Using audio diaries to identify threshold concepts in 'softer' disciplines: a focus on medical education

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Abstract

Within Medical Education students more readily engage with the 'hard' sciences seeing sociology, psychology and ethics as 'nice' rather than 'need' to know. Yet within the published literature, there has been little research into students' experiences of these subjects. In this paper we discuss a research method that allows the application of threshold concept theory to the exploration of the process of 'non-biomedical science learning in medical education'.

16 students from a UK medical school were asked to record on their smart phones, their experiences of 'doctor facilitated' small group sessions. The students uploaded their recordings to a secure drop box facility and recordings were removed daily and transcribed. 68 transcripts were analysed for both substantive concepts and exemplars (within students' language) of threshold concept criteria. Concepts were then cross-referenced against threshold criteria. Where concepts appeared to meet the criteria of

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transformation, liminality, integration and troublesomeness we speculated that these might be 'threshold'.

Audio diaries appear to be a promising methodology for applying threshold concept theory to understanding learning. The study provided an insight into students' experiences. We learned that our students currently re-appropriate sociological ideas to the medical setting often finding new terminologies situated in their own 'student speak'. We were able to spot gaps in their learning and notice how and where students get 'stuck'. A resolvable limitation is we were unable to test for irreversibility. We also found little evidence of boundedness leading us to speculate about the nature of threshold concepts in the non-biomedical sciences.

Keywords: Threshold concepts, medical education, non biomedical sciences

Introduction

The soft sciences in medical education

Non-biomedical science disciplines have featured as a core component of medical training internationally since the 1950's. For example, sociology and psychology have been included in successive policy documents in the US and the UK as a curricular intervention to help induce a much needed cultural shift in medical care (Todd 1968, General Medical Council, 2009). Within medical training, the humanities and ethics have also contributed extensively to contemporary thinking about patient care and increasingly, in many medical schools, subjects such as professionalism are viewed as academic reflexive components of training rather than as a set of material competencies to be learned (Hafferty and Levinson 2008).

Despite recommendations to integrate aspects of the non-biomedical sciences into medical school at the structural level, the 'everyday work' of helping students engage with these subjects is notoriously problematic. An extensive literature stretching back some 60 years has shown that students prefer to engage with the so called 'hard' or 'need to know' sciences', as opposed to the 'nice to know' sciences such as sociology and psychology, which they often perceive pejoratively as 'soft' or 'fluffy' (Dacey and

Weintrob 1973, Begun and Rieker 1980, Hunt and Sobal 1990, Benbassett et al. 2003; Cuff and Vaneslow 2004, Litvia and Peters 2008).

The stated reasons for this are complex but always relate back to the cultural dominance of the scientific epistemology that pervades the public view of medicine (and by default the cultures of the institutions within which medical training operates). The scientific paradigm, holds that the most reliable and valid knowledge is that which can be attained via the experimental methods of the natural sciences. Physics, chemistry, biology, engineering and mathematics for example, all adhere to a scientific paradigm. These subjects are also known within the philosophy of science as the hard sciences (Kuhn 1962). This is because the extent of their knowledge is bounded: the criteria for discerning whether 'a law' or theory is 'true' are clearly defined. In contrast, out of necessity, (because the social world cannot be understood by pure scientific method alone), the social sciences are underpinned by a 'variety' of philosophically and methodologically defensible positions, the criteria for measuring 'the truth' is therefore less 'black and white'. Within the philosophy of science, the social sciences have also been called the 'soft sciences' to illustrate the more contestable' nature of the knowledge produced (Matthew & Pritchard 2009).

Recently literature relating to the non-biomedical sciences in medical education has focused on the challenges posed by 'integration' (Harden 2000). In the UK in 1993, partly in an attempt to refine overcrowded medical curricula, the General Medical Council (GMC) produced new guidance for medical schools (GMC 1993). *Tomorrows Doctors* promoted (and continues to promote) clinically focused, integrated teaching and life-long learning (GMC 2003, GMC 2009). Alongside this, approaches such as Problem Based Learning and Clinician Facilitated Small Group Work have become widespread. Critics of the integrated approach argue that in multidisciplinary settings teachers are more likely to espouse a confusing array of non-biomedical perspectives (Russell et al 2004, Litva & Peters 2008). This poses the danger that social sciences can appear 'relative' to students (they can take or leave the multiple explanations on offer). As a result, integration can unintentionally support the idea that the soft sciences are common sense and integration may deter deep learning (Scambler 2010).

The soft sciences in medical education and threshold concepts

With the exception of two papers (Field 1988; Knight & Mattick 2006) our own recent review of over 200 papers related to medical education has found no reference to students lived experiences of learning the non-biomedical subjects. This suggests that crucial aspects of students learning in the 'soft sciences' have remained unexplored. We believe that 'threshold concepts' might provide a useful heuristic framework for addressing this area. In addition to illuminating the neglected domain of affective learning within medical education, threshold concepts might address questions such as 'what are the transformative moments around students' learning of non-biomedical sciences?'; 'what (if any) are the catalysts in students' experiences that lead to deep and enduring learning?' and 'what areas of learning are troublesome and why?' Threshold concepts theory might also shine a much needed light on the associated practical activity of 'teaching well', leading to a better understanding of how to support students through troublesome areas and difficult shifts in identity: how, in general, in 'a crowded curriculum' can we streamline our efforts in order to optimise the potential for learning?

The 'soft sciences' at Peninsula

Formally Peninsula Medical School, Peninsula Colleges of Medicine and Dentistry in the UK (PCMD) are known as exemplars of integrated teaching. In medicine, learning in the non-biomedical sciences occurs in lectures, workshops and problem based learning as well as in small group sessions. Students are expected to learn a broad range of concepts related to sociology, psychology, ethics and professionalism that have a bearing on health and illness. These are, for example, the bio-psychosocial model, identity, gender, class, ethnicity; concepts relating to the 'experience of illness', 'the doctor patient relationship' and 'health behaviour' and concepts relating to working in medicine such as reflection, time management, work life balance and medical uncertainty.

The small group sessions are the focus of the study that we report here. Led by doctor facilitators (mainly GPs), the small group sessions are designed to provide opportunities for students to safely reflect on and make sense of their experiences in clinical and community settings. Students experience a range of placements, from GP surgeries to a drug and alcohol rehabilitation centre, a homeless hostel and in later years, hospital

wards. As well as exploring their own views and values, students are encouraged to consider academic explanations relating to the issues discussed; to transfer learning more generally to the practice of medicine and apply their understanding to their own role as future doctors. The content of the sessions is not assessed; on average they take place once every 4 weeks, for 2 hours, across the 5 years of the programme and they are compulsory.

Our annual evaluation shows that whilst most students see their relevance to medical practice, small group sessions are not as popular with students as clinical skills and life sciences teaching. However, we have also observed that some ideas from the disciplines of sociology and psychology have been experienced by students as 'life changing'. For example, the idea of the hidden curriculum appears to orient some students to issues of power and politics in medical practice and to provide new ways of thinking and behaving professionally. Yet other concepts such as gender appear to remain passive or elusive to students (Neve & Collett, 2014).

Thinking about methods for exploring threshold concepts in non-biomedical sciences

While the potential benefits to the student learning experience of identifying threshold concepts are increasingly being recognised, identifying them has not proven to be easy. Diverse methods have been used across a variety of disciplines, including semi-structured interviews, analyses of exam responses, observation of classroom behaviour (Barradell 2013) and questionnaires (Holloway et al. 2009).   However, we perceived that if threshold concepts represent a powerful change in individual ways of knowing (and therefore 'being') such experiences might be complicated, intense, personal, and potentially hard to describe. Coupled with our wish to find out how students experienced the learning of non-biomedical science subjects, we felt that an ethnographic study, with its emphasis on gaining rich descriptions from participants about events as they occur in naturalistic settings (Hammersley & Atkinson 1983 and Denzin & Lincoln 2005) would be the best approach.

We first considered literature related to the use of critical incidents in student learning. In medical education, short unpolished narrative critical incident accounts written by medical students, physicians or faculty have been found, as Branch (2005) puts it to

'speak from the heart …(and) bear witness to the travails and challenges of becoming and being a doctor.' (Branch, 2005:1064). In addition, detailed descriptions from individuals taken frequently and 'just after key occurrences' can limit the 'distancing' from events and characters that can occur using other research methods and reduce the risk of hindsight bias (Shinners Kennedy, 2014). Critical incident reflections used in education can also lead to discovery and transformation and help students in grappling with their emotional and moral development.

In healthcare, reflective accounts by students on critical incidents have been used as a trigger by Clouder (2005) to begin the identification of 'caring' as a threshold concept. However, our experience has been that medical students often find it hard to engage in reflective writing. Therefore we turned to the use of audio diaries. Solicited audio diary methodology (as it is known) is an underused but powerful tool for researchers (Monrouxe, 2009). Instead of writing their reflections down participants record their thoughts as they occur. This discursive think aloud process gives participants the opportunity to tell their stories and is said to open up potential new insights into the way individuals make sense of the world.

Previous research at PCMD has found a high drop-out rate with audio diaries, however asking participants to frequently record thoughts, comments and events on a free phone hotline had proved to be very successful. This is because hotlines are experienced as easier to accommodate into the busy daily round: 'something that can be done in between jobs' or 'immediately after something has happened'. Developing this idea in partnership with students, we decided to ask students to download a voice recording application to their smart phone from where they could upload easily their anonymised recordings to a secure drop box. The drop box would then be screened twice a day and all recordings would be transferred to a password protected computer, to which only three researchers had access.

Following funding from the Plymouth University Pedagogical Research Institute (PEDRIO) and ethical approval from the Plymouth University Ethics committee, in the summer term of 2013, adverts for student volunteers were posted on the medical school intranet. We stated that we wanted to study non biomedical science learning in small

groups using audio diary methods. 36 individuals expressed an interest across years 1 – 5 of the curriculum. We purposefully did not mention the term 'threshold concepts'.

After receipt of detailed information sheets and consent forms, students interested in taking part in the study attended orientation sessions. We explained that over a 6 month period, following each small group session, we wanted them to record relevant experiences on a smart phone, including in their reflections: any 'aha' moments, (times when things seemed to come together or change the way they saw things); 'struggles', (including times when they did not understand or could not see the relevance of something) and examples of 'I've got it / no, I haven't got it' oscillations. Interestingly the students found the idea of the project easy to grasp, identifying immediately, with the notion of 'ah ha' moments, troublesome learning and oscillations in their understanding.

16 students consented to participate in the study (year 1 n = 2, year 2 n = 4, year 3 n = 6, year 4 n = 3 and year 5 n= 1) and between September 2013 and April 2014 we received frequent recordings from all but one of the participants, resulting in some 90 audio files. The recordings were often informal and chatty for example:

> *Hi Nicole!* (Simone, year 3)
> *… So, I've had two Small Group sessions so far...* (Jake, year 2)
> *Hi this is participant xx and my small group was, um, Monday* (Michael, year 4)

Analysing the audio-diaries

We transcribed the recordings verbatim as they were received. When we had 24 transcripts, the 3 members of our project team developed analytical frameworks individually and then met to agree on a more concrete working framework. Unexpectedly, rather than presenting a series of clearly bounded academic concepts as described in text books, the concepts raised by the students were 'expressions of academic ideas'. These were for example: 'medicine is not black and white' (an expression relating to the idea in sociology and medicine of complexity and uncertainty), 'patients have freedom to choose' (relating to autonomy); 'being a doctor is more than just treating the symptoms (relating to the biopsychosocial / holistic model), 'two way

discussions' (relating to adherence), 'being like a doctor' (relating to identity) and 'hierarchy' (relating to the concept of power). Other ideas that appeared to move the students included: 'dealing with conflicting emotions', 'doctors not knowing', 'adapting a role appropriate to the patient', 'doctor versus patient experience', 'no single answer', 'the moral position of the doctor', 'importance of other's viewpoints', 'fairness and equality' and 'treating the whole patient'.

In keeping with our methodology we treated students' individual concepts as discrete entities however the research team identified and agreed broad themes to which the concepts 'belonged'. These were: 'holistic care', 'being a doctor', 'ethical issues', 'patient experience', 'the culture of medicine', 'autonomy', 'reflection' and 'communication skills'.

Whilst we were coding the data into concepts and related themes, we also began to code the data according to Meyer and Land's criteria for threshold concepts (Meyer & Land 2003). This included examples of liminality, troublesome knowledge, transformation and integration. The criteria for each of these categories were derived from the language used by students as follows.

Transformation

Indicators of transformation were first, 'a change in view'. For example, a student might say 'it changed my view … on health', or comment on finding something 'quite revolutionary'. In relation to transformation, students also spoke frequently about 'realising'. For example Seema (year 2) states: 'I had one of those 'aha' moments where I realised …' and Jake comments:

> … *and this has led me to realise the importance of practising medicine as an art, as well as a science* (Jake, year 2).

Also linked to transformation, were comments that suggested mastery where students said they 'finally understood' or where they used extended language (Meyer and Land, 2003). For example:

We need to respect patient's *autonomy* (Jeni, year 3)

It will probably make us more *emotionally intelligent* (Jake, year 2)

A lot of these discussions were *evidence-based* (Syed, year 4)

Connected to transformation we also found examples of reconstitutive learning (Land et al 2005), indicating that students were starting to let go of previous ways of thinking. This is exemplified in the following statement:

It has very much challenged the way I used to look at the whole doctor/patient relationship (Emma, year 2)

Liminality

Language that we perceived to be indicative of liminality included expressions of oscillating between understanding and confusion. Students 'got things', then didn't get them', '… thought they understood and realised they didn't get it' or said they were 'confused'. A good example of liminality is contained in Eithne's quote below:

*… something that I found quite difficult to understand um, and I keep thinking that I've got it in my head, and I keep thinking that I know how to balance them out, but again I was a bit confused…(*Eithne, year 4)

Another student stated:

…it's one of those things that I keep thinking I've actually understood (Seema, year 2)

Troublesomeness

Examples of troublesome knowledge were contained in expressions such as 'struggling to understand', 'thinking things aren't right' or 'ideas being weird'. Sam stated for example:

I found this quite a difficult thing to think about (Sam, year 3)

Jake, states

> *… so ... I get a bit confused …*

Integration

Whilst they were quite frequent the examples of integration were less diverse and simply included speech that indicated 'things coming together', 'linking' or 'fitting'. For example, Mary (Year 4) states:

> *…another point that I think has come together and I'm starting to see links in um, like it's starting to fit together now.*

And Jo (year 4) states:

> *… those two exercises together kind of really hit home to me*

Irreversibility and boundedness

We identified in students' language, many examples of liminality, integration and transformation, however we found few examples of irreversibility and boundedness in our data.

Transfer and proactive knowledge

Notably, whilst we did not include these in our findings, during the phase of discerning criteria for the Threshold Concepts we observed that some students described the ability to transfer a newly learned concept to other contexts. For example, Syed discusses what he had learnt through being part of a small group:

> *… You know, it was a very relaxed open atmosphere and we discussed several concepts that may not come up in a Jigsaw session if we had simply followed the syllabus... …But I think it's so important to make sure we focus discussions and ensure that everyone is able to take part in the conversation...*

Syed then moved on, to apply the same concept to the doctor-patient relationship ...

> *… because I mean if you were to apply this concept to medical scenarios, when you're in a consultation, you would want the patient to be able to talk to you about anything, even if it is unrelated, but you'd also want to make sure that you have your say and they have their say.* (Syed, year 4)

Were there Threshold concepts in medical students' accounts?

Using NVivo, after we had coded the data we produced a data matrix (see for example, Cassell and Symon 2005) allowing us to cross reference the students' concepts with criteria for threshold concepts (see figure 1).

Figure 1.   Section of initial data matrix used for identifying non-biomedical threshold concepts in medical students' audio-diaries

	Integra-tive	Irreversi-ble	Liminali-ty	Transforma-tive	Bound-ed	Trouble-some
BEING A DOCTOR						
A good doctor	0	0	1	0	0	2
Being a doctor	3	0	3	4	1	1
Culture of doctor	0	0	0	2	0	0
Drs role not just helping individual but benefiting society	0	0	0	1	0	0
Patients don't expect doctors to know everything	2	0	0	0	0	0
Practicing medicine as an art	0	0	0	1	0	0
Professional Courtesy & Professionalism	0	0	0	2	0	1
Responsibility	0	0	0	1	0	1
Stress management	0	0	1	0	0	1
Thinking like a doctor	1	0	4	2	1	1
Uncertainty in medicine	1	0	0	1	0	1
No single solution	0	0	0	1	0	1
Saying I don't know to a patient is acceptable	2	0	0	2	0	0
ETHICAL ISSUES						
Applying theoretical models to ethical dilemmas	0	0	0	0	0	2
Being limited by ethics	0	0	2	0	1	0
Fairness & equality	0	0	0	1	0	2
Medicine not black and white but grey and complex	1	0	1	1	0	1
Moral position of the doctor	0	0	0	1	0	3
No simple or single ethically correct best answer	0	0	1	2	0	3

Figure 1 demonstrates that when we cross referenced the students' concepts with the threshold concept criteria a number of the themes stood out. Within these themes, certain concepts met 3 or more of the criteria for a threshold concept. We identified these concepts as being those most likely to be a threshold concept.

For example, under the broad theme of 'being a doctor' the possible threshold concepts appeared to be: 'being a doctor' (referring to the actual embodied lived experience of doctoring) 'thinking like a doctor' and 'uncertainty in medicine'. Under the theme of 'ethical issues', 'medicine is not black and white' and 'there is no simple ethically correct

answer' met 3 or more of the criteria. Other themes (not represented in figure 1) were as follows: under the theme of communication skills 'empathy' and 'two way discussions' were possible threshold concepts. Under the theme of 'holistic care', potential threshold concepts included 'being a doctor is more than just treating symptoms' and 'the importance of treating the whole patient'. Finally, within the theme of 'the patient experience', 'patient expectations of doctors' stood out as a possible threshold concept. Our initial findings are illustrated visually in figure 2 below.

Figure 2. Possible threshold concepts relating to non-biomedical sciences in medical education (broad THEMES in capital letters, likely threshold concepts: small ovals)
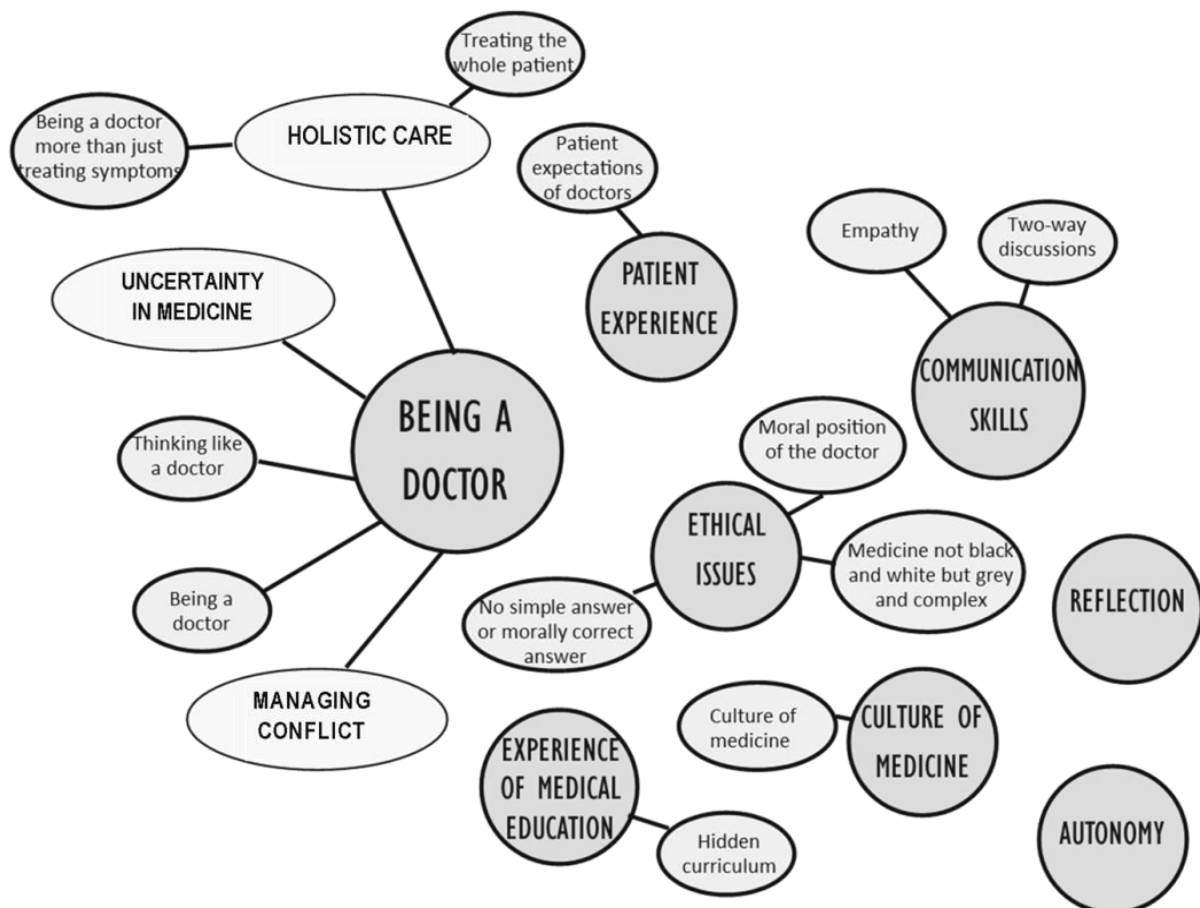
Concluding thoughts

Over the past 60 years evidence based research focussing on the social components of health and illness has led to vast improvements in medical outcomes and patient care.

Yet despite recognition of the contribution of the social sciences, their inclusion in medical education has been fraught with problems related to the cultural dominance of the biomedical mind set. In recent years due to the efforts of social scientists and socially minded doctors, particularly with the field of medical education, much has been done to change this. However, we do not know if students are any more 'engaged' and this leaves a gap in our understanding. Our initial exploration of this issue using threshold concept theory as a framework has yielded important methodological and educational insights. Our study appears to show for example that clinician facilitated small group work can lead to profound shifts in the way that students think about medicine, particularly with respect to the act of being a doctor. We wonder whether a different set of facilitators (patients for example) might help students to explore threshold concepts related to being a patient and provide students with a deeper understanding of the patient experience. In addition, as stated above, our study indicates that students' ideas connect with elements of broader concepts within the social sciences and that there may be potential to extend thinking about these elements triggering mastery of more potent ideas.

Importantly, our study has revealed to us some of the strengths and weaknesses of our own teaching. As teachers we wonder whether we introduce some concepts at too a high a level, automatically assuming that students will 'get' complicated ideas such as gender or class. We then 'move on' potentially wasting valuable curriculum time. For those of us working with integrated curricula in multi-disciplinary teams, we need to ensure that we make discursive connections with one another so that we can align the explanations that we provide for students. In addition, using students' language as a starting point, we can make the development of socially focused threshold concepts 'in' and 'for' medicine a two way process and in the course of doing so make clear to students what they know and how far they have come in their learning.

With regards to methodology, this project has been an exploration from which we have learned a great deal. We found audio diary research to be a valuable method for gaining an insight into students' experiences and were surprised at the level of engagement and enthusiasm from our students. However, we are mindful that we were only able to identify 'likely' threshold concepts and that further research and testing is required.

With respect to the threshold concept criteria, in terms of the reliability of our findings we found that we had to stick strictly to our criteria for threshold concepts. For example, during our analysis of troublesomeness it became clear that we needed to distinguish between students being stuck, because the knowledge was troublesome or difficult to understand and students struggling with the real-life uncertainty of clinical situations:

> *So …I get a bit confused I guess because in what case, in what scenario do I respect patient's autonomy, and when do I decide that, that is not the best option for the patient, and who am I to decide what is best for the patient or not.*(Jeni, Year 3)

> *I found this very fascinating, and I hadn't really thought about it, and in a space of 10 minutes, you know, everybody in the group was just silent thinking about - you know, you could see everyone going back and forth as to whether they would or wouldn't* (Sam, year 3)

Furthermore, in our study we found few examples of irreversibility. However, we believe that this may due to the methodology used. Zander (2008) argues that

> If the interview is conducted while the student is still grappling with a particular concept, or when he or she has very recently mastered it, the troublesome and transformative criteria are easier to investigate, but irreversible is harder. Such interviewees may be able to describe their problems vividly, but it is impossible to tell whether, if and when they master the concept, they will then forget it." (Zander 2008).

With respect to irreversibility we concur with Cousin (2009) that an important element of the identification is 'transactional curriculum inquiry', the dialogue that takes place amongst teachers, students and educational designers. Focus group discussions with teachers and students, looking back over their learning will form the next stage of our study and we will be looking for examples of irreversibility as part of this.

One area of interest that arose from the study was the issue of transfer. During the phase of discerning criteria for the Threshold Concepts we observed that some students described the ability to apply a newly learned concept to other contexts (for example, Jake, year 2). Taylor (2008), in her study of threshold concepts in biology found that the ability to apply learning was important arguing that you have to start applying the theory before it makes sense. Similarly, Perkins (1992) discusses the idea of near transfer

(application of knowledge to similar contexts) and far transfer (the ability to apply knowledge to different contexts and disciplines) and introduces the notion of 'proactive knowledge' which requires a student to be alert to where a concept applies, able to apply the concept with understanding as well as to engage energetically with the knowledge (Perkins 2008). We noticed many examples of students transferring their knowledge to other situations and wonder, whether this way of talking is evidence of mastery. If this is the case, then transfer might be an additional threshold concept criteria in our research methodology enabling us to see more easily the types of concepts that students have already internalised.

A final problem that we encountered with the project was the issue of boundedness. Whilst we identified that the concepts identified were discrete inasmuch as they were different than other concepts raised, we found few examples within students' accounts where students outlined clearly 'the edges of the idea'. However concepts in the soft sciences are more contestable and 'less bounded' than the more black and white "hard sciences'.

Many concepts in the social sciences (such as identity, risk, discourse, class, stigma and consumerism) have stood the test of time as explanatory tools. (Giddens and Sutton 2014). Unlike typical concepts in the physical sciences, whilst they are explanatory, they are theoretically diverse, cover a wide range of subjects, and importantly can be contested. Indeed, many concepts have changed over time Perhaps we need to consider whether the notion of boundedness applies to threshold concepts in the soft sciences? It may be more useful for example, to emphasise how overarching concepts in the social sciences can be unpacked. Clouder drawing on Tronto (1993) illustrates for example how the concept of caring comprises 4 conflicting (discrete) dominant discourses that can produce real tension in students' experiences. These are: 'caring about', 'taking care of', 'care giving' and 'care receiving'. Rather than glossing over 'caring', by making these conflicting components clear, students are in a better position to arrive at more sophisticated understandings of their professional role. Perhaps this is the case with the concepts discovered here – as components of holistic care for example, students need to achieve mastery in a series of related concepts.

Some final limitations: first as a qualitative approach it is not possible to use audio diary research to explore the threshold concepts of all students. Secondly whilst some of the

concepts do overlap with threshold concepts identified in other disciplines (for example uncertainty has been proposed as a threshold concept in physics and climate change (Wilson et al. 2010, Hall 2006)) what we have reported here is our interpretation only. We have made every effort to triangulate our emerging ideas about the data with one another however a test of the reliability of the findings would be if they could be replicated in other similar groups. In this study we have not considered the trajectory of students' learning as they pass through each year of the course although this is something that we hope to undertake in the next phase.

Acknowledgements

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