

**Analysis and design for  
complex learning ...**  
environments  
networks  
systems  
spaces  
(etc)

Peter Goodyear  
Centre for Research on Learning & Innovation  
(CRLI)  
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## Overview

1. The production of educational design knowledge  
Knowledge that is useful to people who design (for learning)
2. R&D from *inside* the (learning) system: its architecture, how it functions, etc ... **analysis**
3. Activity-centered analysis and design (ACAD)
  - Focus on what students actually do (their activity)
  - Distinguish carefully between what can be designed in advance and **what happens at 'learntime'**
  - Design components: *what should we offer?*
  - Entanglements: *how does this work?*
4. Integrating multiple forms of knowledge & ways of knowing
  - Designers, design knowledge and epistemic fluency
  - Students as designers of their own learning (environments, networks ... )

## Ed Tech as a discipline or field



Education Trends  
Why It's Time for Education Technology to Become an Academic Discipline

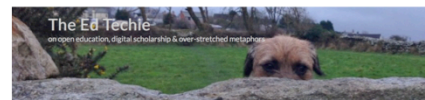
19 Sep 2016



Audrey Watters on 28 Sep 2016  
hackededucation.com

The University of Sydney

Tom Reeves on 26 Sep 2016, Facebook



Ed Tech as discipline

Sep 27, 2016

Ed Tech

Martin Weller on 27 Sep 2016  
blog.edtechie.net

Page 3

## Ed Tech as a discipline or field



### Reeves

- outrage at ignorance (how would a geologist feel if someone who knew nothing about the field decided studying rocks would be a good idea)
- maybe it's our fault for being too insular

### Weller

we have a lot of the apparatus of a professional field (journals, conferences, professional accreditation schemes), but people come into Ed Tech with very partial knowledge of the field – maybe we need:



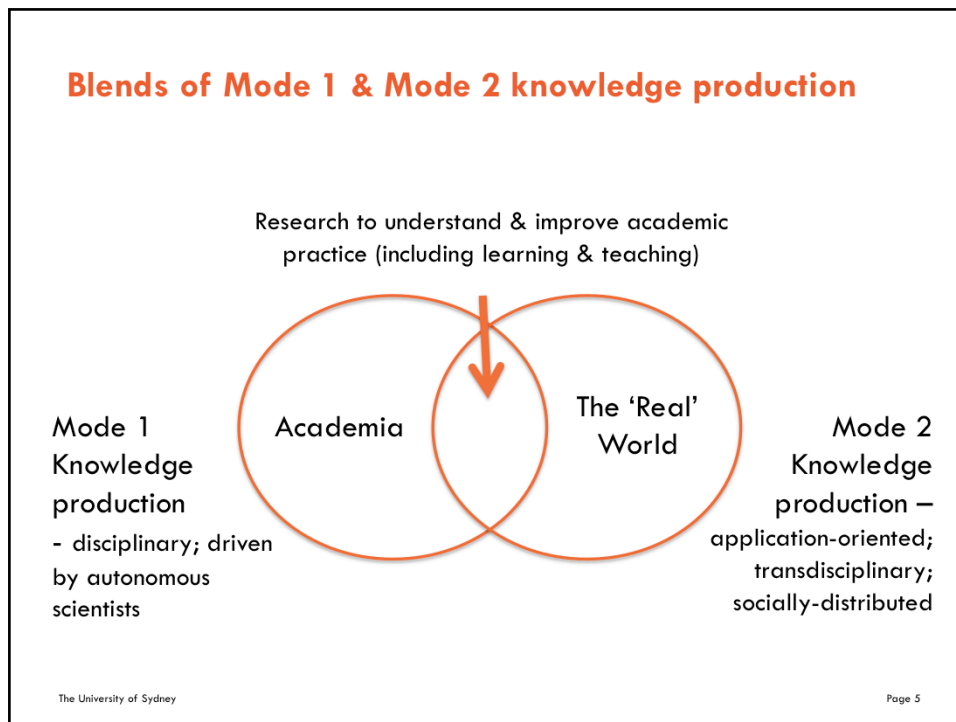
- undergrad degrees; canonical body of texts – and something solid for critical work to push against
- greater intellectual rigour – good principles/process for evaluating evidence



### Watters

- we need 'undisciplining'
- 'utter lack of criticality'
- ed tech can't see its own disciplinary practices, mechanisms, technologies





EDR/DBR for/in HE sits in what can be an awkward space – neither Mode 1 nor Mode 2; or a bit of both

It's a space in which different drivers/shapers of research rub against each other – friction, not nec. productive

Not surprising that there's uncertainty about appropriate forms of research etc

In passing; this space is (a) potentially key to improving the quality, effectiveness, efficiency, productivity etc of Australia's 3<sup>rd</sup> biggest export earner (after iron & coal), yet (b) under-resourced – with the scrapping of ALTC/OLT, (c) structurally disadvantaged – eg hard to get Linkage grants; definitions of 'non-academic' impact/engagement don't work smoothly here.

## Key questions/uncertainties in our field/discipline

- What counts as useful knowledge?
  - functional x critical; general principles x locally applicable
- How should such knowledge be produced?
- Who should be involved in this knowledge production work?

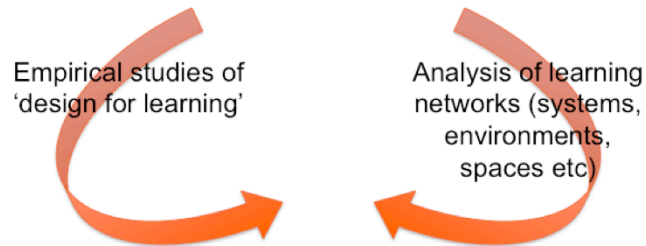
Exacerbated by:

- Marginalised/subordinate status of ed techs in academia

Despite being at the confluence of two of the great shaping forces of our time:

- Knowledge economy; intellectual capital; innovation; learning
- Technology (digital; hybrid)

## Learning, technology and design: architectures for productive networked learning



Research as analysis (of learning networks, systems etc) to  
create *actionable* knowledge *for design*

Research on methods for analysis & design, especially to  
enhance collective/participatory design processes

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Page 7

cf Phil Levy (2003) Networked action research.

## Design knowledge & design research

Design research: an activity capable of producing knowledge useful to those who design – that is, design knowledge

- Research *for* design: produces better conceptual and operational tools for designing
- Contrast with research *through* design (where the emphasis may be more on refining theories of learning, for example)



Motives for design research include:

- Increasing scale & complexity of challenges tackled by design teams
- Design is increasingly distributed among numerous actors, who can work better if they share some design knowledge (shared ways of representing, discussing and making decisions about what exists and what is needed)

x-ref Cross and Laurillard

Manzini, E. (2015). Design, When Everybody Designs: An Introduction to Design for Social Innovation. Cambridge MA: MIT Press. (interactions between diffuse & expert design)

## What does 'analysis' mean (in ed tech/ed design)?

Analysing a problem;  
needs analysis; performance (gap)  
analysis; task analysis; content analysis  
Analysing what students  
currently know and need to know  
Analysing contextual issues, constraints on  
poss designs etc

Especially suitable for new  
courses, programs, learning  
resources etc: "Greenfield sites"  
e.g. ADDIE

**Analysing what already exists  
and how it works**

**Shortage of tools & methods  
for this**

"In medias res" as the norm:  
we are rarely working on a  
greenfield site

Goodyear, P., & Dimitriadis, Y. (2013). *In medias res: reframing design for learning. Research in Learning Technology*, 21. doi:<http://dx.doi.org/10.3402/rlt.v21i0.19909>

## As the VC\* sees it

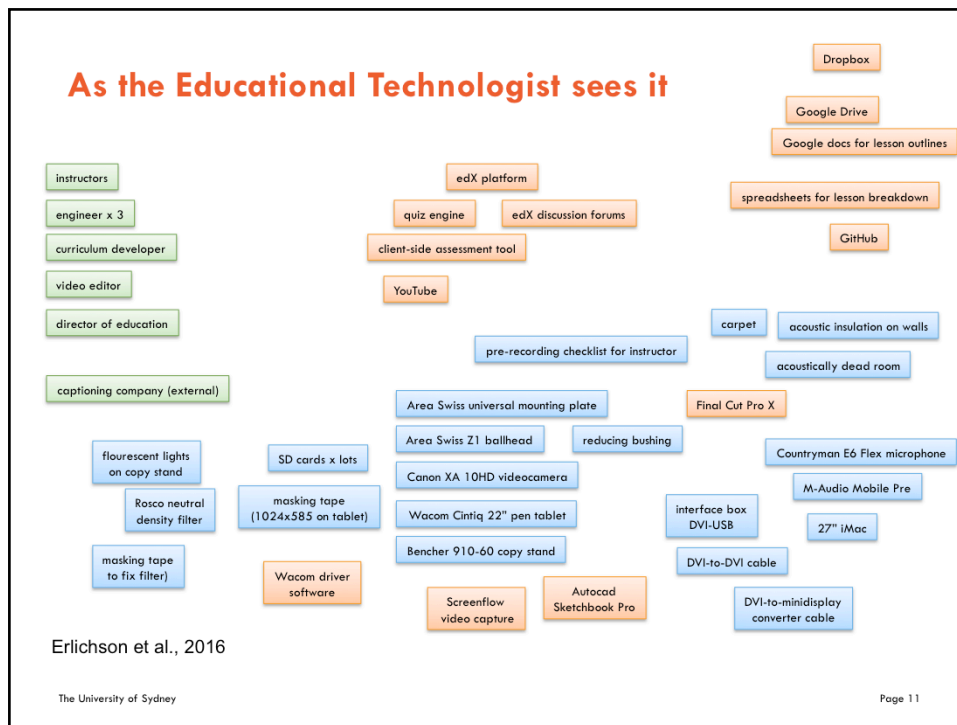


**VC\* - could be Vice Chancellor; could be Venture Capitalist**

<http://www.sciencesmaths-paris.fr/upload/Contenu/Photos%20cours%20et%20images/CaucherBirkar.jpg>

<http://cdn1.ustream.tv/zendesk/forums/cameras/hpx170.png>

<https://www.edx.org>



<https://university.mongodb.com/about/how-mongodb-university-online-courses-are-produced>

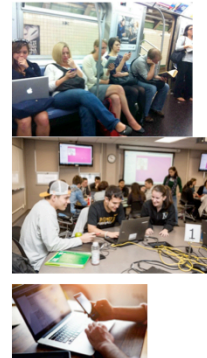
This is mainly 'Khan academy style' lecture + realtime handwritten text/diags – instructor's hand & gestures as well as what they write/draw

Notes:

- 1) There are 5 pages of instructions on essential customisation to Sketchbook Pro before first use – default pen & canvas sizes etc and 7 pages of instructions about how to composite & edit the video
- 2) Also 2-3 pages on the promotional headshots they do for each course & on curriculum dev & costs

"As you can see from the process above, designing good online classes is a significant amount of work and planning" !!

## As the Educational Technologist sees it



“As you can see from the **process** above, designing good online classes is a significant amount of work and planning”  
(Andrew Erlichson, Jerzy Fischer, and Shannon Bradshaw, 2016)

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Page 12

<https://university.mongodb.com/about/how-mongodb-university-online-courses-are-produced>

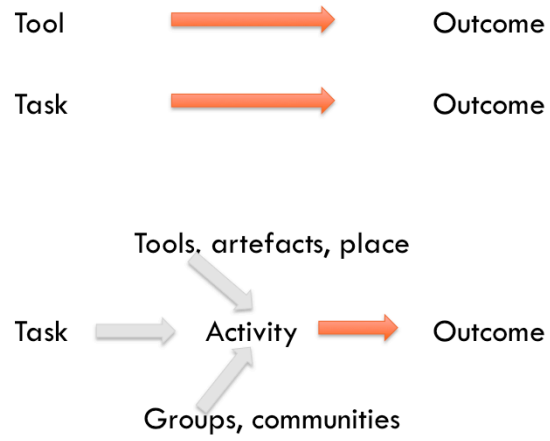
Their use of the term ‘above’ refers to the main text of their article which is really a process description (20pp) – this diagram is our creation & merely maps out the tools, artefacts, software programs, and key personnel involved.

Moreover – when we are thinking about analysing the learning environment (etc) we’re not just thinking about how learning objects get produced; that’s only part of the story.

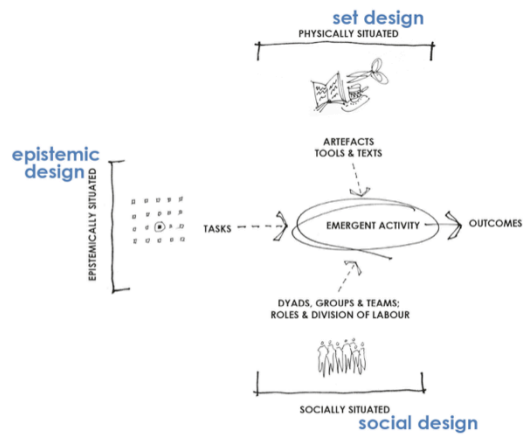


Architecture of the NALA network (Pinto, 2014)

**From analysis to design:**  
**what matters is ... *what the student does***



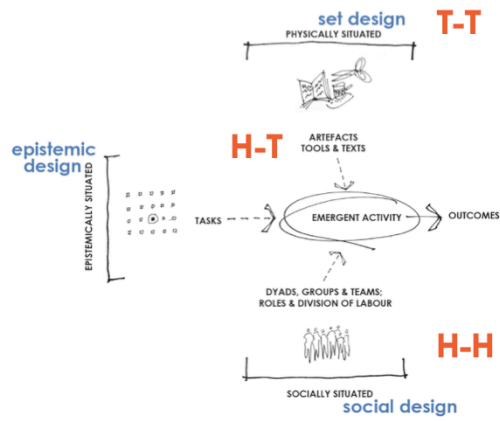
## Activity-Centered Analysis and Design (ACAD) framework



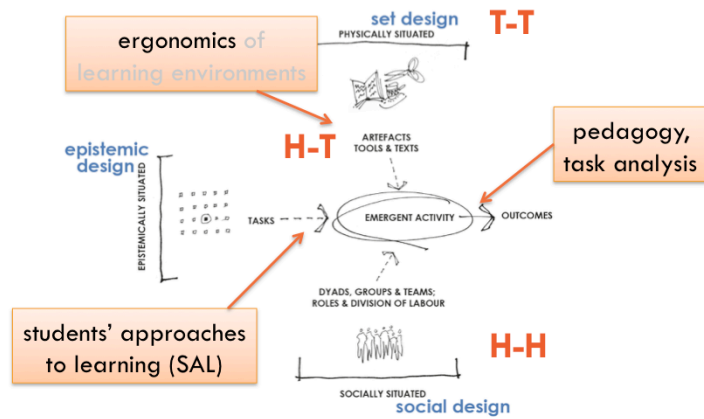
### Activity centred analysis and design: some core tenets

- Activity is central ... what people are actually doing (thinking, feeling, etc) really matters – it is consequential
- Activity is physically, socially and epistemically situated
- Activity cannot be designed – it emerges [indirection]
- Design can lead to the creation of artefacts, places, divisions of labour, tasks etc that situate and influence activity, but rarely determine it. Design issues invitations.
- Activity can involve the (collective) reconfiguration of artefacts, tools etc: it can cause lasting changes in the learning environment (network, system ...)
- Design is often distributed, but distributions vary between networks/systems and over time

## Design knowledge that helps with reasoning about relations between humans & things



## Design knowledge that helps with reasoning about relations between humans & things



## Representation and collective (re)design (1/2)

Challenges in the evolution of a learning network (system etc) where design solutions are not self-evident (including 'wicked' problems, where criteria for judging between solutions are not self-evident)

May require the invention of means of inquiry (methods of analysis and representation)

Three coupled processes:

- a shared commitment to action (skin in the game)
- use of structured discussion to create a shared (temporarily stabilised) conception of what action should be taken
- production of models/representations of problem(s) and candidate solutions ( $\approx$  how the network/system functions; how it might function better in the future), as resources for structured discussion

(Ison & Blackmore, 2014)

## Representation and collective (re)design (2/2)

Choices can be made about representations in terms of

how they are meant to function in a structured discussion, which is  
(in turn) being used by a team of people who are invested in, and committed to,  
taking some design action

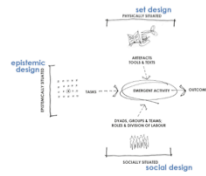
Particular appropriate in the context of 'participatory design'

understood as a paradigm in which people are designing for their collective good,  
and as a practice in which joint inquiry and structured decision-making processes  
are needed in order to make progress with complex, even wicked, problems

ACAD as a way of helping participants in learning network/  
system converge on ways of representing key aspects of how it  
functions:

- broad brush (e.g. Carvalho & Goodyear 2014 book), or
- specific areas of activity & infrastructure seen as problematic

## Cyclic/spiral process: incremental adjustment



analysis &  
(re)design

'runtime' or  
'learntime'

'entangled'  
activity system

But aren't you just talking about DBR/EDR?

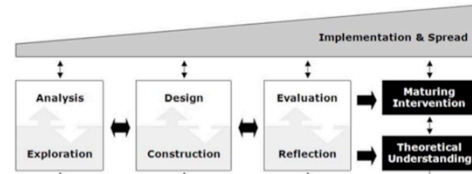
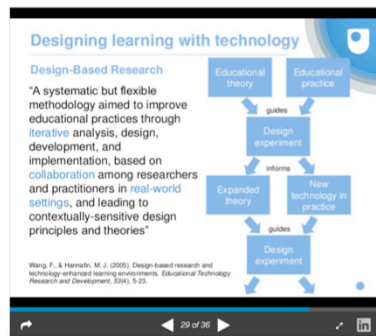


Figure 1. McKenney and Reeves (2012; p.159) generic model of Educational Design Research (EDR).

Or better use Tom Reeves et al 2011.

## The paradox of (educational) design (-based) research

DBR: ostensibly an approach to working with the complexities of real learning environments; sheparding a theory-informed educational invention into practice & deriving publishable insights (theory, design principles etc)

- making academic educational research more relevant to practice (Reeves, McKenney, Herrington, 2011)
- mapping & testing design conjectures; refinements to learning theory (Sandoval, 2014)

BUT, this is the tail wagging the dog; we need to focus inquiry on the key phenomena without an *a priori* goal of contributing to such-and-such a literature; else we distort the approach from the outset. [How do design principle &/or LT agendas distort how we frame phenomena?]

DBR doesn't take *design* seriously; or analysis

DBR insists on researchers as protagonists; but ed teams can do inquiry without leadership from academic researchers (and become researchers)

Reeves, T., McKenney, S., & Herrington, J. (2011). Publishing and perishing: The critical importance of educational design research. *Australasian Journal of Educational Technology*, 27(1), 55-65.

(was also an award winning paper at ascilite 2010)

Sandoval, W. (2014). Conjecture mapping: an approach to systematic educational design research. *Journal of the Learning Sciences*, 23(1), 18-36.

Wozniak, H. (2015). Conjecture mapping to optimize the educational design research process. *Australasian Journal of Educational Technology*, 31(5).

Table 1: A family of approaches to endogenous service innovation

	Approach	Sources
E	Action learning	Pedler, 2011
	Action research	Lewin, 1952
E	Community-based design research	Bang et al, 2016
	Creative communities	Manzini, 2005
	Design anthropology (emic; etic)	Gunn et al., 2013
E	Design-based implementation research	Fishman et al., 2013
E	Design-based research	Kelly et al, 2008
E	Expansive learning	Engeström & Sannino, 2010
E	Formative interventions	Engeström et al., 2014
	Formative/developmental evaluation	Patton, 2010
	Lean <u>startup</u>	Gong & Janssen, 2015
	Participatory design	Schuler & Namioka, 1993
E	Participatory design research	Bang & Vossoughi, 2016
	Participatory action research	Whyte, 1991
E	Practice-based research	Levy, 2003
	Rapid prototyping	Connell & Shafer, 1999
	Second order cybernetics;	Sweeting, 2016
E	Self-managing learning ecologies	Ellis & Goodyear, 2010
	Soft Systems Methods	Pries-Heje et al, 2014;
E	Social design experiments	Gutiérrez & Vossoughi, 2010
	Theory-based/driven evaluation	Coryn et al., 2011
	Transformation design	Burns et al., 2006

Note: E in column 1 denotes an approach originating in, or best exemplified by, research and practice in education.

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Page 24

The refs above can all be found below:

## References

- Aditomo, A., Goodyear, P., Bliuc, A.-M., & Ellis, R. A. (2013). Inquiry-based learning in higher education: principal forms, educational objectives, and disciplinary variations. *Studies in Higher Education*, 38(9), 1239-1258.
- Bang, M., Faber, L., Gurneau, J., Marin, A., & Soto, C. (2016). Community-based design research: learning across generations and strategic transformations of institutional relations toward axiological innovations. *Mind, Culture, and Activity*, 23(1), 1-14.
- Bang, M., & Vossoughi, S. (2016). Participatory design research and educational justice: studying learning and relations within social change making. *Cognition and Instruction*, 34(3), 173-193.
- Baranova, P., Morrison, S., & Mutton, J. (2010). *Service design in higher and further education: A briefing paper*. CETIS, University of Derby.
- Beetham, H., & Sharpe, R. (Eds.). (2013). *Rethinking pedagogy for a digital age: designing and delivering e-learning*: RoutledgeFalmer.
- Blomkvist, J. (2015). *Ways of seeing service: surrogates for a design material*. Paper presented at the Nordic Design Research Conference.
- Boder, A. (1992). The process of knowledge reification in human-human interaction.



## Combining incremental change with radical rethinking

Structural critiques of normative hierarchies of power and  
imagined possible futures

PLUS

Consequential impacts in the here and now.

(Bang & Vossoughi, 2016, 174  
Participatory Design Research)

Monitoring inequitable distributions of benefits (and costs)

Deeper, forward-looking analysis of what outcomes are most  
valuable

Helping students learn to how to reconfigure their own learning  
spaces (environments, networks ...)

Bang, M., & Vossoughi, S. (2016). Participatory design research and educational justice: studying learning and relations within social change making. *Cognition and Instruction*, 34(3), 173-193. doi:10.1080/07370008.2016.1181879

<https://epistemicfluency.com>

Epistemic fluency involves a set of capabilities that allow people to recognize and participate in different ways of knowing, using different forms of knowledge. Such people are adept at combining different kinds of specialised and context-dependent knowledge and at reconfiguring their work environment to see problems and solutions anew.

- TT relations x HH or HT relations
- local x general x universal knowledge
- identifying what knowledge (and kinds of knowledge) are appropriate for the design task at hand
- designing appropriate forms of inquiry/analysis etc
- *learning how to (re)configure one's environment – surround oneself with helpful tools, resources, people etc – to tackle novel problems.*

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Page 27

Markauskaite, L., & Goodyear, P. (2016). Epistemic fluency and professional education: innovation, knowledgeable action and actionable knowledge. Dordrecht: Springer.

## Acknowledgements:

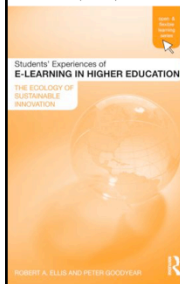
Laureate team: Lucila Carvalho, Kate Thompson, Roberto Martinez Maldonado, Beat Schwendiman, Dewa Wardak, Pippa Yeoman, Ana Pinto, Martin Parisio, David Ashe  
Australian Research Council, Laureate & other funding  
Rob Ellis, Simos Retalis, Maarten de Laat, Lina Markauskaite, Yannis Dimitriadis



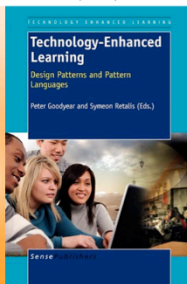
**Slides, references, follow up:**

<https://petergoodyear.net>  
[peter.goodyear@sydney.edu.au](mailto:peter.goodyear@sydney.edu.au)

Ellis & Goodyear  
(2010)



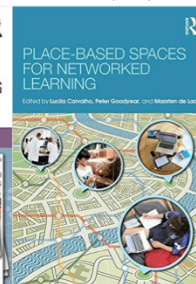
Goodyear & Retalis  
(2010)



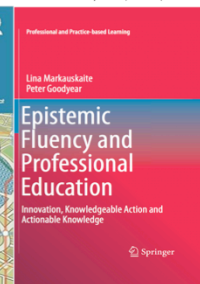
Carvalho & Goodyear  
(2014)



Carvalho, Goodyear &  
de Laat (2016)



Markauskaite &  
Goodyear (2016)



## Design Principles Database

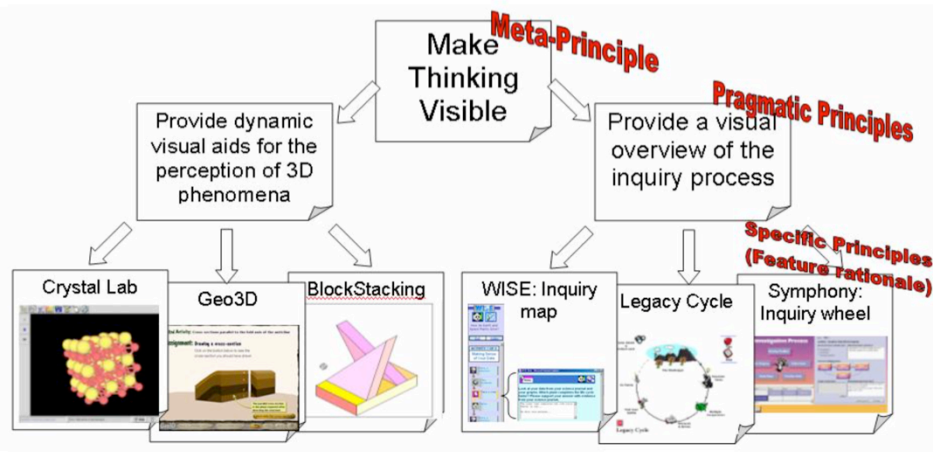
*feature*: any effort to use technology to advance learning ... designed artifacts, or parts of artifacts, such as modeling tools, simulations, micro-worlds, visualizations, collaboration tools, games, and assessment tools.

*learning environment* as a system that incorporates a set of *features* along with a navigation system and curriculum materials.

*design principle* to refer to an abstraction that connects a *feature* to some form of *rationale*. Design principles can be at several levels of specificity. Principles can link to one feature, to several features, and can link several principles together. Design principles emanate from and connect to theories of learning and instruction

<http://www.edu-design-principles.org>

The design principles project has stimulated the development of an emergent vocabulary to communicate design ideas. Terms used in the database follow: We use *feature* to refer to any effort to use technology to advance learning. In particular, we use *feature* to describe designed artifacts, or parts of artifacts, such as modeling tools, simulations, micro-worlds, visualizations, collaboration tools, games, and assessment tools. We define a *learning environment* as a system that incorporates a set of *features* along with a navigation system and curriculum materials. We use *design principle* to refer to an abstraction that connects a *feature* to some form of *rationale*. Design principles can be at several levels of specificity. Principles can link to one feature, to several features, and can link several principles together. Design principles emanate from and connect to theories of learning and instruction



<http://www.edu-design-principles.org>

## Ed tech as a discipline

“To practice a discipline is to be a lifelong learner on a never-ending developmental path.

A discipline is not simply a ‘subject of study.’ It is a body of technique, based on some underlying theory or understanding of the world, that must be studied and mastered to put into practice.

As you develop proficiency, your perceptual capacity develops; you gradually surrender to new ways of looking at the world.” (Senge et al., 1994, p7)

## Design anthropology [probably cut]

The creativity of design is not found in

“prefigured solutions to perceived environmental problems but in the capacity of inhabitants to respond with precision to the ever-changing circumstances of their lives ... *finding the grain of the world's becoming* ... [and] bending it to an evolving purpose ... opening up pathways rather than setting targets” (Gatt & Ingold, 2013, p145, our emphasis).

Underestimates the complexity of some of the binds in which people find themselves – traps people in a world they can directly sense

Analytic representations as tools for shared inquiry, sense-making and action rather than as claims to truth