quite active in the scholarship, if that is scholarship, trying to get some publications, which is think is the hardest for, I don't know if it's fair to say for us, but it is for me. I think it's a completely different language we need to get engaged with, isn't it?*

Conception of teacher- or student-centredness was expressed by many of the interviewees. They often discussed the importance of their development as a teacher, rather than their facilitation of student learning as an example of the ontological shift discussed in the context of Threshold Concepts.

> *I think since I started with the PGCert and I did the PGDip and now I'm doing the Masters, I think I changed as a person regarding the teaching. I believe, and you would need to ask my students, but I believe I'm a better teacher*.

However, most of the areas that were troublesome were not easily categorised according to Trigwell et al's (2000) framework. These troublesome areas are not situated easily in either the Informed, Communication or Conception dimensions of Trigwell et al's (2000) model, although they are related to an individual's ability to engage with all three dimensions. As a tentative definition, I would categorise them as "Analytical" and "Paradigm" dimensions.

The Analytical dimension deals with practicalities, such as how to handle or approach data and understanding research methods. For life science academics coming from a positivist tradition, this is a major issue, and source of anxiety. The research process for life scientists may be designing an experiment, observing, collecting data, which is numerical, analysing that data, usually by using software or computer modelling, and using statistical analysis. While the process of designing an experiment may be similar, the processes of how to gather and analyse data in an appropriate way is a hurdle to overcome. Understanding that what one person says is important because of the import of *what* they say is incomprehensible. Scientists would ask questions like, "how many people are saying that?" or say, "well, if only one person has this opinion, it can't be very important":

> *because we're in a science background, we tend to look for quantitative type measures, and we never think of the qualitative*

In addition to data handling, research methods are also a troublesome area for life scientists, whose research methods typically involve using equipment. To think of a range of ontological approaches to research is an alien concept because there is generally perceived to be only one tradition, and that is positivist.

This moves us on to the other, related category, which I have called "Paradigm dimension". This relates to understanding the nature of SoTL itself, understanding pedagogy as a theoretical concept, and understanding that there are different approaches, or paradigms, a concept which is alien to most scientists:

> *what's the factual evidence here, it's just people's opinions about other people's opinions. I want to know facts, so I did biology and then eventually realised that that was all just people's opinions as well.*

Table 6 summarises the places where Threshold Concepts occur, including the Analytical/Paradigm dimensions.

Table 6. Proposed dimensions of scholarship of teaching (adapted from Trigwell et al., 2000, p. 163)

Level	Informed (ID)	Analytical/ Paradigm	Communication (ComD)	Conception (ConD)
1	Uses informal theories of teaching and learning	Effectively none	none	Sees teaching in a teacher-focused way
2	Engages with the literature of teaching and learning generally	**Relies on disciplinary experimental methods and data collection**	Communicates with departmental/faculty peers (tearoom conversations; departmental seminars)	
3	Engages with the literature; particularly the discipline literature	**Attempts to engage with new paradigm, but from a disciplinary perspective**	Reports work at local and national conferences **often with no/little requirement to integrate literature or theory**	
4	Conducts action research, **but does not relate this to a synoptic approach to literature or theoretical concepts**		Publishes in **disciplinary educational journals**	Sees teaching in a student-focused way

Discussion

There appears to be an argument for the existence of Threshold Concepts for Life Science academics engaging in SoTL. Using Trigwell et al's (2000) model, all three dimensions show evidence of places where there are barriers, however it is only by looking at them in the context of Troublesome Knowledge that we can elucidate why there are barriers. Table 6 summarises where the Threshold Concepts are, and

includes the position of the tentative additional dimensions of scholarship, Analytical and Paradigm. Identification of these Threshold Concepts, including the ontological and discursive issues have also been identified by Webb's (2014) study of mid-career academics.

There is a relationship between the Threshold Concepts in all categories of the model. Life science academics are professionals in their own fields. However, they are being asked to conduct research in a completely different area, with a literature that is impenetrable. They are being asked to conduct this research after a certificate level, part time course. Compare this to the length of time it takes to progress to a first academic position, which is at least ten years of full time study and work, and includes two, perhaps three degrees, and it is easy to understand why life scientists fall back on disciplinary protocols when trying to do pedagogical research. Until now, assumptions have been made that if an individual is an expert in their discipline that this easily transfers to research within another paradigm. In terms of supporting colleagues through this process, I believe that one of the important issues is that of linking engagement with literature to communication, specifically, insisting on the inclusion and discussion of literature for conference presentations and seminars. Interestingly, referring back to the Semantic Differential results, there is an acknowledgement of the *potency* of both SoTL and Pedagogy for academic staff not engaged in disciplinary research. Academics may well see the power of SoTL and Pedagogy in transforming their roles, even before they fully understand it.

Further work

This paper presents the possible threshold concepts involved with Life Scientist academics' engagement with SoTL. There are many possibilities for further work. Although I have tentatively identified Analysis and Paradigm as new dimensions, further analysis is required to clearly define what constitutes these dimensions and how they interact with Trigwell et al's (2000) Dimensions of Scholarship. In addition, more work is required to elucidate why the barriers occur where they do, with a view to better supporting academics in their scholarly activities.

Beyond the scope of this study is the question of how academics in other areas engage with SoTL, and where the thresholds exist for them. For example, in the other STEM areas, it would be reasonable to speculate that the Threshold Concepts are similar to those found with Life Science academics. This speculation is supported by the work of Webb (2014) who has identified similar Threshold Concepts in mid-career academics from across the disciplines. It is important to find out where the barriers lie, as increasingly, academics are being asked, in effect, to become educational researchers. If this is to continue, robust, longitudinal support has to be put in place in order to support the development of practitioners as pedagogic researchers. As has been discussed in this paper, there is a need for more support in ensuring that Life Science teaching-focused academics can successfully realise their potential as pedagogic researchers.

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