

# Computers in Education: Reflections on Learning, Technology and Design

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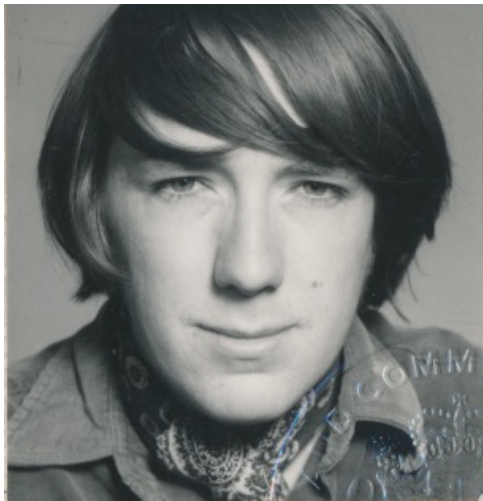


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Australia

28<sup>TH</sup> INTERNATIONAL CONFERENCE ON COMPUTERS IN EDUCATION

23-27 November 2020





# Reflecting on practices of co- designing for computer- based educational activities

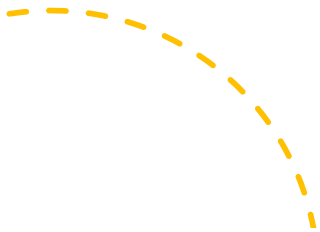
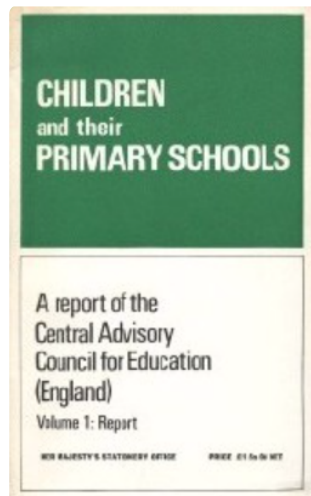
1982, South East London

- 20 primary school teachers ('early adopters'; very experienced, enthusiastic teachers of young children; mostly inner city)
- Me: Lecturer in Computing, Teacher Training College; no specialist educational knowledge or qualifications
- Pedagogical foundations: Piaget & Papert?
- Small group discussions, me demo-ing software programs available, them imagining potentially worthwhile educational activities, planning ancillary resources etc



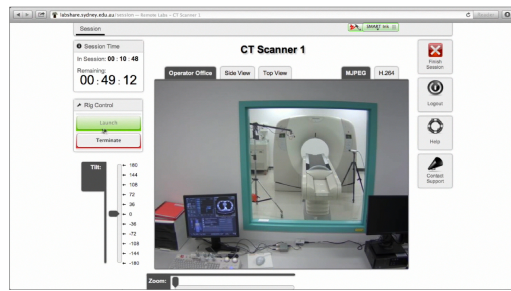
# Ideas about Learning as manifest in our work then

- “Useful little programs” (ULPs) – brainstorming, discussing and refining possibly useful educational activities pivoting on a “ULP”
- “Solutions in search of a problem”
- Primary school teachers - confident in their ability to improvise worthwhile talk/learning opportunities around emergent student activity
- Grounded in deep, local sense of “what works”, a “folk psychology” of learning and a knowledge of, and confidence in, a robust Primary curriculum – itself reflecting child-centred education principles and constructivist beliefs. [Plowden report, 1967]



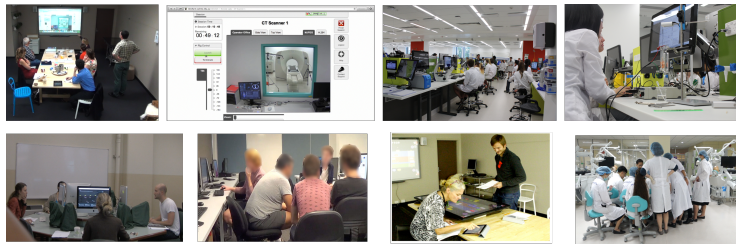


# Ideas about Learning as manifest in our work currently



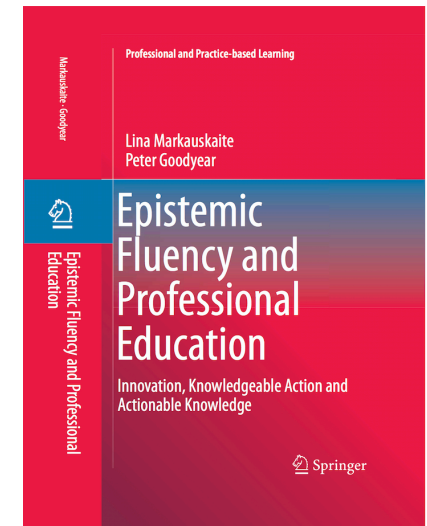
Understanding, designing, enhancing hybrid (complex, digital-material) learning spaces

# Ideas about Learning as manifest in our work currently



Understanding, designing, enhancing hybrid learning spaces, for

- Discipline and/or profession-specific concepts, skills etc
- 'Generic' skills and dispositions (e.g. learning to work well with others)
- Learning to harmonise multiple forms of knowledge and ways of knowing, as the situation demands
- Learning to inquire and to design new forms of inquiry
- Learning to create and customize epistemic environments



M&G 2017, esp Chapters  
19 & 20



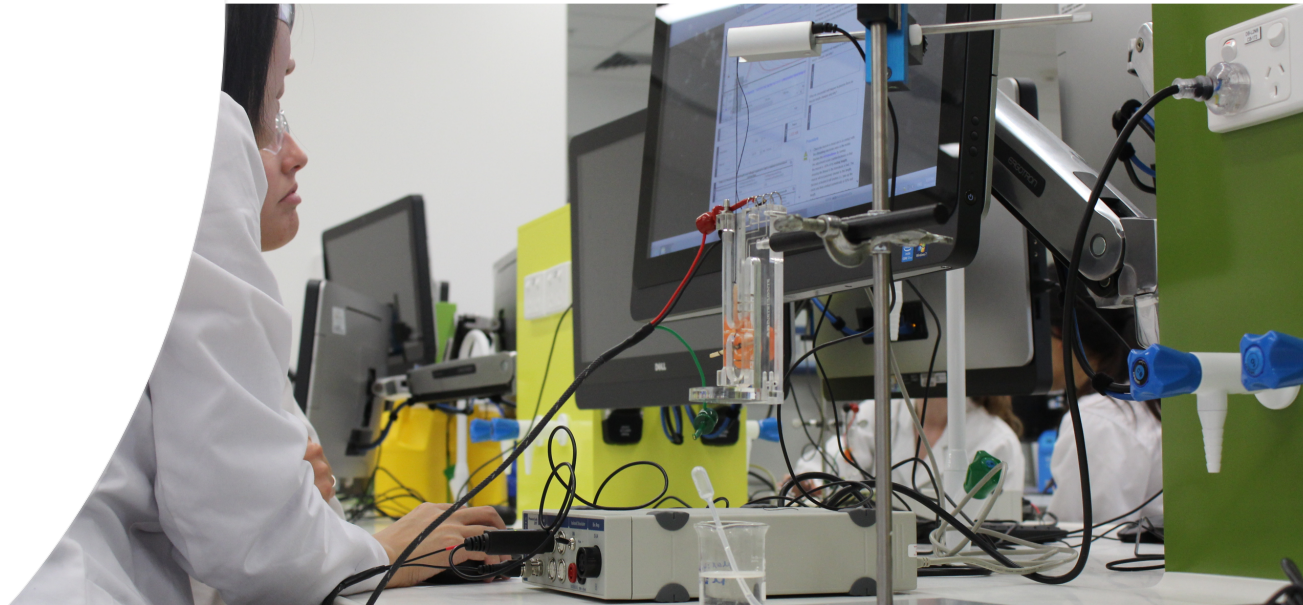
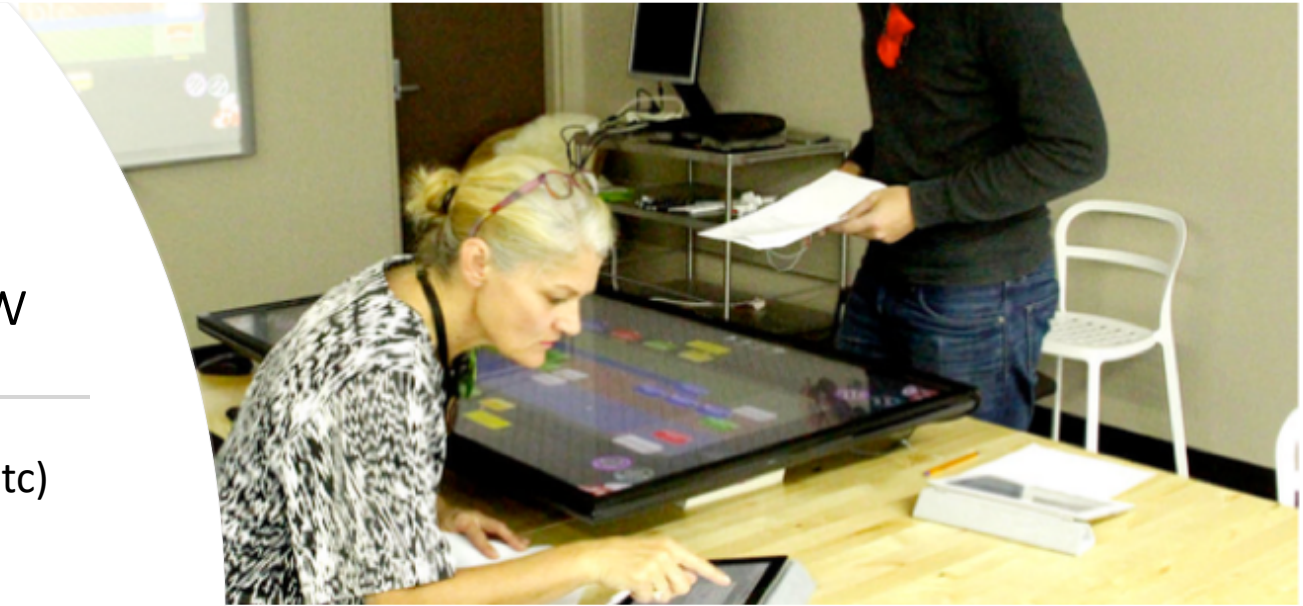
# Ideas about Technology as manifest in our work then

- Scarce
- Expensive
- Singular – rarely networked
- Black-boxed
- Imported (sometimes transient)
- Heavy
- Less mobile than children
- Slow to set up and/or change usage: hard to integrate into existing practices



## Ideas about Technology as manifest in our work now

- Quasi-ubiquitous (but – digital divides, etc)
- Highly networked
- Interdependent
- Woven into everyday practices
- Taken-for-granted
- Mobile, personal, BYOD
- Hybrid, heterogeneous, multiple





# Archetypal framings for research, development, evaluation, design etc

THEN



1-to-1 interactions, or  
1 computer– small group interactions

'Lab-based' studies often seen as necessary  
and appropriate, 'context' wished away

NOW



Complex, dynamic ecologies of networked  
personal and organizationally-provided  
devices, spaces etc

'In situ'/Field studies seen as essential

## Theorising spontaneous practices of co-designing for computer-based educational activities

- Situated problem-solving by experienced teachers or teacher-designers; the power of constraints and local knowledge
- Innovative practice often runs ahead of normative theory
- Practice theory (Kemmis, Schatzki, Nicolini, Shove)
- Patterns of “doings, sayings and relatings”, held together in distinctive projects

Goodyear, P. (2020). Design and co-configuration for hybrid learning: Theorising the practices of learning space design, *British Journal of Educational Technology*, 51(4), 1045–1060.



# Computers in Education: Reframing Design Inquiry

- Looking more closely at design for learning: practices, expertise, knowledge-bases, design inquiry, etc
- Understanding complex (hybrid digital-material) learning environments
- Some silences in the DBR literature



## Design as a noun

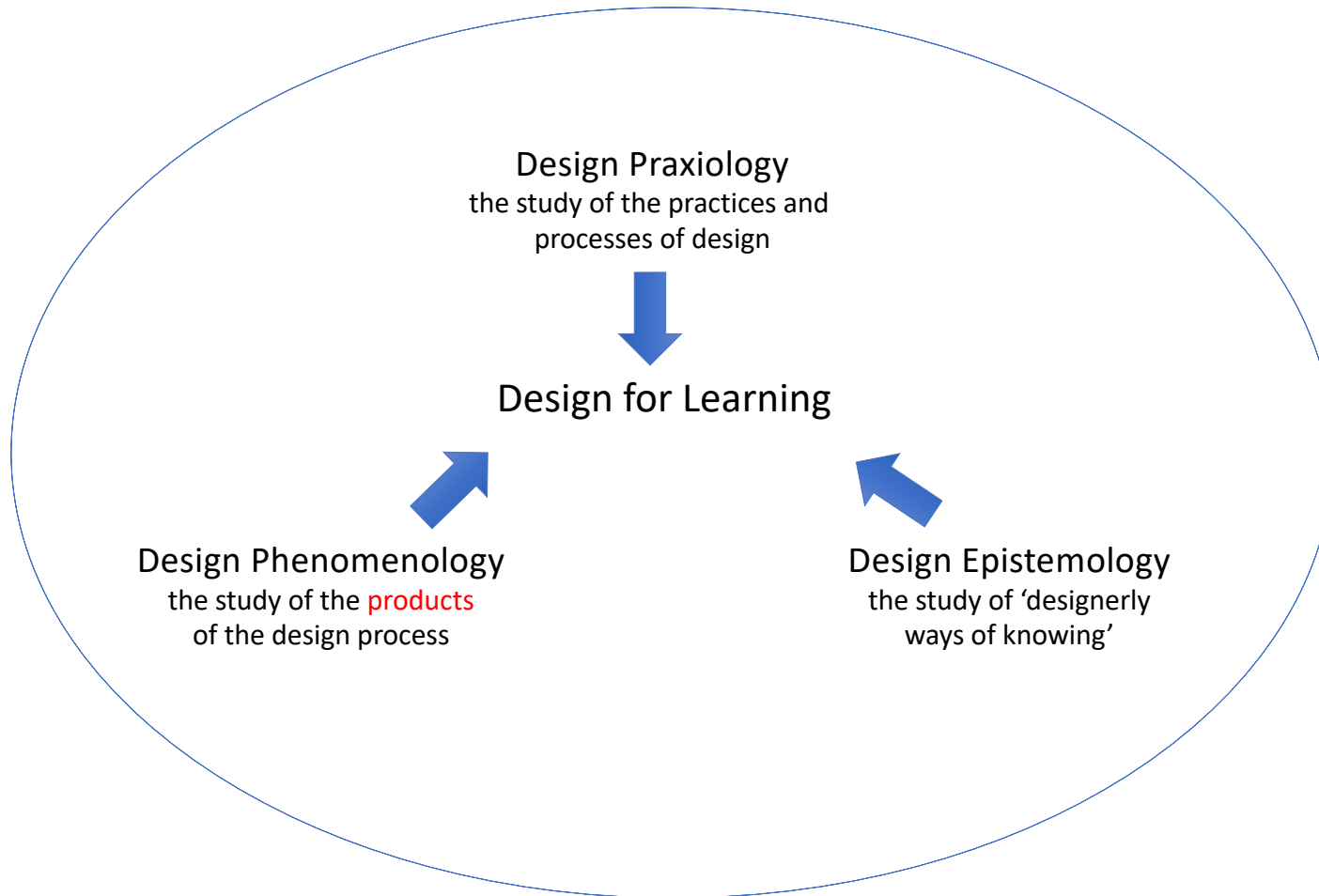
An artefact produced by some kind of design process (e.g. a blueprint or instructional plan or educational resource or App)

Where/what is design in 'design based research'?

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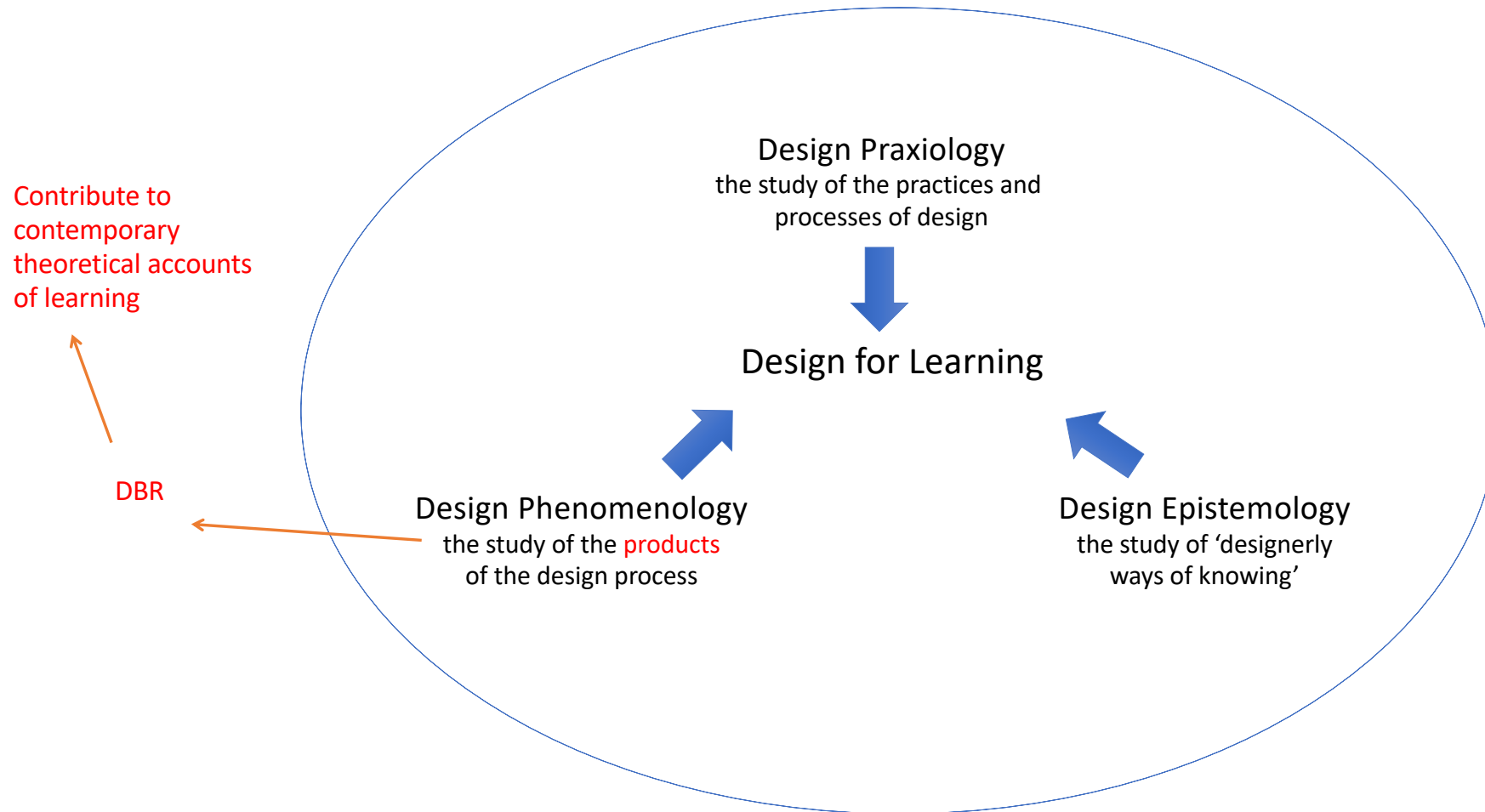
## Design as a verb

A skilled collaborative practice interleaving inquiry and the formulation of candidate solutions



Cross, N. (2006). *Designerly ways of knowing*. Berlin: Springer.

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>



Cross, N. (2006). *Designerly ways of knowing*. Berlin: Springer.

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>



# Learning, environments, chance and design

“We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great difference.”

Dewey, J. (1938). *Democracy and education*. Whitefish, MT: Kessinger.

“Human intention, made visible and concrete through the instrumentality of design, enables us to create conditions, systems, and artifacts that facilitate the unfolding of human potential through designed evolution in contrast to an evolution based on chance and necessity – a highly unpredictable process”

Nelson, H. & Stolterman, E. (2014) *The design way: intentional change in an unpredictable world*,  
Cambridge MA, MIT Press.

# Inquiring into the field of design for learning: esp. learning environment design

1. Learning to shape environments that are conducive to (beneficially shape) learning and thinking
2. Research guided by pragmatics of use: actionable knowledge & the working practices of 'end users' (designers, teachers)
3. Understanding how specific learning places (spaces, networks, environments, systems) function
4. Activity-centred analysis and design (ACAD)
5. Educational ecology as an applied science (Ellis & Goodyear, 2019)

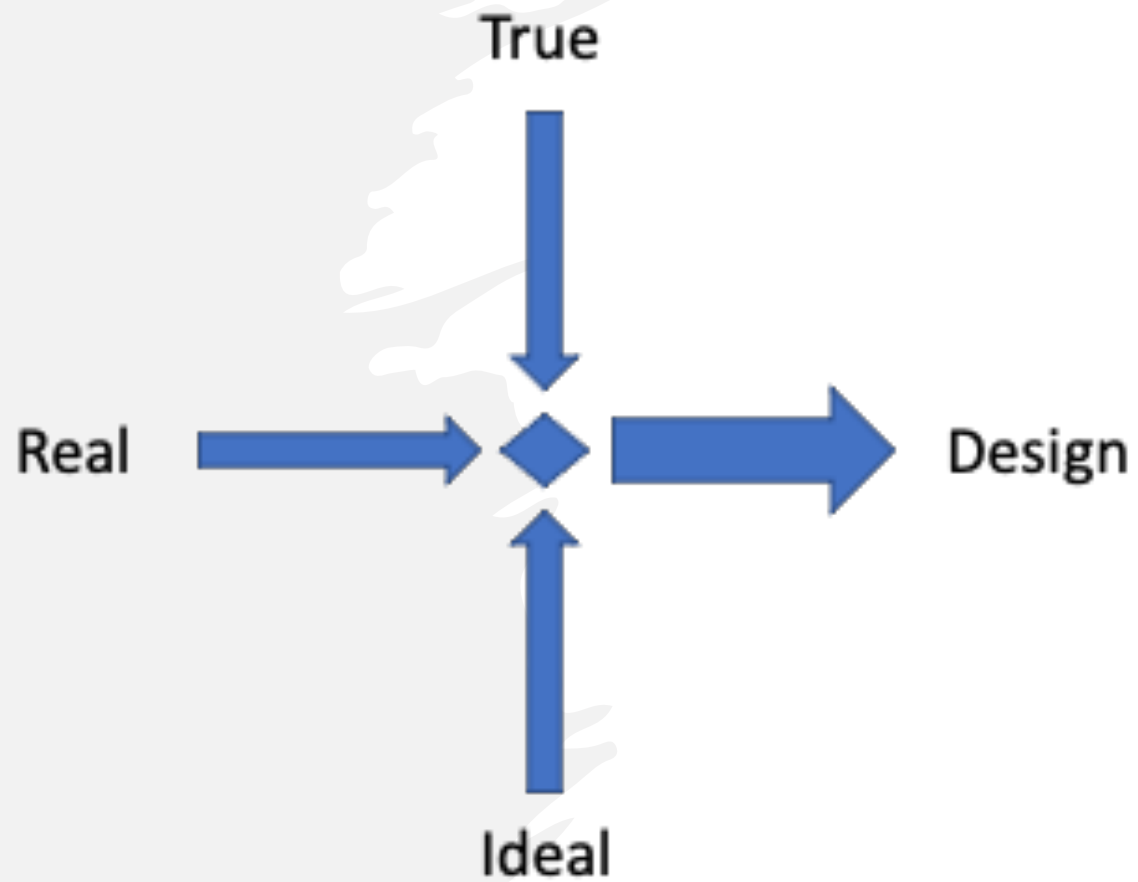
We don't even have a good, shared, term-of-art for the object of research. 'Ecology' 'Ecosystem' 'Classroom' ?

Research intended to help people who design, manage and use complex learning spaces (especially in universities) to do a better job.

Much of the research on learning that is undertaken within educational psychology aims to explain human cognitive mechanisms **without regard for the path to application** of the resulting knowledge. This is not a problem for curiosity-led research, but it creates a vacuum with respect to the work of translating research-based principles into guidelines (etc) for application.

Consider another strategy. In a sense, it parallels some research approaches familiar in the areas of design and engineering. These **forge paths back from a sense of what needs to be created** - including its structure, components, etc - to questions for research.

The **architecture of the class of object**, system, machine etc that is being designed provides researchers with **clear signals about the kinds of evidence that will be valuable** (scope, constraints, reliability etc of findings).



*Design inquiry: an emergent compound  
exploring the universal, the particular and the desirable: with a commitment to act*  
(Nelson & Stolterman, 2014, 37)



## Causal mechanisms, explanation, useful knowledge

“ ... it is a mistake to presume that general laws are the only form of useful knowledge. Rather, ecology has been advancing significantly through the development of **local causal mechanisms** and approaches to testing for their occurrence in systems.”

David Hammer, Julia Gouvea & Jessica Watkins (2018, 14)

“But one basic principle to observe in the quest for causal mechanisms is that explanatory priority in a given context ‘turns not on what factor, if any, does the greatest amount of actual work but on **what makes the difference** between the cases where the outcome obtains and those where it does not’ (Clark, 2000, p160)”

Lambros Malafouris & Colin Renfrew (2010)  
quoting Andy Clark

Clark, A. (2000) Twisted tales: Causal complexity and cognitive scientific explanation. In Keil, F. & Wilson, R. (Eds.) *Explanation and cognition*. Cambridge MA, MIT Press.

Hammer, D., Gouvea, J., & Watkins, J. (2018). Idiosyncratic cases and hopes for general validity: what education research might learn from ecology *Infancia y Aprendizaje*, 1-49.  
doi:10.1080/02103702.2018.1504887

Malafouris, L., & Renfrew, C. (Eds.). (2010). *The cognitive life of things: recasting the boundaries of the mind*. Cambridge: McDonald Institute for Archaeological Research/University of Cambridge.

In some of our research work at least, we need to be both more ambitious and more modest.

We need to rise to the challenge of understanding learning writ large, but we need to do this with the modesty of analytic researchers – trying to understand how some complex existing arrangements actually work **without prematurely imposing constraints based on what we think we will be able to change**

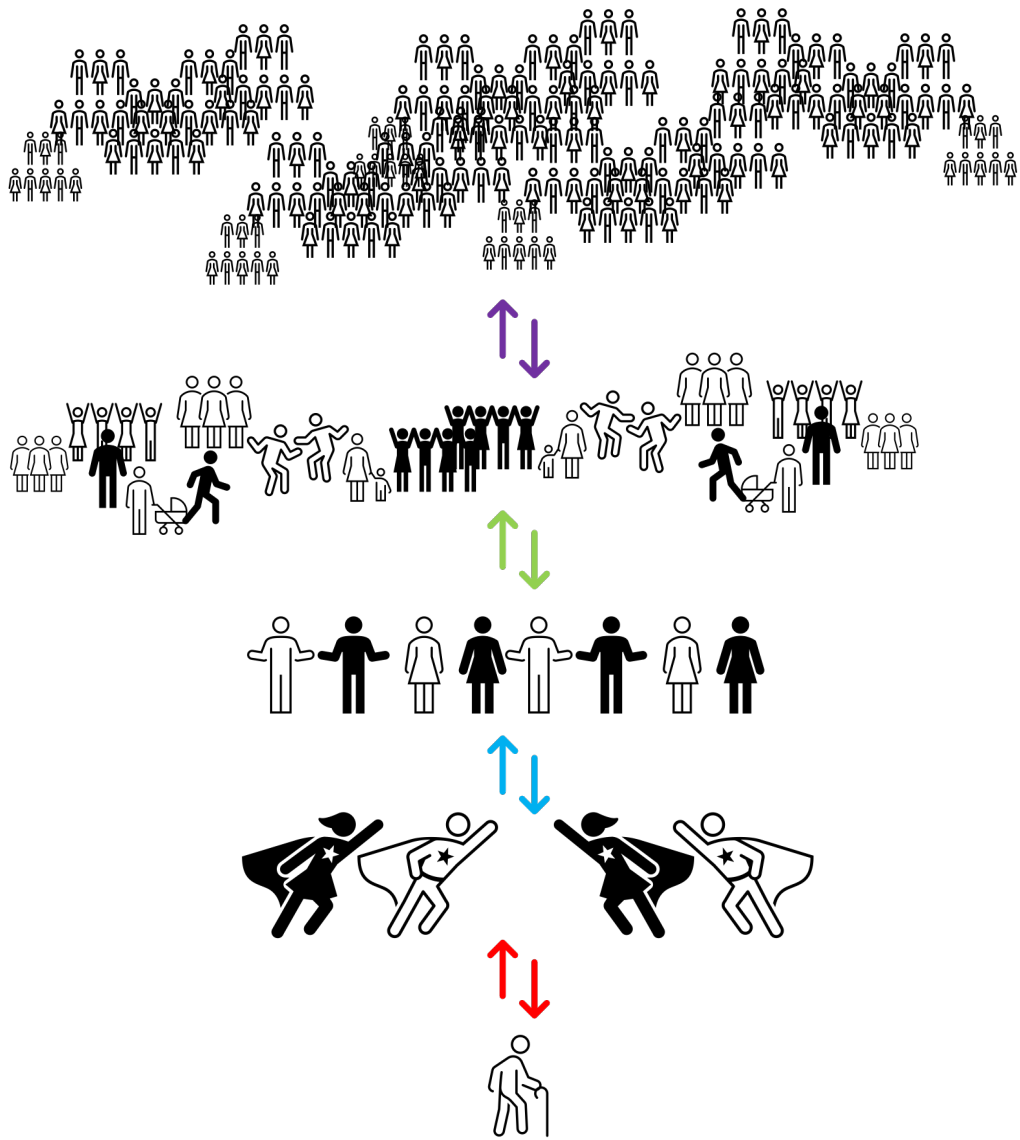
(Goodyear, Ellis & Marmot, 2018, Learning spaces research: framing actionable knowledge)

(or thinking too narrowly about how this will make a good journal article)

# Activity-Centred Analysis and Design (ACAD)

Resources for Design Discussions





Communities, publics

Students

Teachers – ‘professors’, lecturers, tutors,  
teaching assistants etc

Educational technologists, instructional  
designers, academic developers etc

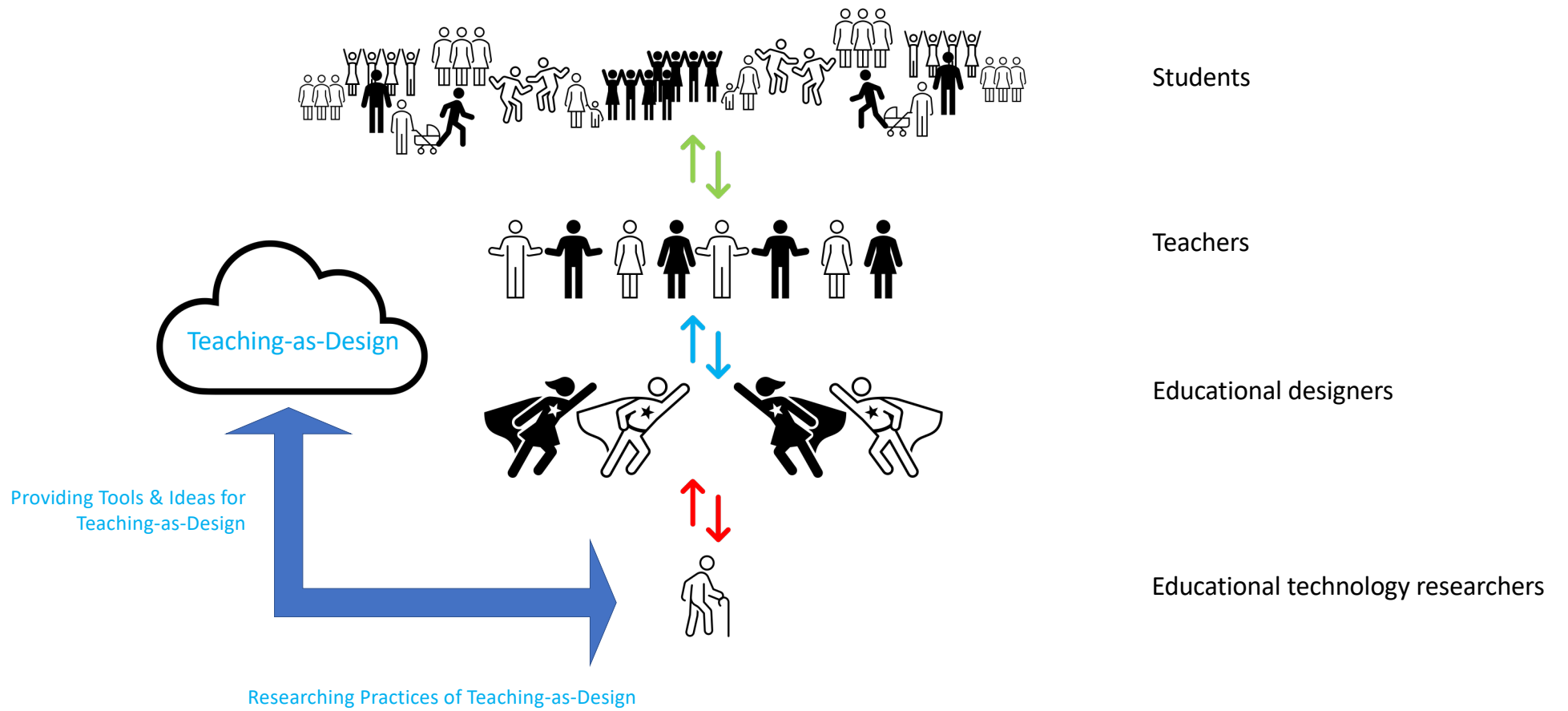
Educational technology researchers

Enhancing university education and its outcomes

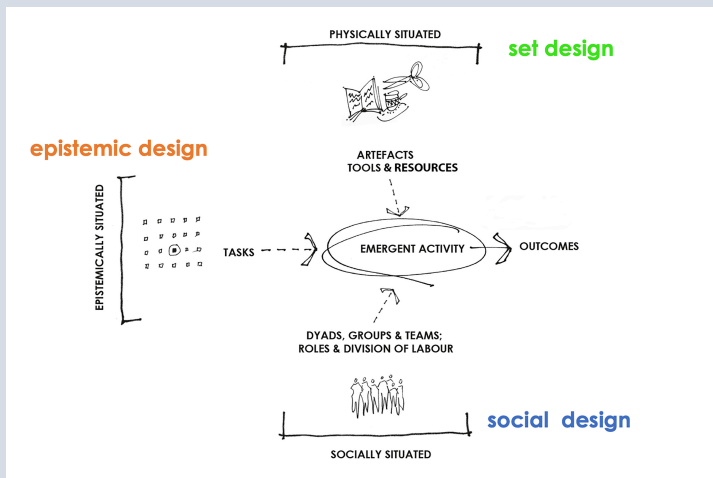
Value Chain







# ACAD: Activity-Centred Analysis and Design



Providing Tools & Ideas for  
Teaching-as-Design

Researching Practices of Teaching-as-Design

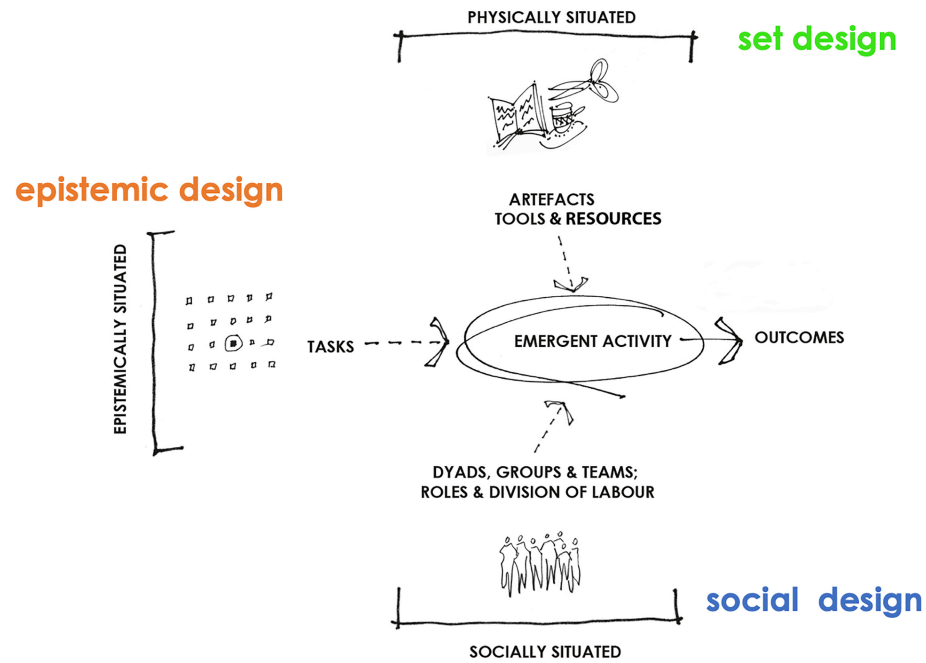
## ACAD: Activity-Centred Analysis and Design

a meta-theoretical framework for understanding and improving local, complex, learning situations

ACTIVITY	means 'what students are actually doing' – mentally, physically and emotionally – during a period of time in which they are meant to be learning something (a learning episode or 'at learn-time')
LEARNING SITUATION	underscores the point that students' learning activity is always situated: physically, socially and epistemically (and more)
LOCAL	because educational work is also situated; done by real teachers in concrete situations, with/without help from educational designers/evaluators
COMPLEX	because teachers do not need an analysis and design methodology to diagnose simple problems and prescribe simple remedies.
META-THEORETICAL	in that ACAD does not insist on any one theory of learning, or one theory for explaining connections between activity and the situations in which it unfolds

# ACAD: Activity-Centred Analysis and Design

a meta-theoretical framework for understanding and improving local, complex, learning situations



It's not a process model for how to design or analyse/evaluate  
Rather, it focuses attention on what can be designed – and what can't



## ACAD: Activity-Centred Analysis and Design

a meta-theoretical framework for understanding and improving local, complex, learning situations



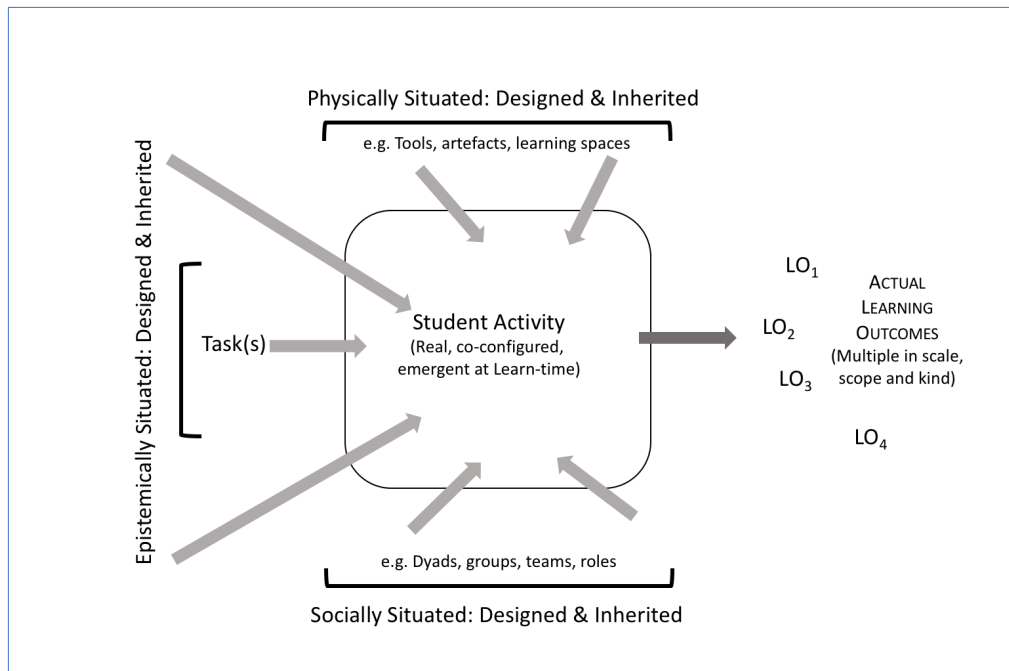
Easiest to make the case for ACAD with events that involve 'active' learning, 'learning by doing' and where teacher supervision is light or absent

Insert the ACAD video here

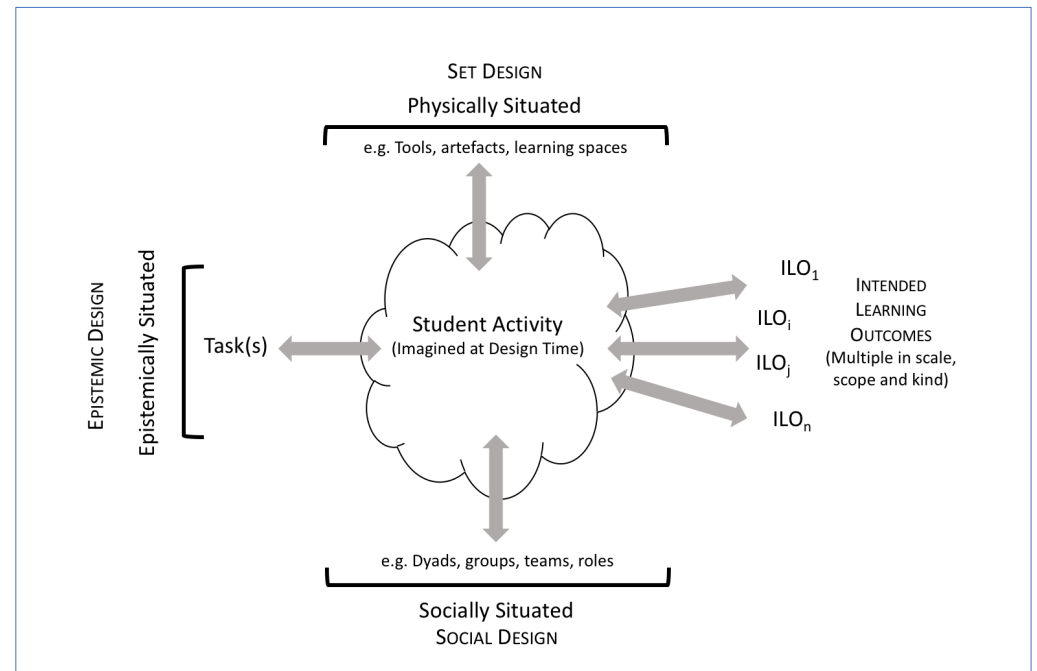
<https://player.vimeo.com/video/302378219>

# ACAD: Activity-Centred Analysis and Design

## The Dual Ontology: Analysis of the Real and Design of the Imagined



Analysis of the Real



Design of the Imagined

# ACAD: Activity-Centred Analysis and Design

## ACAD Tools: Cards and Wireframe

### blue cards

(philosophy/ pedagogy)

What learning theory underpins your design?



e.g. constructivism— learning as a process of actively building knowledge.

### yellow cards

(epistemic design)

How will you structure and pace tasks?



e.g. lecture, case studies, model building etc. and forms of assessment.

### green cards

(set design)

What resources will you use?



e.g. smartphone, pen & paper, LMS, outside, collaborative learning studio, seminar room.

### orange cards

(social design)

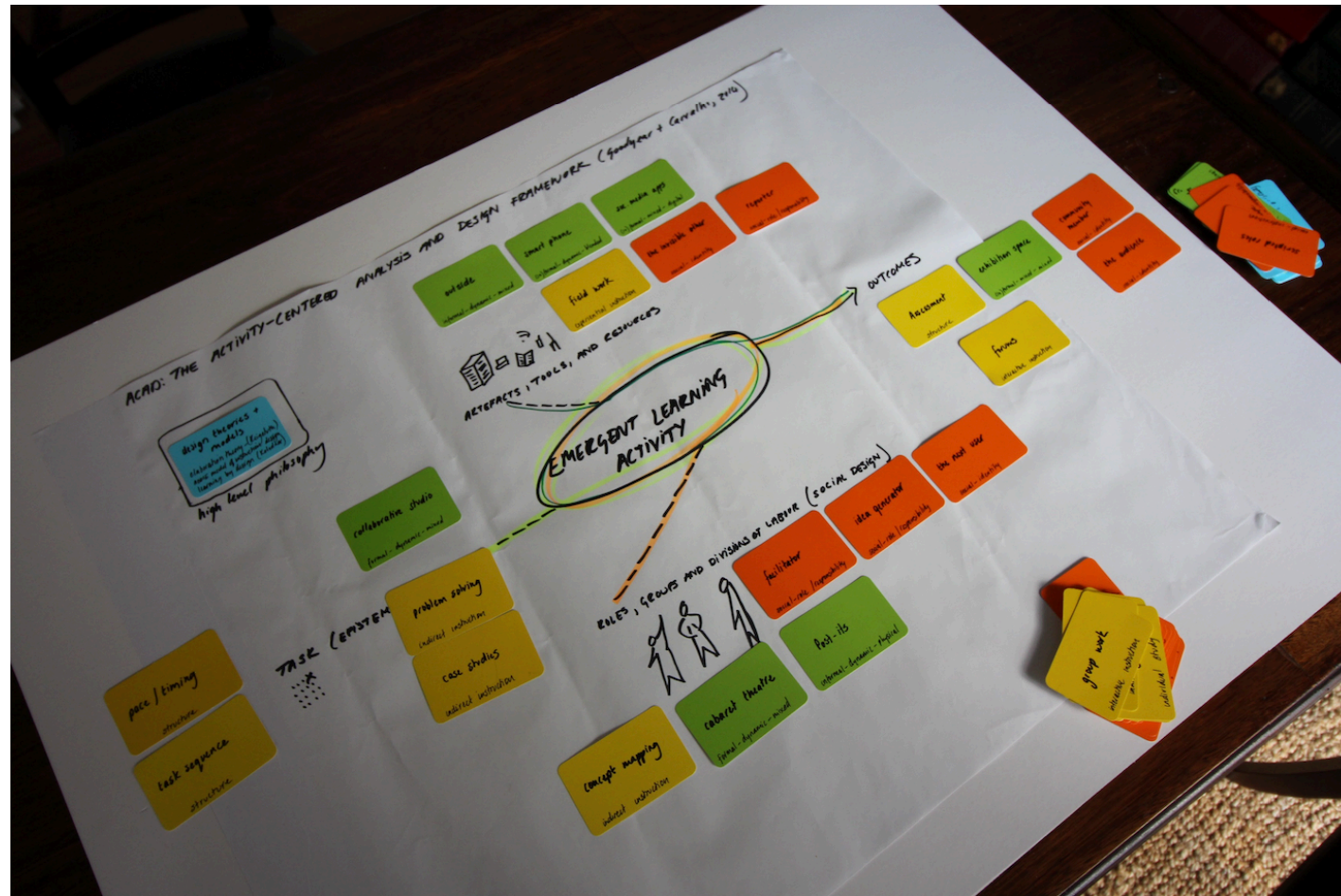
How will you group learners?



e.g. groups, pairs, scripted roles, note-taker, mentor.

# ACAD: Activity-Centred Analysis and Design

## ACAD Tools: Cards and Wireframe





## Making design rationales explicit to help students become more capable at designing for themselves and others

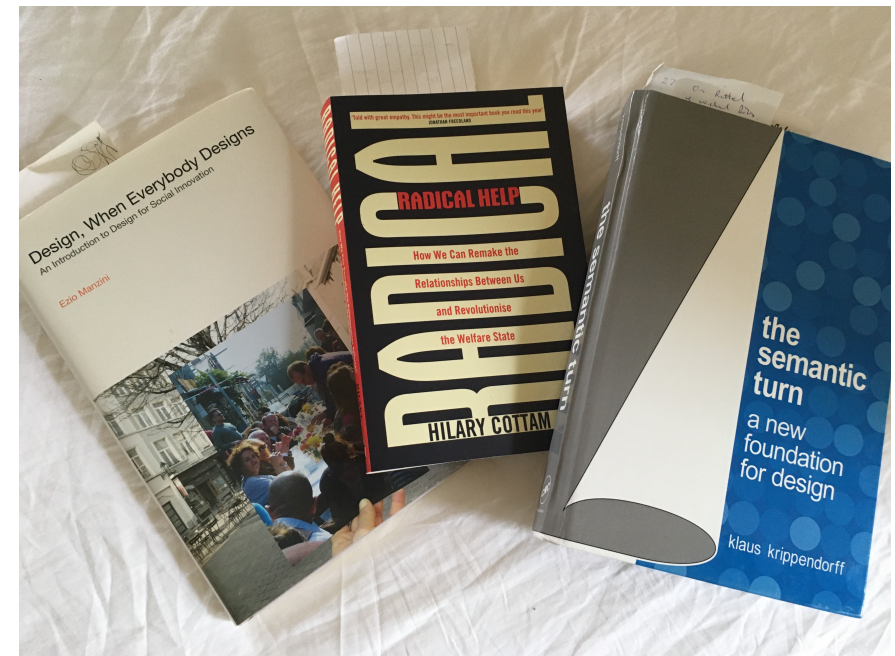
Design as communicative – the semantic turn in design (Krippendorff, 2006)

Students as ‘completing’ designs (Sun & Goodyear, 2019)

Students co-configuring what has been designed for them

And thereby learning to work with others to configure new epistemic environments (Markauskaite & Goodyear, 2017)

And participate in citizen-based social innovation (Manzini, 2015; Cottam, 2019; Goodyear, 2019)



Cottam, H. (2019). *Radical Help: How we can remake the relationships between us and revolutionise the welfare state*: Little Brown.

Goodyear, P. (2019). Networked professional learning, design research and social innovation. In A. Littlejohn, J. Jaldemark, E. Vrieling, & F. Nijland (Eds.), *Networked professional learning: emerging and equitable discourses for professional development* (pp. 239-256): Springer.

Krippendorff, K. (2006). *The semantic turn: a new foundation for design*. Boca Raton FL: CRC Press.

Manzini, E. (2015). *Design, when everybody designs: an introduction to design for social innovation*. Cambridge MA: MIT Press.

Sun, S. Y. H., & Goodyear, P. (2019). Social co-configuration in online language learning. *Australasian Journal of Educational Technology*, 36(2), 13-26. doi:<https://doi.org/10.14742/ajet.5102>

## Selected reading

Design, Learning Environments, Epistemic Fluency etc

Epistemic Fluency	Markauskaite, L., & Goodyear, P. (2017). <i>Epistemic fluency and professional education: innovation, knowledgeable action and actionable knowledge</i> . Dordrecht: Springer.
Design Patterns	Goodyear, P., & Retalis, S. (Eds.). (2010). <i>Technology-enhanced learning: design patterns and pattern languages</i> . Rotterdam: Sense Publishers.
Researching design	Muñoz-Cristóbal, J., Hernández-Leo, D., Carvalho, L., Martínez-Maldonado, R., Thompson, K., Wardak, D., & Goodyear, P. (2018). 4FAD: A framework for mapping the evolution of artefacts in the learning design process. <i>Australasian Journal of Educational Technology</i> , 34(2), 16-34. Carvalho, L., Martínez-Maldonado, R., & Goodyear, P. (2019). Instrumental genesis in the design studio. <i>International Journal of Computer Supported Collaborative Learning</i> , 14, 77-107. doi: <a href="https://doi.org/10.1007/s11412-019-09294-2">https://doi.org/10.1007/s11412-019-09294-2</a> Carvalho, L., & Goodyear, P. (2018). Design, learning and service innovation. <i>Design Studies</i> , 55, 27-53. doi: <a href="https://doi.org/10.1016/j.destud.2017.09.003">https://doi.org/10.1016/j.destud.2017.09.003</a>
Complex learning spaces	Ellis, R., & Goodyear, P. (Eds.). (2018). <i>Spaces of teaching and learning: integrating perspectives on research and practice</i> . Singapore: Springer Nature. Ellis, R., & Goodyear, P. (2019). <i>The education ecology of universities: integrating learning, strategy and the academy</i> . Abingdon: Routledge.



## Selected reading

### ACAD

ACAD Overviews	Goodyear, P. 1999, Pedagogical frameworks and action research in open and distance learning. <i>European Journal of Open, Distance and E-Learning</i> , 1–7
	Goodyear, P., & Dimitriadis, Y. (2013). <i>In medias res: reframing design for learning. Research in Learning Technology</i> , 21. doi: <a href="http://dx.doi.org/10.3402/rlt.v21i0.19909">http://dx.doi.org/10.3402/rlt.v21i0.19909</a>
	Carvalho, L & Goodyear, P (eds.) 2014, <i>The architecture of productive learning networks</i> , Routledge, New York. (esp. Chapter 3)
	Goodyear, P. (2015). Teaching as design. <i>HERDSA Review of Higher Education</i> , 2, 27-50. Retrieved from <a href="http://www.herdsa.org.au/system/files/HERDSARHE2015v02p27.pdf">http://www.herdsa.org.au/system/files/HERDSARHE2015v02p27.pdf</a>
	Goodyear, P., Carvalho, L & Yeoman, P (under review) Activity-Centred Analysis and Design (ACAD): core purposes, distinctive qualities and current developments, <i>ETR&amp;D</i>
	Goodyear, P, Carvalho, L, Yeoman, P, Castañeda, L & Adell, J 2020, Una herramienta tangible para facilitar procesos de diseño y análisis didáctico: Traducción y adaptación transcultural del toolkit ACAD. (A tangible tool to facilitate learning design and analysis discussions: Translation and cross-cultural adaptation of the ACAD toolkit), <i>Revista de Medios y Educación</i>
Cards & Wireframe	Yeoman, P., & Carvalho, L. 2019, Moving between material and conceptual structure: Developing a card-based method to support design for learning. <i>Design Studies</i> , 64, 64-89.



Thank You!

Follow up: slides, links, reading

[petergoodyear.net](http://petergoodyear.net)

@petergoodyear

### Acknowledgments

#### People

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ic design

