CERE slideset 3:
Concepts and Empirical Results in Education

The big 3 theories

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http://www.psy.gla.ac.uk/~steve/courses/cere.html

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Three significant theories of the LTP

This session is mainly about three theories of the LTP (learning and teaching process): Perry's, Deep and Surface learning, and Laurillard's model.

I think they are important because many observations and techniques can be understood better in relation to them.

It is important that they are independent of each other i.e. that a learning design may be good in terms of one but poor in relation to another: in all combinations: so that each theory adds something to our understanding.

One practical way of using them is to critique or appreciate any given learning design in relation to each: to how well or poorly the design addresses each.
This is quite productive in critiquing one's own plans for a course or talk.

Part A: Perry

Perry:
 Critical thinking,
        and hence learning reasons not just conclusions

Perry Intro.

Learning unquestioned truths vs. debateable but evidenced ideas

• Perry (1968) book first put it forward. Other work since.

• Based on a big interview study of Harvard undergraduates.

• Explicit analogy to Piaget's stage theory.

• Key idea: that HEIs should be supporting students through a developmental progression from a simplistic to a mature view of what knowledge is.

• Perry discriminated 9 stages.

• Later work at GU simplified it to 3 main stages, as illustrated in the following tables.

Perry position terminology: warning.

Many short summaries of Perry, and Perry himself, adopt philosophy's terminology for the supposed "positions" or beliefs of learners about the nature of knowledge e.g. Realism, Relativism, Dualism, etc. As a psychology student, this may be distasteful to you.

If we wish to discuss actual philosophical positions, then we should probably learn the terminology which has a long history.

However philosophy is mainly concerned with what positions may be defended and constructed as consistent and logical wholes. Actual humans do not seem to do this, and philosophy does not lead to discovering the various implicit attitudes to the nature of knowledge which learners actually have. This, as I will mention, is Perry's biggest mistake in fact.

Nevertheless, Perry's theory represents an important issue for all learning and teaching despite his mistaken assumption of how it generalises.

Aspects of a learner's views at 3 different points on the Perry spectrum

	Student in position A	Student in position B	Student in position C
Student Role	Passive acceptor	Realises that some responsibility rests with the student. But what? And how?	Sees student as source of knowledge or is confident of finding it. Debater, making own decisions. Wants to explore contexts; seeks interconnections.
Lecturer's Role	Authority, giving facts and know-how	Authority, where there are controversies, wants guidance as to which the lecturer favours.	One authority among others. Values views of peers. Teacher as facilitator or gateway.
View of knowledge	Factual; black and white; clear objectives; non-controversial; exceptions unwelcome.	Admits 'black-and-white' approach not always appropriate. Sees no way to choose between alternative views. Feels insecure with these uncertainties.	A matter of competing views or theories, with different supports. Evidence, not just conclusions, an important part of knowledge. Enjoys creativity, scholarly work.
View of exams	Regurgitation of 'facts'. Exams are objective. **Hard work** will be rewarded.	**Quantity** is more important than quality in demonstrating maximum knowledge.	**Quality** is more important than quantity. Wants room to express own ideas, views.
Student confidence depends upon:	The teacher	Little confidence, high uncertainty.	The student her/himself

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Aspects of a learner's views at 5 different points on the Perry spectrum	Student in Unknowable position	Student in position A	Student in subjectivist position(B)	Student in proc position	Student in constructivist position(C)
Student Role	React to demands	Passive acceptor	Realises that some responsibility rests with the student. But what? And how?	Follow rules	Sees student as source of knowledge or is confident of finding it. Debater, making own decisions. Wants to explore contexts; seeks interconnections.
Lecturer's Role	Make arbitrary demands	Authority, giving facts and know-how	Authority, where there are controversies, wants guidance as to which the lecturer favours.	Supply material, and support increasing skill at the rule of argument.	One authority among others. Values views of peers. Teacher as facilitator or gateway.
View of knowledge	Not possible to know things	Factual; black and white; clear objectives; non-controversial; exceptions unwelcome.	Admits 'black-and-white' approach not always appropriate. Sees no way to choose between alternative views. Feels insecure with these uncertainties.	A matter of competing views or theories, with different supports. Evidence, not just conclusions, an important part of knowledge. Enjoys creativity, scholarly work.	Enjoys creativity, and employing procedures for own original ends.
View of exams	Meaningless torture	Regurgitation of 'facts'. Exams are objective. **Hard work** will be rewarded.	**Quantity** is more important than quality in demonstrating maximum knowledge.	Demonstrate ability to produce reasoned arguments (though only to questions that do not challenge paradigm)	**Quality** is more important than quantity. Wants room to express own ideas, views.
Student confidence depends upon:	Being told what to do	The teacher	Little confidence, high uncertainty.	Mainly self; although also important to be part of a community following the same (CT) rules	The student her/himself

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Demo

(Music. Arithmetic)

Just speak for 30 seconds on the topic I give you, perhaps as if your 6 year old niece had asked you "Tell me about music ..." and you decided, as any good aunt should, to treat them seriously **...**

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Perry for Science, not only humanities

- Perry himself only looked at Humanities students
- Real scientists (as opposed to science fans and consumers) _do_ do critical thinking _although_ without calling it that.
- They invent guesses ("hypotheses") and test them: they understand that predictions are not facts.
- Feynman, especially, distinguished reality from names and guesses.
- They distinguish the relative certainty of observations and facts, from that of theories. This is not black and white thinking.

- The rebuttal "The Perry theory is a pile of bunk" signals the issue of of whether science degrees train their learners well enough on the Perry dimension for them to become science researchers as opposed to consumers in their thinking.
- It is actually like Perry in assuming that a person has one fixed philosophical position they apply to everything; and is arguing about Realism vs. Relativism.

Perry: extra points

Perry-D ?
We should not stop at evaluative judgement (discussing alternatives and then choosing one), but go on to designing and carrying out a way to decide for sure: scientific experiment. This is science, not Aristotle.

The arc of development:
We might say that all of education has a vital social aspect that Perry in fact expresses: getting used to dealing with the fact that we can deal with people who do not have the same ideas and prejudices as us. People are not right or wrong, just because ideas may be.

Hall's categories (1)

Hall (1959) suggested 3 quite different types of knowledge for non-academic learning. They are all probably of Perry type A (black and white): subtypes? But possibly they hint at transitions between the "silenced"/"unknowable" position, and type A.

They are, furthermore, interesting because they illustrate that our knowledge of "one" concept (e.g. time) actually consists of parts or aspects from all 3 Hall types simultaneously: another implicit critique of Perry's presupposition of one-learner ➔ one-universal-type or attitude to knowledge.

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Hall's categories of kinds of knowledge (2)

"Formal": Explicit, prescribed. PerryA. No reasons. E.g. word meanings, legal requirements. [Surface. PerryA. Instructivist.]

"Technical": Explicit, with reasons (deep learning). E.g. Training military technicians, aircraft maintenence. Medical protocols. "Leave the roast to rest for 10 mins". [Deep. PerryA+. Instructivist.]

"Informal": Implicit, usually behavioural ("procedural") not concepts. e.g. response time conventionns. Associative memory and induction. Learning by imitation? [Surface. PerryA-. Constructivist.]

Surface: rote learning / reproducing. Deep: linking to experience, reasons, ...
Instructivist: learning by being told.
Constructivist: constructing from your own resources.

All Perry positions (revised)

- Unknowable / silenced
- Hall's "Informal"
- Hall's "Formal"
- Hall's "Technical"
- PerryA (Dualism: true or false, complete certainty)
- PerryB (Subjectivist: rival views, no way of choosing)
- Procedural knowing
- PerryC (Constructivist: make your own choice, backed up by reasons)
- PerryD Design and create knowledge by e.g. experiment.

Questions?

1. What don't you understand yet?

2. What is the single most important message / issue here under "Perry"?

- Shout out
- Vote
- Correct

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Perry: summary of aspects

Perry drew attention to a spectrum of learner attitudes to the nature of the learning process, and of the content.

❑ The Perry positions A – B – C (– D)
  ❑ AND the additional positions identified by Belenky et al.
  ❑ AND Hall's knowledge / learning types
❑ The strength of evidence and so the certainty of the conclusion
❑ This can be re-viewed in terms of implications about the content that must be learned.
❑ "Meta-knowledge" (knowledge about knowledge): additional content:
  • Learn not only conclusions (facts), but reasons
  • Degree of certainty of each conclusion
  • Degree of consensus about each conclusion;
    & who believes which view

Part B: Deep and surface

Deep and Surface learning
        (linking new knowledge to other things)

If you know the name of a given bird in 20 languages you know something about people, but nothing about the bird. [Feynman]

Types of depth as structure of the knowledge

Understanding, or deep learning, is never complete.

Some types of connection to make to approach it:

- Concept to example: can you produce examples?

- Concept to personal experience (feelings, perceptions,...). This is about how a concept or theory shows up in evidence and experience. Although evidence may decide between theories, a more general issue for learners is to learn how an idea connects to any evidence at all: what does it mean for experience? What is "force" in the world? What is the difference between pain and discomfort?

- Concept to concept: alternative theories of the topic [Perry]. This will be about rival claims to truth.

- Concept to contradictions, inconsistencies, ... What things actually or potentially conflict with a given concept or theory?

- Enlightenment / relevance / validity: What prior questions does this answer; what useful problems does this theory solve?

Deep and shallow learning: aspects

- The structure of the knowledge itself, the kinds of link between bits of what you know.

- The goal of the learner (for this topic): e.g. to understand (deep learning) or to learn ≈ to do some specific task e.g. pass a test (shallow learning). (Intrinsic vs. extrinsic motivation. Approach vs. avoidance goals.)

- Method (or "strategy" or "approaches"): learning styles, activities. How the learner goes about understanding / learning this topic.

  What measures they use to regulate their learning e.g. aim for grades? for doing all the problems in the textbook? for that inner feeling of understanding? [Snyder]

•• And all of these may apply differently to different topics of learning for the same learner — but almost all the literature assumes they are pervasive traits.

Extra points on deep/surface learning

Pintrich's mastery vs performance motivations are approximately deep vs. surface.

Deep and surface probably correlate with far vs. near transfer; and also with length of retention.

There is no end to or completion of deep learning.

Aspects of the generalised D&S theory

• The structure of the knowledge being learned (regardless of the learner): number of types of links made.

• The goal of the learner (to understand vs. to learn how to perform successfully)

• The learner's selected method / approach / strategy to learning (this is the original Marton work, and the empirical evidence)

• Assessment (test type): see Snyder (1971)

Summary / connections of D&S

Learning should (to be deep) make multiple types of connection

It will lead to higher transfer / more general understanding

Reflection: deep learning is to a great extent linked with reflection:
    searching the existing contents of one's mind for connections to the new knowledge.
    To other things you know; and other ways you could use the new knowledge.

Not knowing the meaning of what you do (= surface learning)

Is shallow learning a unique human advantage?

Questions?

1. What don't you understand yet?

2. What is the single most important message / issue here under "Deep & Surface"?

• Shout out

• Vote

• Correct

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Part C:

The Laurillard model
of the LTP (learning and teaching process)
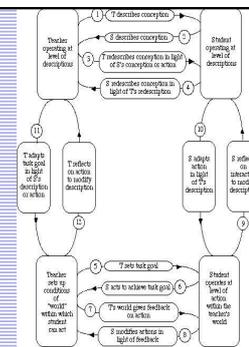
Laurillard's diagram of 12 activities for teaching and learning.

It is redrawn with the numbers modified from fig. II.1, p 103, in
Laurillard, D. (1993) **Rethinking university teaching:**
A framework for the effective use of educational technology
(Routledge: London).

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Laurillard's 12 mathemagenic activities

Conceptual description
1. Teacher describes the conception.
2. Student re-expresses the conception.
3. Teacher redescribes the conception in the
   light of the student's expression or action.
4. Student redescribes the conception in the light
   of the teacher's redescription.

Personal experience / action
5. Teacher sets task goal.
6. Student acts to achieve the task goal.
7. Teacher's world gives feedback on the action.
8. Student modifies actions in the light of feedback.

Reflection: (linking description and experience)
9. Student reflects on action to modify description.
10. Student adapts action in light of concept.
11. Teacher adapts task goal in light of student's description.
12. Teacher reflects on action to modify description.

Laurillard's model: underlying principles

A] Equal weight to teacher and learner:
   Teacher and learner both active
   What is learned depends on what others know (social distribution of knowledge)
   Academic learning is not passive, nor usually achieved without active contributions from teachers.

B]   Feedback and Convergence. (or: Iteration and interaction)
   Teacher and learner don't just do things separately.
   Learners need feedback.
   Teachers need to adapt this to each student's needs.
   Both need to produce versions and then relate them.

C]   Two aspects to any subject:
   Public (formal) conceptual description   (e.g. terminology)
   Personal experience (e.g. labs)
C2]   (Reflection) Plus the links between them

(A)   Teacher centered or Learner centered?
3 Types of theory of the TLP

1)   The Transmission theory   (Teacher centered)
   The Nurenberg funnel
   Knowledge as a kind of substance that is transmitted.
   (The teacher is crucial, learning is passive.)

2)   Constructivism (Piaget)   (Learner centered)
   Learner centered approaches.
   (The learner is crucial, teachers cannot cause learning.)

3)   Conversational models of the TLP
   (Teacher and Learner equally crucial; and both must be active.)

Diana Laurillard   (1993;   page 103)
Rethinking university teaching   (Routledge: London)

(A)   Teacher centered or Learner centered?
Aspects of a "teacher" element in TLP models

• Represent the Teacher as a key agent
• Set up 2 poles in learner interactions
• Represent both source and destination
   (cf. prior conceptions —> target conceptions)

• Represent asymmetry of T&L, of source and destination
• Represent the diffuse social nature of the destination
   (socially distributed nature of knowledge)

• "Teacher" is a role or function, not a person
• A real teacher is a nexus for this function
• The metaphor of teacher as a hillwalk guide

(C) Conceptual description vs. personal experience

Physics: Newton's Laws vs. how it feels to push (apply a force)
   to a trolley

Literature: Writing a critical essay vs. the emotions you feel when
   seeing a play.

Maths: doing arithmetic vs. counting or measuring physical
   objects.

Economics: The law of supply and demand vs. deciding to buy an
   item or setting a price.

Zoology: watching a bird vs. studying taxonomy.

Psychology: STM theory vs. trying to hold a phone number in the
   mind.

(B) Feedback and Convergence:
a.k.a. Iteration and interaction
(why have them)

• Learners must act:
  Applying (processing, re-expressing) the knowledge
  is important to learning

• Feedback from the (effects of the) action is important

• Feedback is specialised to that action:
  It is where learning becomes individual
  => Interaction, not independent action by T&L.

• This captures contingent tutoring, or at least shows that her
  model has a place for it.

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1. T—>L
   To get various types of feedback to learner

2. T<—L   Teacher gets feedback:
   a) on topic: T may learn more about the subject
   b) on quality of learners' grasp of subject
   c) on teaching effectiveness

3. Convergence, negotiation
   a) Of the topic (product):
      E.g. T's concepts applied to L's examples

   b) Of processes being taught/learned:
   Teacher as showing/teaching by example
   How to grapple with the topic
   (learning the process not product of knowing)

(B) Feedback and Convergence:
Active learning => interactions with whom / what?

A crucial aspect of an adequate theory of the learning and teaching process is the interactions a learner performs; thus, implicitly, acquiring feedback.
But interaction with (feedback from) whom or what?

Learners may / must (productively) interact with:
A teacher
Peers (fellow learners)
The world / concrete action
Self (reflection)

[Many theories emphasise one of these, and overlook others.]

(B) Feedback and Convergence:
Types of feedback to learners

1. Internal judgement of success by the learner.
2. Information on success or failure.
3. Information on   a) learner's output,   b) correct output,
                      c) and the difference.
4. Diagnosis of which part of student output was wrong.
5. Explanation of why correct answer is correct.
6. Explanation of why student answer is incorrect

Feedback may come from learner, the task itself (intrinsic feedback), or teacher / surrogate (extrinsic feedback).

Feedback may be about the level of concepts, or of personal experience.

(B) Feedback and Convergence:
a.k.a. Iteration and interaction
Chi's framework (1)

Going to and from between teacher and learner (or peer and peer) is also a key principle in Chi's Active-constructive-interactive framework for classifying learning activities: so this principle connects to Chi's insight too.

But not all activity, nor inter-activity, is equally productive for learning.

Chi's Active-constructive-interactive framework (1)

Chi (2009) proposed a scale of increasing learning effectiveness:
   a) Active e.g. answering a closed question (e.g. an MCQ)
   b) Constructive e.g. generating reasons or "self-explanations"
   c) Interactive (with peers).
These all involve mental (re)processing of the matter being learned: just as Laurillard's model does. [Principle B]

But Chi's three imply a prior category of not learning: inattentiveness.
And between that and Chi's 3 activities, there is also being active, but not in a way that affects learning e.g. mindless button pushing, filling in colouring books.

Giving a full spectrum of activities you see in a classroom:
   a) Inattentive
   b) Passive e.g. listening
   c) Irrelevant physical interaction (so no useful mental processing)

   d) Active e.g. answering a closed question (e.g. an MCQ)
   e) Constructive e.g. generating reasons or "self-explanations"
   f) Interactive (with peers).

Chi's Active-constructive-interactive framework (2)

Applying it to methods of revision by students:

Too passive mentally: Mere re-reading (b), perhaps with a highlighter pen (c), has little effect on learning.

Active (d): Re-writing, particularly if the learner transforms the representation rather than does dictation or reproduction

Constructive (e): Self-explanations: generating one, not copying or reproducing one e.g. explain to someone else, answer a different test question.

Interactive (f): With a peer or teacher.

Search ref. list for "[memory and study strategies]"
*Roediger.   Karpicke.*

Main educational senses of "reflection"

Principle B (convergence, iteration) from Laurillard's model also relates to concepts of reflection; and its importance in learning.

[OED: "Reflect: go back in thought, meditate, consult with oneself, remind oneself or consider." 5th of 6 meanings.]

- Thinking: about concepts? or about action / experience? Schön: iterate within practical experience alone

- Iteration: learning as a cycle, not a one-shot event [Laurillard B]

- Relating concepts and experience [Kolb] [Laurillard C]

- Reflection is related to deep learning: making new connections

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Kolb cycle

Kolb cycle
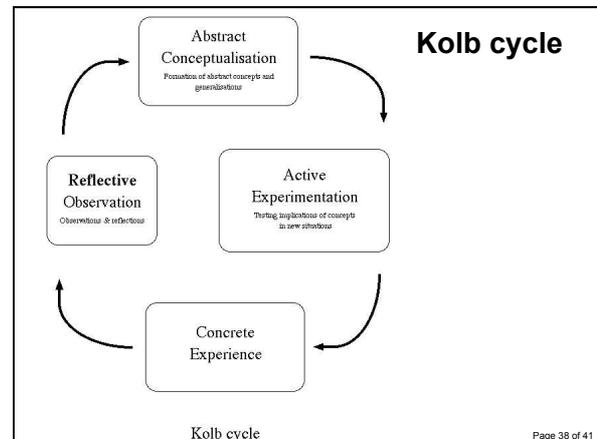
The concept of mathemagenic activity

An activity essential for learning?
> Ideal theoretical construct: but doesn't correspond to our experience. Like vitamins: one of many causes, all necessary.

An activity that always causes learning?
> Great for theory, but must be internal and invisible: so can't tell when it occurs, and not directly useful to designers. Like a force: a single sufficient cause.

An activity that sometimes causes learning?
> Great for practical work: we can define these as observable, use them in instructional design; but they may not cause learning, and for a theory that predicts learning we will need some other construct? A step model.

Rothkopf,E.Z. (1970) "The concept of mathemagenic activities" Review of educ. research vol.40 pp.325-336

Questions?

1. What don't you understand yet?

2. What is the single most important message / issue here under "Laurillard's model"?

- Shout out

- Vote

- Correct

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Laurillard model: summary of aspects

This model represents not one, but three separate general principles about learning and teaching.

Each can and should be applied separately in education.

On top of that, its 12 activities may be applied to any learning design to check whether / how they are all supported.

The biggest uncertainty here is whether each needs some explicit teacher-provided activity, or will be addressed implicitly by the learners the course is designed for.

Homework for next time

Homework:
See instructions on course web page.

Basically:
1) Read essay comparing Perry, D&S, L-model
2) Exercise using L-model to critique a learning design
3) Look at paper Miyake, to get a sense of what peer discussion of the right type ("Constructive Interaction") is.

A place to stop

For the slides, handout etc. see:

http://www.psy.gla.ac.uk/~steve/courses/cere.html