Integrating Threshold Concepts and Ways of Thinking and Practising: Supporting Physiotherapy Students to Develop a Holistic View of the Profession through Concept Mapping

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Abstract

The work practices of a health professional involve a complex weaving together of *knowing what*, *knowing how,* and *knowing why*. To help students engage with what is required for practice, educators need to have an expansive view of what it means to be a health professional in the rapidly changing real-world contexts that people inhabit today. Threshold concepts, and the complementary framework Ways of Thinking and Practising (WTP), are educational ideas that can help educators to think in those broad ways about health's knowledge base, behaviours, and values, and how these appear in the curriculum. This article offers a case example from a pre-clinical entry-level physiotherapy subject to illustrate how threshold concepts and WTP informed what students came to understand about health professional practice. A curriculum that considers threshold concepts and WTP in combination helps both educators and students to engage with learning from multiple perspectives and to develop a connected understanding of their chosen profession. Helping students to articulate the connections between knowledge (e.g. threshold concepts) and how this knowledge is put to use (e.g. through the WTP of the profession) enables them to reconsider practice-related contexts in meaningful ways.

Keywords: clinical practice; concept maps; physiotherapy; threshold concepts; ways of thinking and practising

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Introduction

Health professionals need to learn *about* practice – its knowledge base, skills, and values – in order *to* practise. One of the biggest challenges for health professional education is how to organise and assemble a curriculum to tackle achieving these outcomes. Curriculum decisions are not straightforward because the knowledge base of future practitioners is continually growing, evolving, and emerging. To this end, threshold concepts and ways of thinking and practising (WTP) (McCune and Hounsell 2005) are educational ideas that are useful for health professional educators and practitioners to 'think with'.

Threshold concepts have been described as one of ten teaching and learning innovations with the potential to make a substantial impact on educational practice (Sharples *et al.* 2014). Certain characteristics (transformative, troublesome, integrative, bounded, and irreversible) distinguish threshold concepts from more basic concepts (Meyer and Land 2003, 2005). In particular, the *troublesome* and *transformative* nature of threshold concepts means they represent critical points in students' learning. These characteristics also suggest that threshold concepts are important to knowledge transformation through: (i) a focus on areas of conceptual challenge essential to disciplinary mastery (helping to address the challenge of a volume-laden curriculum); (ii) forming links between areas of conceptual knowledge so as to develop integrated knowledge of the field; and (iii) learning more about oneself through participating in, and interacting with, the conventions of the discipline.

The idea of WTP has been a useful addition to threshold concepts, helping to foster a more expansive view of curriculum (Barradell, Barrie, and Peseta 2017). Ways of thinking and practising acknowledge the complex relationship between the domains of theory and practice, and that these are connected rather than separate components of being and becoming professional. Ways of thinking and practising put knowledge to work in ways that are central to the discipline's world-view and purpose. They are described as offering:

> the richness, depth and breadth of what students might learn through engagement with a given subject area in a specific context. This might include, for example, coming to terms with particular understandings, forms of discourse, values or ways of acting which are regarded as central to graduate-level mastery of a discipline or subject area
>
> (McCune and Hounsell 2005: 257).

Taken together, attention to threshold concepts and WTP is important for student learning in health contexts. The work of a health professional involves working with different forms of knowledge – a weaving together of *knowing what*, *knowing how,* and *knowing why.* Threshold concepts and WTP can usefully expand curriculum efforts by helping educators think about the uniqueness of the profession – its knowledge base, behaviours, and values – and how to translate complex, multifaceted professional practices to meaningful curriculum, whether university- or work-based.

This article describes how these ideas (threshold concepts and WTP) informed the curriculum design of a pre-clinical third year physiotherapy subject. The subject aimed to help students develop a more holistic, connected view of the profession as they approached the transition between learning at university and at work (i.e. clinical placements). The article provides background on the ways that threshold concepts and WTP were put to use in the subject by drawing on professional (physiotherapy) and scholarly literature. It offers a portrait of the connections and associations evident in a concept mapping activity, and theorises students' learning in relation to how a cohort of physiotherapists see professional practice, in particular, its threshold concepts. Engaging students' in mapping the key concepts of a profession – in this case physiotherapy – is useful to: (i) readers interested in the profession of physiotherapy; (ii) those designing curriculum as it offers an example of how redesign can be strengthened when informed by strong educational ideas (i.e. threshold concepts and WTP); and (iii) any discipline or profession keen on discerning students' understandings.

Background – the subject

The subject that provides the case example for this article occurs in Semester 1 of the third year of a four year bachelors/masters physiotherapy degree (which is equivalent to first year of a graduate masters) and centres on a core area of physiotherapy practice (neurological physiotherapy). It is one of four Semester 1 preclinical subjects that students must pass to progress to Semester 2 clinical placements. These preclinical subjects occur at an important transition point between university and work-based learning environments. Together, they aim to prepare students for learning in the clinical environment so that they begin to think and practise as 'learner' physiotherapists and emerging professionals rather than seeing themselves as students. The subjects aim to encourage shifts in knowledge (what students know but also how they come to know), the formation of professional identity (what it means to be a health professional) and more holistic views of practice.

Table 1: The movement from clinician-identified statements to essential framing ideas

Statements identified through nominal group technique process with clinicians	Framing ideas reached by added analysis of threshold concepts Health Professions literature
Understand functional neuroanatomy and neuroplasticity, and the influence of pathology on presentation, prognosis and outcome, and meaning to physiotherapy.	Neuroplasticity; World Health Organisation's International Classification of Functioning, Disability and Health (WHO ICF); Systems model; Clinical reasoning
Integrate knowledge about aetiology, assessment findings in context of individual in order to develop problem lists, treatment plans, and goals.	Systems model; WHO ICF; Problem-oriented assessment; Clinical reasoning
Recognise variation to 'normal' movement during formal and informal observation.	Person-centred approach; Systems model; Clinical reasoning
Handling and the environment impacts activity at an impairment and functional level.	Systems model
Recognise the integration of all parts of the body in movement.	Systems model
Recognise need to re-evaluate and adapt treatment continuously.	Clinical reasoning
Client-centred approach and attitude.	Person-centred approach
Recognise value of goal setting and importance of re-evaluating goals.	Person-centred approach; Clinical reasoning; Problem-oriented assessment
Communication skills are different for neurological patients	Person-centred approach
Recognise active motor control as different to strength	Muscle plasticity
Impact of non-physical factors of the patient on the physiotherapist's role in the multidisciplinary team	Person-centred approach; WHO ICF
Recognise patient and their support network are going through a major life-changing event.	Person-centred approach; Reflective practice; WHO ICF
Clinical experience is a privilege and opportunity for students.	Reflective practice

While a threshold concepts framework informed the design of the subject, at the time of the initial curriculum renewal (and subsequent to that) there were few published studies that had identified threshold concepts in physiotherapy (Barradell and Peseta 2017). The exception is Clouder's (2005) suggestion of 'caring' as a threshold concept. As part of the curriculum development of the case subject of this article, a pilot project involving consultation with physiotherapy clinical educators (physiotherapists who supervise students whilst on clinical placements) was undertaken to identify physiotherapy threshold concepts (Barradell and Peseta 2016). Using nominal group technique, the clinicians identified 13 statements (Table 1). These findings unearthed what a sample of the physiotherapy profession considered to be clinically important for students to learn although they were

Table 2: A summary of the eight framing ideas

Idea	Description
WHO ICF	The WHO ICF is an internationally recognised framework that helps to think holistically about a person's and/or population's situation from multiple perspectives of health and wellbeing. It is a bio-psycho-social model of health that addresses weaknesses of the medical or social models in isolation (World Health Organisation, 2018)
Systems theory or model of movement	Movement (or action) is a result of a person's body (and its multiple systems) interacting within the context of a particular environment and as a result of the properties of a specific task (Shumway-Cook and Woolacott, 2012).
Neuroplasticity	The ability of the brain to change in response to stimuli, experience, and interactions with the environment. The brain's ability to change is harnessed in any situation where learning is desired (i.e. physiotherapy capitalises on the brain's ability to adapt when working with patients in intervention contexts) (Nudo, 2007).
Muscle plasticity	Muscles are a focus for physiotherapists due to their interest in movement. *Muscle plasticity* represents the idea that muscles change (i.e. and lead to particular presentations) and can be changed (i.e. which is of relevance to aims of physiotherapy intervention).
Person-centred approach	A practice approach where partnership with the patient (and their significant others) is central to effective care. It is a multidimensional approach that requires, for example, understanding of humanness, collaboration, respect, relationship building, teamwork, and empowerment.
Reflective practice	Critical reflection is a process of making sense of a situation through consideration of multiple perspectives resulting in new knowledge and understanding being formed. It is one of a number of capabilities that enables practitioners to respond to new and changing situations, and is part of a commitment to lifelong learning (Foote, 2013).
Problem-oriented assessment	An assessment approach that centres on problems of concern to the patient and what activities the patient is experiencing as changed or limiting.
Clinical reasoning	A complex cognitive and meta-cognitive process used by health professionals to understand a patient-related problem or situation. It involves a range of skills (e.g. analysis, problem-solving, decision-making, critical thinking) and dispositions (e.g. open-minded, willing to question assumptions and personal beliefs) (Smith, Ajjawi and Jones, 2015)

perhaps more representative of learning outcomes rather than threshold concepts. Appraising these 13 statements in the context of the existing threshold concepts literature helped to gain a more expansive understanding of the essential ideas that students might need to have learned and wrestled with prior to placement. Literature that was useful included Foote's (2013) work on critical reflection, the work of occupational therapy academics (Rodger and Turpin 2011, Tanner 2011) which included client-centred practice and real-world practice, and dealing with uncertainty as described by Land and Meyer (2011). Table 1 shows the movement from the clinicians' 13 statements to the eight eventual ideas that provided the framework for the subject. These ideas were considered to represent a mix of threshold concepts (i.e. knowledge) and WTP (i.e. elements that put knowledge to work). Table 2 provides a summary of the eight ideas developed by one of the researchers; each comprises core knowledge introduced in earlier foundational subjects but integrated in the case subject described here. Parts of Table 1 represent example areas of broad core knowledge: for example, anatomy, neuroanatomy, pathology, physiology, assessment skills, and goal setting. Further support for the eight ideas came from the physiotherapy field (e.g. Lennon and Basile 2009, Lennon 2011). The eight framing ideas were therefore collectively derived from consultation with the profession, both professional and higher education literature, and scholarly practice, which differs from traditional curriculum decision-making processes described in the literature (Chipchase 2007).

The eight framing ideas were intended to help students begin to develop (e.g. create and understand) a fledgling model of practice that connected declarative, professional and personal knowledge, and assist students to understand practice beyond cognitive or technical proficiency. Deliberate realisation of practice models can helpfully adjust students and graduates to the shock that might be experienced at key professional transitions (Higgs 2016). The subject's teaching and learning activities, and its learning environment more broadly, were intended to support student engagement with the ideas expressed in Table 2, and to grapple with how those ideas are related to each other as part of a developing holistic picture of the profession. For example, an enquiry-based learning approach was adopted requiring students to problem-solve authentic clinical case scenarios and come to understand and operationalise the various eight framing ideas. These eight ideas were described to students as overarching themes rather than threshold concepts or WTP. Some learning activities required students to 'step back' from 'doing' practice to articulate the concepts and processes physiotherapists used in neurological physiotherapy.

The next section of the article explores some of those activities and outlines what students understood about practice and its implications for curriculum. The aim was to use concept maps as a vehicle for helping students identify, connect, and organise the key ideas that inform physiotherapy professional practice. Examples of student work are included to support this discussion. This project was approved by the University's ethics committee (FHEC11/60).

Exploring students' understanding of the framing ideas: developing a concept map

One activity that students were asked to develop was a concept map in response to the topic '*Key concepts that influence the ways of thinking and practising of the physiotherapist who works with the person with neurological dysfunction*'. Concept maps offer a way of making students' thinking and learning visible (Hay, Kinchin, and Lygo-Baker 2008). They provide students with a tangible means of identifying and engaging with the abstract ideas of the discipline they are studying, as well as the knowledge frameworks that are integral to the discipline. They also provide an explicit means of gauging students' networked understandings of theory and practice via a visual representation of information. Further, concept maps allow students to depict the relationships between information. The intention behind concept maps is to promote meaningful learning by connecting and reframing relevant prior knowledge with new knowledge. Concept maps possess a particular structure and organisation (Novak 1990a, Novak 1990b, Novak and Cañas 2008) that help to show how knowledge has been constructed.

Areas of misconception and assumption can also be brought into focus. It has been suggested that concept mapping may make students' learning of threshold concepts transparent in that it can visibly demonstrate the 'breakthrough' in understanding as the threshold concept is grasped (Land and Meyer 2010). Yet, while concept mapping has been mentioned in the threshold concepts literature (i.e. Land and Meyer 2010) it has not yet been linked with WTP in any substantial way. However given the relationship between the two (i.e. between knowledge, and knowledge being put to work), it is entirely likely that concept mapping offers a vehicle for the learning of WTP too.

At key points of the semester, students were supported to develop concept maps and to use them to develop and show relationships between ideas. In Week 1, a one-hour concept-mapping tutorial was conducted explaining concept maps, how they assist learning, and advice on how to draw them. Students were also offered scaffolded practice to develop concept maps for topics from previous years of the subject. As part of this scaffolding, students were initially given 'select and fill' maps (e.g. a list of specific concepts and students had to decide how those concepts related to each other, and organise them accordingly). Students were later required to develop a map from scratch (i.e. identify relevant concepts, the connections between concepts and how those concepts should be organised). Specific map topics about the case scenarios being explored in class were also a part of subsequent learning activities. These afforded students the opportunity to consider the concepts and processes they were using to understand the case scenarios.

The mapping task was analysed according to three criteria informed by Novak and Gowin's (1984) proposed method for assessing concept maps: first, whether the ideas that informed the subject had been identified (e.g. breadth and related foundational concepts); second, the relationships developed between ideas (e.g. interconnectivity, hierarchy, accuracy); and third, the overall structural properties of the map (e.g. layout, whether it represented a concept map with nodes, connectors and linking words). It was anticipated that students were likely to approach the map in slightly different ways and make connections to other subject areas, as would be true in practice.

Table 3: Number of each map category identified

Map Category	Number of students
Consistent with Figure 1: includes all or most framing ideas and breakdown to relevant foundational concepts, relationships of the ideas is highly organised (overarching idea versus sub-components) and developed (connections), and represents the layout of a concept map	20
Consistent with Figure 2: includes many ideas but with less breakdown to relevant foundational concepts, relationship of the ideas is less organised and developed, and represents the layout of a concept map	35
Consistent with Figure 3: includes very few subject ideas with emphasis instead on foundational concepts, relationship of the ideas is very underdeveloped and whilst the layout still appears to a concept map, further scrutiny shows that is more procedural than conceptual in nature	30
Other	15 (late =1, answered different question = 2, did not identify ideas = 4, did not identify ideas and was not in the layout of a concept map =8)

One hundred concept maps were analysed (95 from students enrolled in the bachelors/masters, and five from Graduate Entry Masters students). Four broad categories of map were identified (Table 3): first was a map with all or most of the subject's framing ideas, a significant degree of conceptual organisation and significant integration; second, a map that identified many of the ideas but with less organisation +/- less integration; and third, a map with few subject ideas identified and was more procedural and/or descriptive. The remaining 15 maps represented a range of examples that fell outside of these parameters (category 4). Examples of the first three categories follow, as drawn by students. Student names have been replaced by pseudonyms.

Figure 1 represents a map in which a student (in this case Michael) has identified nearly all of the ideas that framed the subject. Properties of the map suggest that Michael thought these to be represented by the nodes in darkest shades, although a key or legend was not provided to confirm this. Given these ideas framed the subject's design, the location of these nodes would ideally be at the highest levels of the map, which is not always the case in Michael's map. Nonetheless, Michael was able to identify these ideas at early points within the map. Michael appears to recognise the overarching importance of the ideas and this likely reflects a deeper conceptual understanding. His first node '*a multifactorial approach*' is highly appropriate; this approach is often a sticking point for students who find it challenging to be as holistic as (neurological physiotherapy) practice demands. A high degree of integration is demonstrated and relationships are established with accuracy. This is facilitated by the placement of nodes within the map. For example, the close proximity of *evidence-based practice* to *person-centred practice* allows the two areas to be linked in a very clear way. Although other relevant ideas have been identified nearby (i.e. concepts related to the *clinical reasoning framework*, especially the WHO ICF), links have not always been established to the fullest degree.
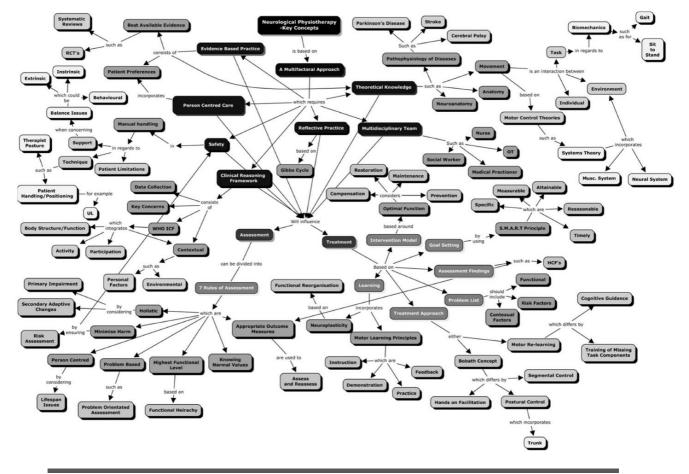
Figure 1: Map completed by Michael.

Overall, however, related ideas are located in similar positions on the map, demonstrating an awareness of interrelatedness if not complete understanding. Some reorganisation of the location of nodes would demonstrate more advanced understanding: for example, a problem-oriented assessment aligns with a person-centred approach and demands sound clinical reasoning and reflection as well as an understanding of a systems model of motor control and the WHO ICF. Michael's map indicates his developing awareness of a complex network of disciplinary knowledge and skills. He is developing a framework about how physiotherapists think and practise. Given that students were completing this task without any clinical practice experience, Michael's level of grasp is highly meaningful at the preclinical stage of the degree.

Figure 2, drawn by Dale, is an example of a map where many ideas of the subject are included. Whilst Dale has been able to identify key words, he has not consistently been able to relate these back to the overarching idea. An example is his identification of task, individual, and environment in the map's left upper quadrant. These terms are integral to an understanding of a systems model of motor control (Table 2); systems theory appears elsewhere though (bottom centre of the map). As a result, fewer links are established (than Michael's map, for example), and the map's structure demonstrates Dale's thinking is less organised. Dale has also mapped many more specific foundational concepts than Michael, and often these are highly positioned in his map. This indicates that Dale has been quite specific in his identification of factual knowledge and information, rather than necessarily identifying the bigger ideas that influence disciplinary thinking and practising. The thinking demonstrated by Dale is still effective. For students at a pre-clinical stage of their degree, grasping subject material with this breadth and to this degree is significant. The organisation and integration of the concepts on Dale's map however suggests a difference in the depth of learning, when compared to what is visible in Michael's map.
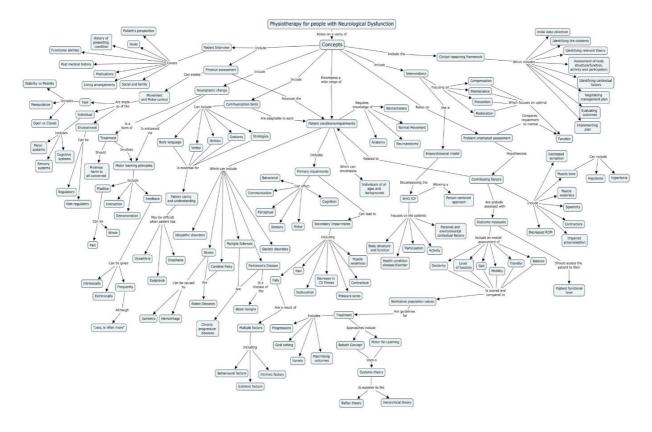
Figure 2: Dale's map.

Finally, Figure 3, belonging to Keenan, is an example of a map in which very few subject ideas are identified. The map is more procedural as a result. Whilst relevant information has been

identified, the map is highly specific and reads more as considerations for practice, rather than the overarching ideas that frame and represent the essence of the physiotherapy. Although links exist, many important ideas are at a distance from each other reflecting less structured organisation of thought. This could suggest superficial consideration or a superficial understanding of the complexities of the topic.
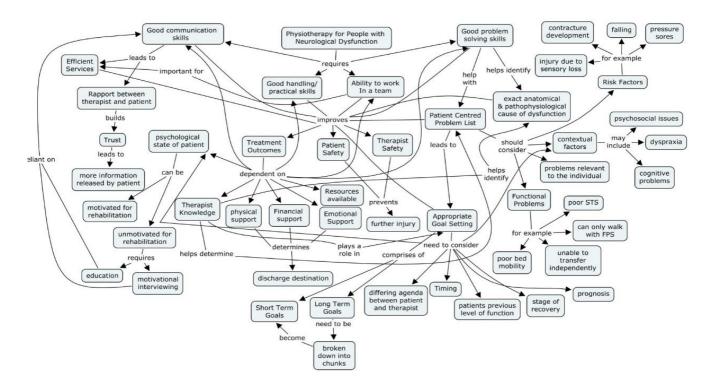
Figure 3: Keenan's map.

In this case, students were not asked to discuss or justify the development of their maps. Inviting them to do so would likely have illuminated their understanding further. However, students were asked to reflect on their development and key things that had contributed to their progress. These written responses provided additional insight into students' understanding of the profession and its practices, and how the eight framing ideas featured in their understanding. For example, Andrew's work showed that he was starting to understand how the WHO ICF can make very individualised healthcare possible, creating the potential to look more holistically at an individual's needs.

> I didn't understand the World Health Organisation's International Classification of Functioning, Disability and Health (ICF) and the insights it gives us on examining the patient's whole situation. I now also have better understanding of its importance in knowing what to assess.

Adrian wrote about how his grasp of person-centredness had changed.

> Initially I thought that addressing a patient's problems would be a relatively simple task… However the enquiries have demonstrated that no two patients are the same, reiterating the need to gain an understanding of patient perspectives when conducting an assessment. As a result treatment will be patient-centred and lead to better outcomes.

Brian discussed making connections with other subject areas.

> Until this semester I didn't recognise the significance of the interplay of body systems in neurological dysfunction – it is not just one system deficit. It was not until recent weeks that I have made the connection between neurology and other subjects.

Karen similarly wrote about connections she had made through linking subject content. Transformation had clearly taken place.

> I have selected problem-orientated assessments as a key concept not only because of its importance across the field of neurological physiotherapy, but how valuable I have found it to my own learning. This concept has evolved from one in which I simply accepted what I was told about its potential benefits, to one in which I have gained a firm understanding of its central role in neurological physiotherapy. I can now see the links between this approach and other key concepts and skills physiotherapists should aim to achieve; these include being patient-centred….

Tony, who was acquiring a more sophisticated view of practice and his own learning, perhaps best represents this transformation.

> Prior [to this case subject], all our learning of manual skills was done on persons who were considered to have normal function. Everything was very black and white. It is also important to recognise that the aims of the skills at this stage [before this case subject] were still largely focussed on assessing the student's knowledge of the anatomy and their technique execution….. Over the semester the initial black and white nature of skills has morphed into a grey area which takes into account many more things other than just anatomy.

Discussion and reflection

There was considerable variation in responses amongst the students, which was to be expected. Variation in student learning is a growing area of threshold concepts scholarship (e.g. Meyer, Land and Davies 2008, Åkerlind *et al.* 2010, Land and Meyer 2010, Meyer 2012, Baillie, Bowden and Meyer 2013, Rattray 2016), where the learning journey has been conceptualised as a series of different events: preliminal (the point at which the students enter the learning), liminal (the learning space), and postliminal (future learning possibilities). The differences in the maps might be attributed to differences in the liminal space and the ways students were occupying that space. For example, it is likely Michael inhabited a different conceptual space or engaged in that liminal space in a different way from Keenan, as Michael was able to identify and integrate a greater number of disciplinary ideas to a greater degree. Michael's map also demonstrated more organisational complexity. One of the characteristics of a threshold concept is they might be troublesome for students to learn (Meyer and Land 2003, 2005). This troublesomeness might manifest as differences in prior knowledge, misconceptions, assumptions or differing speeds at which students reach conceptual understanding. It is conceivable that any or all of these reasons might have contributed to the differences amongst the student cohort. Tracking changes in students' learning through the review of activities across the semester or year levels may be one way to explore the contribution of such factors. Undertaking a review at a future time-point would also seem to be useful. Given this subject was oriented towards preparation for practice, re-analysis during clinical experiences would help to further evaluate shifts in thinking.

The tasks, especially the mapping activity, required students to exercise metacognitive ability. It was necessary for them to 'step back' and reflect on the profession and their own learning, and to consider the concepts likely to influence a physiotherapist's thinking and practising. Learning to become a physiotherapist involves more than discipline-specific knowledge and procedural competence. Metacognitive abilities, including reflection, are an important part of both academic

thinking and professional practice. The willingness and ability to reflect deeply and meaningfully may be another reason for the variation across the cohort. Additionally, drawing meaningful concept maps is a skill that takes time and practice to develop (Davies 2011). Many students were new to concept mapping. By third year (or after the completion of a previous degree in the case of GEM students), learning and study habits are often well established. This could make it more difficult for students to develop such a skill, and students may be more reticent to embrace something new. Anecdotally, students reported finding the task of completing maps challenging and questioned its relevance to physiotherapy, although only a very small number ($n = 8$) were unable to draw something that resembled a concept map. However, students described a shift in thinking once they had completed some of their clinical placements, finding concept maps helpful to think more broadly about patient scenarios, to improve their clinical reasoning, and to develop summaries of important topics. Studies have shown that physiotherapy students (and those in many health professional disciplines more generally) tend to prefer learning in practical situations where there is a correct answer or a single solution (e.g. Zoghi *et al.* 2010). Yet practice contexts that involve working with people autonomously demand flexible skills and varied approaches to learning. Health professional education should involve a range of experiences and opportunities to help students develop and appreciate the diversity of responses required in practice. Early exposure to a range of learning experiences that require different strategies for success will best engage students and help them to see the complexity of what is required for practice.

Conclusion

This work describes a form of teaching and learning scholarship prompted by local curriculum renewal strategies and a desire to connect student learning with practice demands. It drew on various forms of inquiry, including review of higher education literature and consultation with clinicians, to design a pre-clinical subject that aimed to shift its focus beyond knowledge and competencies towards meaningful personal and professional connections. Threshold concepts and WTP were invaluable in thinking about the profession's knowledge, skills, and attitudes, and what might be most influential for students to learn at a key transition point of their degree. To be fit for purpose, professional education needs to ensure that learning opportunities are connected to practice in ways that connect the *know what*, *know how,* and *know why* that professionals put to use every day.

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