

## **The fault in our stars**

### **Constellations of Problem-based Learning: Living with the Liminal**

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The paper argues that today, what passes for problem-based learning (PBL) practice often seems more like guidelines than any kind of reasoned pedagogy. Whilst at one level the range of PBL variations shows the value and flexibility of PBL as an accommodating, adaptable, and culturally relevant approach to learning, there is relatively little understanding of the impact of these different constellations on student engagement and learning. Nevertheless, these diverse constellations of PBL need to be delineated and understood. This paper begins by outlining the constellations of PBL, suggests a number of issues that have not been considered in relation to the use of PBL and then argues for the importance of recognising and engaging with 4 distinct transdisciplinary threshold concepts that have an impact on student engagement with PBL, namely liminality, scaffolding, pedagogical content knowledge and pedagogical stance. The paper concludes by arguing that the risk of not engaging with diverse constellations of PBL, of over scaffolding PBL and not living with the liminal will result in a poverty of PBL experiences, performative pedagogies and curricula in search of criticality.

#### **Constellations of Problem-based Learning**

Since its inception in the 1980s, PBL has developed in diverse ways worldwide, yet there has been relatively little mapping of its theories, practice, or disciplinary differences. This has led to confusion within the academic community about which constellation to adopt, or what would be the best fit for a given curriculum. Merely listing specific and narrowly defined characteristics does not, in fact, untangle the philosophical conundrums of PBL. Further, PBL is an approach to learning that is affected by the structural and pedagogical environment into which it is placed (that is, the discipline or subject, the instructors, and the organization). While PBL is still undergoing a process of change worldwide, such change has been analysed by few in the field of higher education. In some areas, possibly most notably in some medical curricula, there is a sense of performative rules about how PBL should be used, but instead it would seem that we

need pedagogically informed guidelines. The growing constellations of problem-based learning illustrate the value placed on this approach to learning. Yet there is relatively little understanding of the different constellations available, and the terms of inquiry-based, problem-based, and enquiry led learning are still being used willy nilly across the higher education landscape (Savin-Baden, 2014). The idea of locating different formulations of PBL as a series of constellations develops the idea that there is a broad range of PBL approaches. It embraces the overlapping nature of differing PBL practices that relate to one another and intersect in particular configurations or patterns.

The notion of constellations helps us to see that there are patterns not just within the types of PBL but across the different fields of practice (Savin-Baden, 2007). The idea of grouping PBL approaches in this way is drawn from Bernstein (1992), who argued for the use of constellations as ‘a juxtaposed rather than integrated cluster of changing elements that resist reduction to a common denominator, essential, core or generative first principle’. However, with the growth of the use of digital technology in PBL online the notion of what counts as participation is becoming increasingly complex. For example, a study was undertaken to examine human interaction with sophisticated pedagogical agents and the passive and active detection of such pedagogical agents within online PBL. A pedagogical agent (or chatbot) is a software application which can provide a human like interaction using a natural language interface. Example of these are ‘Siri’ or ‘Cortana’, Alexa or the virtual online assistants found on some websites, such as ‘Anna’ on the Ikea website. The study used PBL online, so as to give a focus for discussions and participation, without creating too much artificiality. It was also used with a view to developing the possibility of virtual facilitators and virtual mentors in the future. However, not only are there new developments in the field of PBL, but research into Threshold Concepts is also creating new learning ecologies.

Table 1 Constellations of PBL

	<b>Constellation 1</b> Problem-based learning for knowledge management	<b>Constellation 2</b> Problem-based learning through activity	<b>Constellation 3</b> Project-led problem-based learning	<b>Constellation 4</b> Problem-based learning for practical capabilities	<b>Constellation 5</b> Problem-based learning for design based learning	<b>Constellation 6</b> Problem-based learning for critical understanding	<b>Constellation 7</b> Problem-based learning for multimodal reasoning	<b>Constellation 8</b> Collaborative distributed problem-based learning	<b>Constellation 9</b> Problem-based learning for transformation and social reform
<b>Problem type</b>	Designed to promote cognitive competence	Designed to promote learning through activity	Project-led	Practical resolution	Design-based	Knowledge with action	Managing dilemmas	Defined by team in relation to practice	Seeing alternatives
<b>Level of interaction</b>	Solving of problem	Management of problem	Team learning and practical action	Practical action	Activity-focused	Critique of knowledge, skills and context	Taking a critical stance	Critical Collaboration across boundaries	Exploring and deconstructing structures and beliefs
<b>Form of facilitation</b>	Directive	Activity-focused	Project management	Guide to practice	Project management	Coordinator of knowledge and skills	Orchestrator of learning opportunities	Enabler of group reflection	Decoder of cultures
<b>Focus of assessment</b>	Testing of knowledge	Competence for the world of work	Project management	Competence for the world of work	Design critique and professional capabilities	Use of capabilities across contexts	Integrate capabilities across disciplines	Self and team analysis	Flexible and student-led
<b>Example paper</b>	Alamro, A. S. & Schofield, S. (2012).	Chan, L. K., Lu, J., Ip, M. S. M., & Yip, A. L. M. (2012).	Hayashi, Y. (2013)	Beaumont, C., Savin-Baden, M., Conradi, E., & Poulton, T. (2012).	Ng, M. L., Bridges, S., Law, S. P., & Whitehill, T. (2013).	Good, J., Howland, K. & Thackray, L. (2008)	Beaumont, C. (2012).	Chan, L., Bridges, S. M., Doherty, I., Ng, M., Jin, J., Sharma, N., Chan, N. & Lai, H. Y. (2015).	Savin-Baden, M., Bhakta, R. & Burden, D. (2016)

## Threshold Concepts

Meyer and Land (2003) have argued for the notion of a 'threshold concept,' the idea of a portal that opens up a way of thinking that was previously inaccessible. Yet there seems to be a certain troublesomeness about the whole idea of threshold concepts. It is interesting that these are defined as 'concepts', not as 'knowledge' or 'learning', but as concepts. However, it is suggested here that threshold concepts should be located in a broader conceptualisation of students' disjunction. It will begin by suggesting that although the terms 'concepts' might be seen as both cognitively and ontologically positioned, there still needs to be a greater emphasis on the relationship between learner identities and threshold concepts than there is in some of the current research and literature to date. For example, the difficulty with the notion of locating ideas of troublesomeness around 'knowledge' 'concepts' or 'theories of difficulty' seems to somewhat dislocate the concerns from the identities and biographies of learners and teachers. Further, Davies (2006) has argued that threshold concepts can be located, noticed and identified as generalizable concepts that can necessarily be embedded in curriculum structure. Yet to argue for such a position immediately implies that threshold concepts are dislocated from learner identities.

Whilst this early definition did not specifically locate threshold concepts in disciplines, in fact all the arguments and examples were based in the disciplines. Examples include 'opportunity cost' in Economics, 'pain' in Physiotherapy and 'deconstruction for text analysis' in English literature. Threshold concepts results in a transformed way of understanding, something without which the learner cannot progress, and they have a number of key characteristics (Meyer and Land, 2003) that are summarised below:

- Irreversible: Given their transformative potential, threshold concepts are also likely to be irreversible, i.e. they are difficult to unlearn.
- Bounded: A threshold concept will probably delineate a particular conceptual space, serving a specific and limited purpose.
- Transformative: Once understood, a threshold concept changes the way in which the student views the discipline.

- Troublesome: Threshold concepts are likely to be troublesome for the student, for example when knowledge is seen to be counter-intuitive, alien or seemingly incoherent.
- Integrative: Threshold concepts, once learned, are likely to bring together different aspects of the subject that previously did not appear, to the student, to be related.

There have been a number of shifts away from ‘concepts’

*Conceptual threshold crossing:* are moments when students make the learning leaps start to work at this higher, more conceptual, critical and creative level. Building on theories of threshold concepts developed in undergraduate disciplines, notions of conceptual thresholds have been developed to identify those moments at which postgraduates make ‘learning leaps’, develop their identities as researchers, and start to work at a critical, conceptual and creative level suitable for the achievement of a doctorate (Kiley and Wisker. 2009).

*Threshold capabilities:* Baillie, Bowden and Land (2013) brought attention to threshold capabilities as thresholds to professional learning in a defined area of knowledge. Several capabilities combined will contribute to the development of overall knowledge capability, such as the ability to deal with previous unseen situations and to ‘think like a nurse’, rather than know a lot about a subject. Threshold capabilities are those capabilities that are thresholds to professional learning in a defined area of knowledge, so that the shift in ways of seeing the world occurs through the direct learning of a range of capabilities.

. . . and more recently

### Transdisciplinary threshold concepts

Transdisciplinary threshold concepts are defined here as: Concepts which transcend disciplines and subject boundaries, which are challenging and complex to understand, but once understood, the student experiences a transformed way of understanding, without which they would struggle to progress through the curriculum (Savin-Baden, 2016). It is argued here that whilst the idea of threshold concepts being located within disciplines is useful to a degree, these concepts need to

be broadened. Instead it is suggested that transdisciplinary threshold concepts are more helpful.

It would seem that

- 1) Students who are learning through PBL are often unaware of PBL as a learning approach, the process of getting stuck in learning, or the notion of transdisciplinary threshold concepts
- 2) Recognising common, transdisciplinary threshold concepts could improve student engagement in PBL
- 3) Facilitators who are aware of the impact of transdisciplinary threshold concepts in PBL are more likely to be able to enhance and support student engagement.

It is argued that there are 4 distinct transdisciplinary threshold concepts, summarised below in Table 2, that have an impact on student engagement with PBL, namely

- Liminality
- Scaffolding
- Pedagogical content knowledge
- Pedagogical stance.

### *Liminality*

The state of liminality tends to be characterized by a stripping away of old identities and an oscillation between states, it is a betwixt and between state and there is a sense of being in a period of transition, and an oscillation between states and personal transformation.

Liminality is a transdisciplinary threshold concept in student engagement in PBL because it is a complex, often covert, learning space. It is invariably a place of incoherence and confusion for students and is a threshold concept because students (and often tutors) do not realise or accept that liminality, and the processes involved in managing it, can enable students to adopt deep approaches to learning and emotional engagement with the knowledges put before them.

In terms of PBL, students struggle to know how to learn independently and to take up a pedagogical stance. The result is a shift into liminality which both students and tutors struggle to understand or accept.

## *Scaffolding*

There is a strong focus in higher education and particularly in professional education on the notion of scaffolding learning. The concept of scaffolding refers to the context provided by knowledgeable people to help students develop their cognitive skills. Scaffolding is a transdisciplinary threshold concept as students *believe* they need it and tutors *believe* they must provide it, since both consider it vital for students to learn the ‘correct’ information. In practice tutors who over scaffold can inhibit student learning and prevent both disjunction and resultant movement over any threshold. Further, scaffolding is a transdisciplinary threshold concept because most tutors do not understand that it can be unhelpful to the learning process, since they do not recognise the value of stuckness. Thus, removing or minimising scaffolding can enable tutors to improve student engagement in PBL, since it will assist students to move more effectively through the multiple learning portals available in the PBL process. Removing scaffolding is likely to increase the possibility of disjunction in a range of learning areas and thus promote threshold crossing

## *Pedagogical Content Knowledge*

Pedagogical content knowledge is central to the idea of thinking like an engineer, physiotherapist or teacher. While subject knowledge and pedagogical knowledge are perhaps self-evident, pedagogical content knowledge draws upon knowledge that is specific to teaching particular subject matter. Pedagogical content knowledge also includes an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring to their learning of those most frequently taught topics and lessons. Pedagogical content knowledge may draw on other forms of knowledge as well as knowledge from other disciplines. Students may have, for example, studied psychology in high school, but the use and portrayal of psychology in a medical or theology degree is reformulated to reflect the pedagogical content knowledge. The result is that knowledge for a particular discipline is taught and fashioned both in it and for it, and thus it is for many students a threshold concept. Few students realise that in order to think like an engineer, for example, they have to see knowledge through the lens of the discipline. However, perhaps more pertinently there is also an assumption by tutors that knowledge has to be gained in a particular way related to the pedagogy of the discipline. Tutors see their role as inducting (or forming) students into the

discipline, and rarely recognise their assumptions about pedagogical content knowledge or its impact on learning. Pedagogical content knowledge is a threshold concept because it is bounded; once tutors appreciate this they realise that knowledge, and the teaching of it, has to be seen afresh.

### *Pedagogical stance*

Pedagogical stance depicts the way in which students see themselves as learners in particular educational environments. The choices students make within a learning situation and the particular learner history which they bring to a learning environment all influence students' pedagogical stance. Pedagogical stance is a transdisciplinary threshold concept because tutors and students rarely recognise that they have a pedagogical stance, nor the impact it has on facilitation and student engagement. Types of pedagogical stance can be seen as transdisciplinary threshold concepts, in that they are stages through which students pass on the way to high level, deep engagement in learning. Thus, they journey across multiple thresholds on their way towards reflective pedagogy. However, many students in PBL appear to become stuck because of tutors' views of knowledge and the way in which they scaffold PBL.



Table 2 Summary of threshold concepts in student engagement in PBL

	<b>Irreversible</b>	<b>Bounded</b>	<b>Transformative</b>	<b>Troublesome</b>	<b>Integrative</b>
<b>Liminality</b>	The very nature of liminality means that it is irreversible after transition	Usually bounded by the issue that has resulted in the liminality	It is transformative since the liminality itself helps students to see the world anew	Liminal spaces are complex and uncomfortable by their very nature	Understanding the concept and value of liminality for learning is integrative
<b>Scaffolding</b>	The realisations that different forms of scaffolding available means students and tutors are unlikely to go back	This is bounded by the type of scaffolding adopted by tutor	This is transformative because high level flexible scaffolding prompts the valuing of scaffolding differently	Reviewing scaffolding results in questioning what has been required by the adoption of it	Recognising that some forms of scaffolding are valuable is integrative
<b>Pedagogical content knowledge</b>	The recognition of new forms of knowledge means there is little likelihood of returning to older views	This is bounded by the type of knowledge presented	New views of knowledge result in shifts in critical thinking	Dealing with different forms of pedagogical content knowledge challenges views about what counts as knowledge	Realising the existence and impact of pedagogical content knowledge is integrative
<b>Pedagogical stance</b>	Tutors and students are unlikely to return to a previous state once they have gained a new learning perspective	This is bounded by students' and tutors' perception of their stance	Changes in pedagogical stance enable new perspectives about knowledge values	Shifts in pedagogical stance prompt troublesome challenges to learner identity	Acknowledging the impact of pedagogical stance in learner identity is integrative

However, what has not yet been examined in-depth is the liminal tunnel:

### The liminal tunnel

Land et al (2014) describes the process of moving into the tunnel via a ‘portal or gateway’ triggered by the threshold concept or disjunction, and moving through the tunnel - through the liminal - space and coming out of the tunnel with a shift in learner subjectivity, a discursive shift, or a shift of a conceptual, ontological or epistemological nature. However, Land et al (2014) depict this transformation as a *cognitive* tunnel where the liminal space within the tunnel is entered when triggered by a threshold concept, or a ‘disjunction’, that challenges previous held ideas about something. Disjunctions (Savin-Baden, 2008) are ‘spaces’ or ‘positions’ accomplished through the realization that knowledge is troublesome, for instance after encountering a threshold concept, moving the learner into a liminal space that can be transitional and transformational. Learning in the liminal space often entails oscillation between different states and emotions. The liminal space is characterized by a stripping away of old identities, oscillation between states and personal transformation (Savin-Baden, 2008).

In a recent study (Fredholm, 2017 et al forthcoming) data were analyzed using the theoretical representation of the cognitive tunnel (Land et al. 2014). Students’ narratives described information about the disjunction, their experience of the liminal space and the resulting shift over the threshold. Instead of focusing on a cognitive tunnel as Land et al (2014) suggest, this was related to a particular practical experience functioning as a trigger for moving into the tunnel, learning in the tunnel and coming out ‘on the other side’ of the tunnel with a changed view. The driving force for movement through the tunnel was the students’ inner motivation for learning, originating from the perceived meaning of the practical experience. The self-evident nature of the practical experience, and the need to master these situations created movement and transformational learning. Table 3 depicts movement into, through and out of the tunnel with triggers and consequences.

Table 3 Depiction of movement into, through and out of the tunnel (adapted from Fredholm, 2017 et al forthcoming)

	<b>Triggers to movement</b>	<b>Consequences</b>
<b>Moving into the tunnel: experiencing disjunction</b>	Disjunction in form of an ontological experience	Feeling confused, stuck and frustrated. Experience challenge to previously held beliefs.
<b>Being in the liminal space: learning and developing in the tunnel</b>	Movement triggered recognition of need to learn and shift	Transitional learning and sometimes transformational learning
<b>Moving toward the end of the tunnel and crossing the threshold: the shift</b>	Movement triggered by a sudden or gradual understanding, a stripping away of old identity and personal transformation	An ontological shift evident in change in any or all of personal, professional, learner identity
<b>Exiting the tunnel</b>	Confidence gained though threshold shift	Seeing the world afresh and valuing the disjunction and subsequent shift

Thus, it is proposed here that the liminal tunnel is not merely cognitive as Land et al, (2014) suggest, but ontological. Liminal spaces within the liminal tunnel are suspended states and serve a transformative function, as someone moves through the tunnel. Within the tunnel people begin to re-examine their position, which is not cognitive but ontological, and in doing so see the terrain that they then choose to move through towards the end of the tunnel. The notion of an ontological liminal tunnel carries with it the idea of movement from one place to another and with it the necessity of taking up a new position in a different place.

#### *Temporary tunnels*

These are characterised by boundaries in time and space, they are usually reflective activities, rites of passage and temporary disjunction. Temporary tunnels tend to result in transitions rather than transformations.

#### *More or less permanent tunnels*

These are in a sense liminal states in which one lives, such as the priesthood, serial and long-term travellers and politicians; and possibly serial students and authors. Permanent tunnels are where transformations occur.

The difference between transitional and transformational spaces is that in a transitional space there is a sense of shifting from one place to another, whereas in a transformational space there is a sense of life-shifts, of knowing the world differently in living, working and learning contexts. Such shifts in the 21<sup>st</sup> century require an ability to live liquid lives.

## Discussion

What learning means appears to be more contested than ever, yet social media and networks should be offering us some purchase on the ways in which students consider and enact learning. Learning a module of some subject is no longer enough. What matters is shaping learning so that it enables students to engage in problem management along with a desire to mess around in order to understand and transform their learning lives in liquid ways, so that learning leaks across the various boundaries of their worlds.

Students should bring all their different kinds of learning capabilities to the classroom. They should not be required to leave behind the sophisticated abilities that they have developed through networked publics, contained in some kind of hidden mediascape. The ways in which we operate in/on the internet do seem largely to mirror current society, but things are just shared (faster) on a bigger and wider stage than they used to be. Learning is also on the move; lives are liquid. There is also a need to abandon efforts to codify people's lives by using signs, signposts and maps. Instead, we should do what Fuller (2010) suggests and ensure that higher education is a place of creativity, filled with moments of experimentation. Fuller (2010) asks: what difference does university make if everything produces knowledge or is in the business of knowledge production? His stance is Humboldtian. He argues for the importance of the lecture and suggests that many academics today do not really understand its premise or the important synergy between research and teaching. The university is not just about passing on knowledge. It is about the exploration of wisdom and knowledge: *sapere aude* – 'dare to be wise' or 'dare to know' – was originally used by Horace, but it is more often cited in relation to Kant's seminal essay, *What is Enlightenment?* Fuller asks: how do you prepare a generation to dare to know, to think for themselves? For Fuller, hiring lecturers to give lectures where what they speak about is reducible to PowerPoint presentations means it isn't/shouldn't be worth hiring/hearing; nor, I suggest, is it likely to reflect an increasingly needed Humboldtian research–teaching nexus. Freedom, for Fuller, is not innate; it is learned,

and therefore one needs to discover what one needs to know to be free. Lectures should raise problems and questions for students, not just pass on knowledge. Being free involves discrimination and making judgements. There is a need for staff to have the capacity to improvise, enquire and take intellectual risks. If we can record things or deliver the same lecture accurately in the same way time and again, we will be replaced.

## Conclusion

There is little question that we are experiencing technology learning lag in higher education in general and problem-based learning in particular world-wide, but we seem to be both lacking and lagging in liminality too. Although our students and their liquid learning lives are located and positioned, to a large extent, by market forces, government agenda and our problem-based curricula, they will still question and oppose us and the systems we inhabit; they will not be bounded nor stay still. This is our challenge.

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