

Embedding a Threshold Concept in Teaching and Learning of Product Development Management

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Within specific disciplines there exist significant ‘threshold concepts’, leading to new and previously inaccessible ways of thinking about something.

(Meyer and Land, 2005)

This paper examines...

- ...the application of threshold concepts in product development teaching and learning.
- ... an undergraduate degree course in Trinity College Dublin, linking the theory to teaching principles and to learning activities.
- The students are drawn from two separate disciplines with their own unique ‘ways of teaching and practicing’ (Entwistle, 2005): business and manufacturing engineering, creating an opportunity to combine curriculum content and teaching practice from both disciplines.

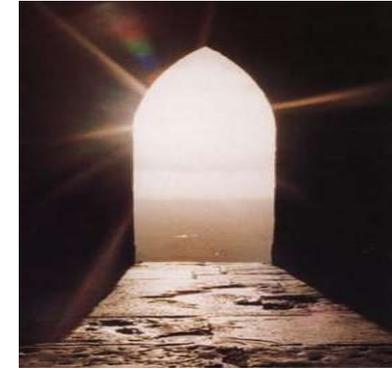
New product development management practice...

- ...is moving towards a multifunctional and cross-disciplinary focus which means that university graduates need to be able to deal with *non-linearity, emergence* and *self-organization*.

Here there is a challenge facing teachers

<p>How to <u>Talk</u> with</p> <p>If you <u>Think</u> like</p>	<p><i>Engineer</i></p>	<p><i>Manager</i></p>
<p><i>Engineer</i></p>	<p><u>Starting point:</u> Once the technical issues are solved, the rest is routine</p>	<p><u>Arrival point:</u> There is a complex set of interactions to be managed in order to get the product from idea to market</p>
<p><i>Manager</i></p>	<p><u>Arrival point:</u> There is a complex set of interactions to be managed in order to get the product from idea to market</p>	<p><u>Starting point:</u> Once the commercial decision is made to develop, the rest is routine</p>

Threshold Concepts are...



...akin to a portal opening up a new and previously inaccessible way of thinking about something.

...represent a transformed way of understanding, or interpreting, or viewing something without which the learner finds it difficult to progress, within the curriculum as formulated.

What are the characteristics of a threshold concept?

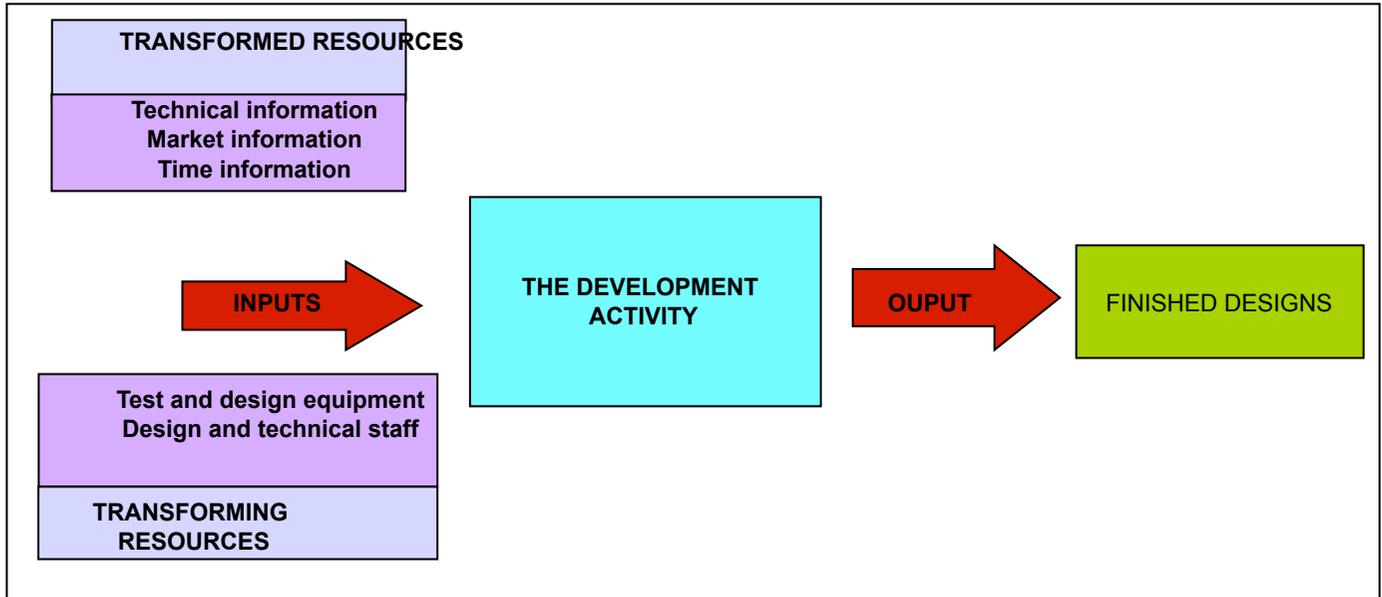
- transformative
- irreversible
- integrative
- bounded
- troublesome

**The “Managing New Product Development”
course challenges students to analyse such issues
as...**

- Success & failure in new product development
- The strategic dimension of new product development
- The product development process
- Organisational interfaces in new product development
- Incorporating design into the new product development process
- Target costing and value engineering
- Design for manufacture
- Evaluating and improving the new product development process

Viewing product development as a complex adaptive system (CAS)...

- ...provides a framework for managers and engineers to manage and to improve this area.
- Three related but different perspectives on product development used in the MNPD course together lead to the embedding of CAS as a threshold concept:
 - Product development as a linear conversion process
 - Product development as a recursive system
 - Product development as a complex adaptive system



Product development as a basic **LINEAR** conversion process

1

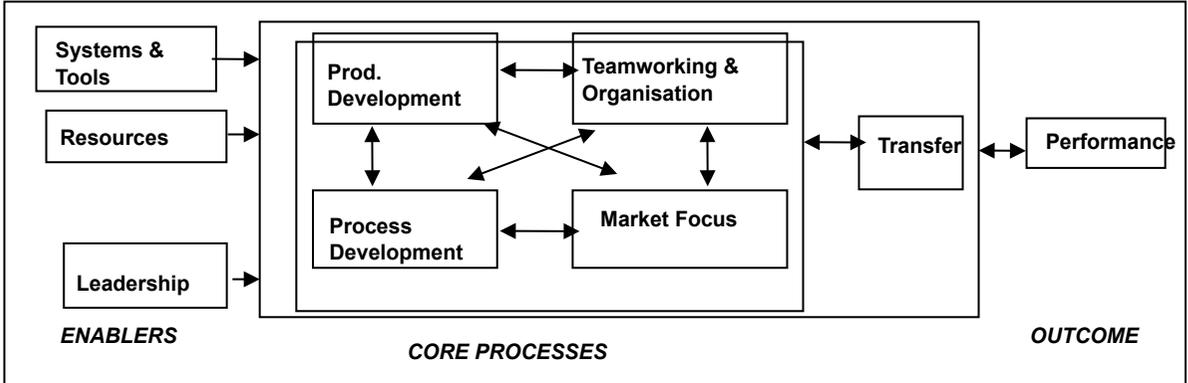
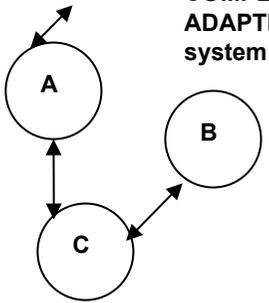
- Obsolescence
- Ruptturing
- Thinker toys
- Confidence
- Challenging within/between disciplines

2

Product development as a **RECURSIVE** set of core and enabling processes

3

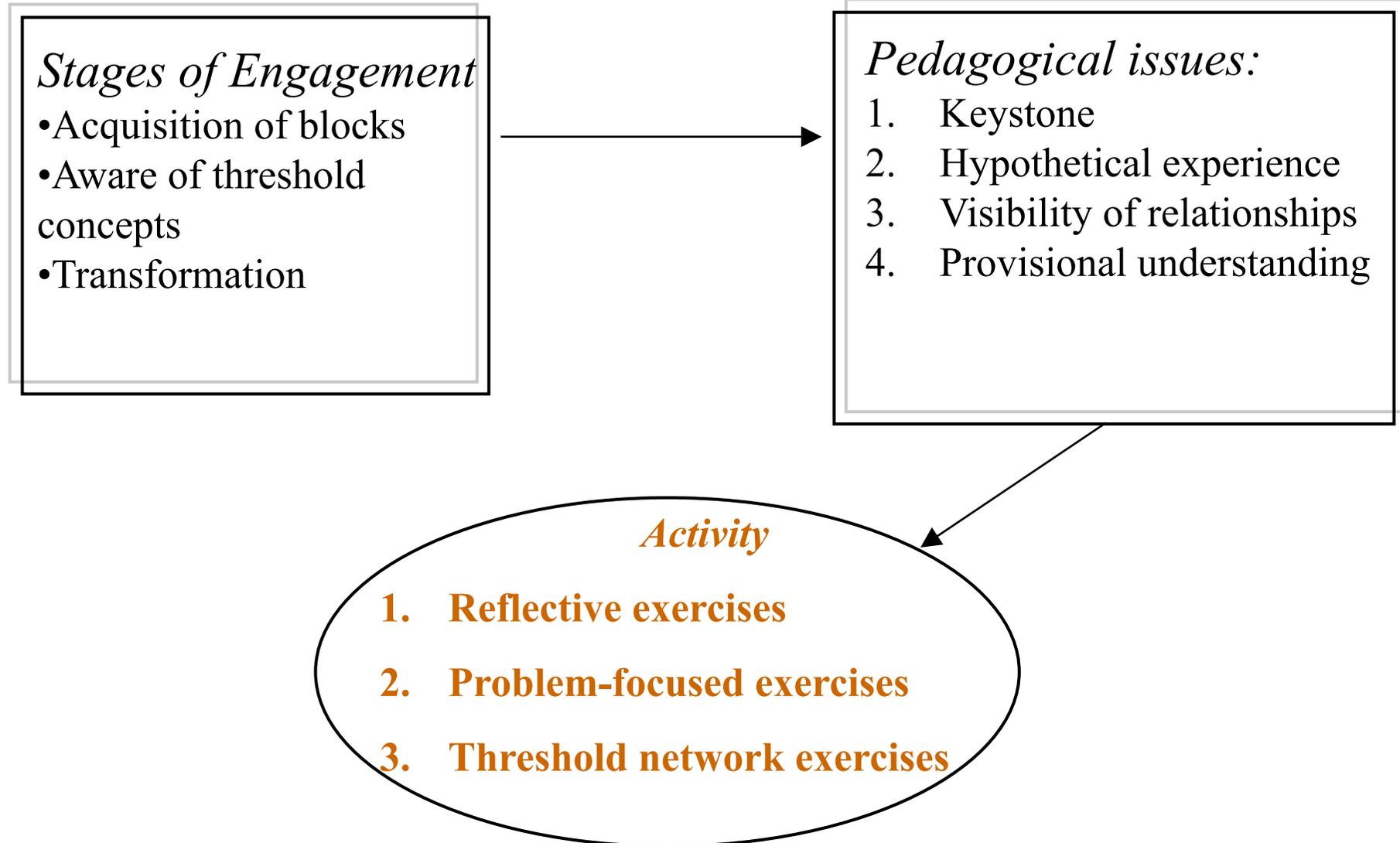
Product development as a **COMPLEX ADAPTIVE** system



Reflecting on product development as a CAS in terms of a threshold concept

<i>Attribute</i>	<i>Evidence</i>
Transformative	The concept of product development as a CAS challenges the student's perception of themselves and of the subject
Irreversible	The student does not return to viewing the area as a function or a technical task
Integrative	The scope of the core and enabling processes brings together a variety of discipline and functional areas to be managed
Bounded	The scope of the core and enabling processes at the levels of the firm and of the project helps to define the boundaries of a subject area and clarifies the scope of the communities of research and practice
Troublesome	Seeing product development as a CAS is taken for granted by many practitioners. The associated knowledge is tacit, alien to disciplinary-bounded students, and conceptually difficult

Helping Learners To Identify Threshold Concepts is difficult



Product Development as a CAS – Pedagogical Issues and Principles

<i>Pedagogical Issues</i>	<i>Pedagogical Principles and Activities</i>	<i>Application to the MNPD Course</i>
The threshold concept acts as a <i>keystone</i>	Highlight variation to ensure sufficient foundation of basic concepts	Product development as a CAS brings form and robustness
The threshold concept is <i>distant initially</i> from direct experience and can only be experienced hypothetically	Integrate understanding through re-working previously acquired concepts in the light of the threshold concept	The hypothetical experience of product development as a CAS is experienced through comparative case analysis
The threshold concept becomes <i>visible</i> through engaging in a new way of practising and of thinking	Expose how scholars use procedural thresholds by highlighting variation in the use of key procedures	Product development as a CAS becomes visible through the field project
The acquisition of a threshold concept <i>transforms understanding</i> of previously acquired subject knowledge	Help students to regard their understanding as provisional and to tolerate uncertainty	The sequential presentation of each perspectives develops provisional subject knowledge

Feedback has come from a number of sources...

- CAPSL surveys
 - 99% found the course good or excellent
- The project
 - ‘Overall, this [course] has been one of the most enjoyable and worthwhile in a practical sense, not just this year, but in my entire college career’.
 - ‘The project enabled us to gain tremendous insight into the practical application of the theory we had studied throughout the course. Many of the issues that we identified within (the company) were similar to those we had seen in the case studies in class and the experience complemented our learning greatly. Likewise, it was helpful to have covered cases beforehand which aided us in understanding the kinds of issues facing [such companies]’.
- The project companies
 - ‘The management team are very impressed with the assessment of the company by [the students]’.

So, in summary

- From a pedagogical perspective, a threshold concept has potential to encourage students towards deep rather than surface learning
- It is best introduced when students have
- acquired sufficient subject knowledge to develop and to practise an integrated understanding.
- Embedding the concept requires that it becomes visible through engaging in a facilitated way of practising and of thinking where students accept that, at each stage in their learning, their understanding is provisional.