CERE slideset 1:
Concepts and Empirical Results in Education

Applied psychology: Education

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

This course is about education:

About learning and teaching in HE

Exercise

What were your personal best and worst educational experiences?

1. Write them down privately on a bit of paper.
2. Discuss them in pairs: turn to your neighbour
3. Merge pairs into groups of 4
4. Plenary

What is wanted on this course?

Some previous exam questions:

1. Does social psychology have anything important to contribute to education?
2. What is the combination of hindering and helping that peers represent for a learner? Comment on your own use and experience of peer interaction and how productive you judge it to have been.
3. Which is the most useful for improving learning and teaching: theories, effect sizes, or concrete learning designs?

What is the content of this course?

Concepts and Empirical Results in Education

There are 3 kinds of topic in this course:

1. Theories (concepts)
2. Big empirical results (huge effect sizes)
3. Specific learning designs
   ("treatments" to an experimentalist)
   (Applied science)

Break:
Look at References list

Part 1:

The nature of learning in HE

- Learning as conscious planned action
- Below vs. above age 4-7 years: un/intended learning
- Even for adults, not all learning comes from intentional and organised education / learning

- *What counts as learning?*
- Recall vs. recognition: Situated learning
- How do you measure it?
- Does the learner know when they know; when they have learned?
- Is knowledge in each person's head OR distributed throughout their society?

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The nature of learning in HE

Psychologists often study learning not at all like HE: involuntary learning (pin pricks), trivia answers picked up in conversation, what you can learn in a few minutes and are tested on soon after.

In HE, learning takes much longer, is tested after a much longer gap, and above all is intentional. It is thus more like problem-solving than "memory" in that it is:

a) Has a goal; is deliberate, willed.
b) Is planned: how it is done depends on the learner's ideas on how learning is done (and so goes better or worse depending on how skilled they are at learning)
c) Is an activity: not instantaneous, but managed; consisting of a complex assembly of actions; and its progress is regulated by judgements of whether the student "knows" it now.

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Motivation

Because it is intentional, and depends on the intention and planning of the learner, "motivation" is crucial.

What are the theories of motivation (that might relate to education)?

<Discuss>

Pintrich:
Approach/avoid X Learning , performance (learning vs. doing)

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Motivation (2)

What are the theories of motivation (that might relate to education)?
Are they adequate?

If I tell students that teaching each other promotes learning, they don't do it.
If I sit them down round my office table and get them to critique each others' work, they all do; they all then say it is valuable; they then usually do it in future without me.
How do we account for this; and particularly, what does it say about motivation?

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Motivation (3)

Learning	Doing
Cognitive state	Behaviour
Mastery	Performance
Deep	Shallow / surface
Understand	Learn it
Intrinsic motivation	Extrinsic motivation
Maslow self-actualisation	Pre-known goal
Episodic memory	Semantic memory
Stories, narrative	

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The nature of learning in HE (2)

A. What is learning: recall vs. recognition. (Situated learning)

B. How do you know when you have learned? —
What is the measure of it?
Transfer, near and far.

C. When do you know you've learned?
Meta-memory, meta-knowledge, meta-cognition.

D. Putnam: knowledge is socially anchored and distributed, not just in the learner's head.

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Part 2:

Some mind-bogglingly big effects

- Learning without teachers
- Chick sexing
- Hake / Hestenes / Mazur

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Effect no.1: Learning not organised by teachers

Allen Tough, a Canadian researcher active in the 1970s, (http://allentough.com/) looked into:

How much learning adults did:
90% had done at least one project in the last year
Average 5 projects per year
Average hours per week: 10

How much of it was independent of courses and teachers (about 4 out of 5 projects).

But also notable is that almost no-one at first said this: they actually didn't realise that this was serious learning, and largely self-directed and self-managed.

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Allen Tough's Adult learning projects (2)

Definition: any period of time in which your primary motivation (over 50% of the motive) is to gain and retain knowledge and skill.

(N.B. very many of these are for practical reasons, but you pursue the eventual practical end through spending time first directed at learning.)

Spend a few minutes writing this down (then we'll do some sharing):

How many such projects have you done in the last year? Start writing down the ones you can remember; and if possible, a guesstimate at how many hours altogether you spent at it.

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Allen Tough's Adult learning projects (3)

Tough and his followers have found a similar pattern in samples from age 16 to 60.

Clearly people have no trouble doing learning, nor in managing their own learning, and more often than not do not find organised teaching (courses) the most useful for their purposes. LifeLong Learning is not new, and doesn't seem to need help.

Most of the literature turns its back on this;
Just as drug companies might prefer you not to compare the effect of their drug with the effect of giving no treatment at all.

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Sugata Mitra

How much children learn with no teachers at all present

Slum hole in the wall

Grandmother effect

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Video games

- 32% of all adults (34% of men, 31% of women) in the UK describe themselves as ‘gamers’ (Interactive Software Federation of Europe)
- One child in two plays games every day (ISFE, 2010)
- 2011’s *Call of Duty: Modern Warfare 3* out-grossed the last four *Harry Potter* films combined (GFK Chart-Track, 2011)
- The average age of a gamer is estimated to be somewhere in the mid-thirties, with the Entertainment Software Association placing the current figure at 37.

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Video games consist of learning tasks

- Best-designed games typically comprise a series of **coinciding or intersecting goals**, with **short-, medium- and long-term conclusions**
- This arrangement of goals, which **permits the student to progress on a number of fronts** – even when one goal is seemingly out of reach – has some significant advantages for **student engagement**
- More difficult to implement in a structured, often didactic, educational environment such as a school or university?

=> Video games are founded on an intrinsic love of learning

Turnover (it's big business)
Not just the young. Not just males.
Voluntary creation of informative websites ....

=> At bottom, the motivation seems to be an intrinsic love of learning stuff which is of no possible extrinsic use in the real world.

so why does formal education do so poorly? .....

My analysis of VideoGames

Their appeal has an overall driving motive of intrinsic love of discovering (learning) the rules for their own sake.

The chief learning method is play (trying things out);
but may involve other learning methods at times.

There may be additional rewards sometimes, both intrinsic and extrinsic e.g. playing for money, or fame (the latter is a social satisfaction); the visual pleasures so many games spend lavishly on creating.

Effect no.2: General effect of teachers

According to Dylan Wiliam:
The biggest causal factor in most studies, is which teacher a child gets: differences (in learning outcomes) are almost always more affected by which teacher than by whether you get the "new" or old teaching method in an experiment.

It will make more difference to a child whether they get the best or worst teacher in a given school, than whether they go to the richest or most "deprived" school in a region.

And most of this is how many years experience the teacher has.

Refs: Wiliam's talk; Chingos et al. 2010, Hanushek 22

Implications: effect of teachers (2)

Since teachers can only get experience by practising, there is no way to give every child a good teacher.

Important aspects of teaching must be, not conscious knowledge, but a tacit skill.

It implies that teacher training may be useless:
If we knew what good teaching was, then surely we could teach it to teachers and avoid the dependence on experience?

When we do experiments on teaching methods, we should use as a scale, the size of change that teacher experience makes.
Methods with as big an effect are important….

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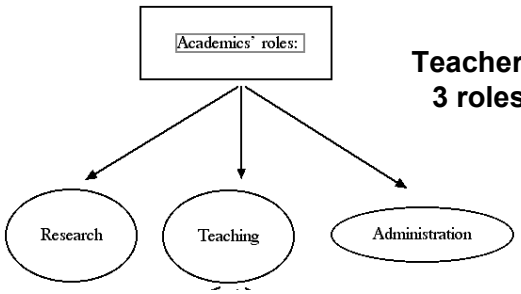

Teachers' 3 roles

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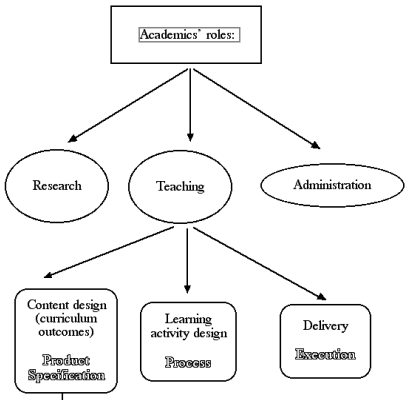

Teachers' 3 roles

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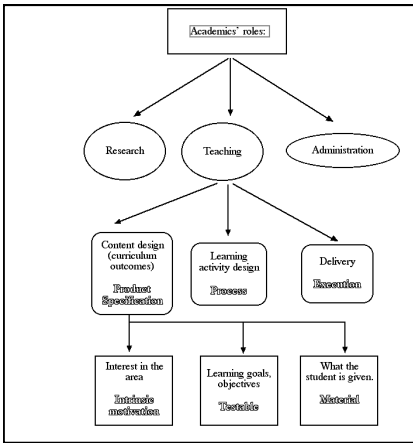

Teachers' 3 roles

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3 roles of teaching

(Academic jobs are typically expressed as having 3 kinds of work: Research, teaching, administration.)

But in fact, teaching has 3 facets.
And a person might be excellent at one, yet rubbish at another.
I.e. good teaching is not a single thing

- Delivery e.g. lecturing, facilitating discussions. [role 3]
- Knowledge selection and expression. [role 1]
  Selection of topics; selection or authoring of materials
- Designing learning activities. [role 2]

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Role 3 of teaching: Delivery. The "Dr.Fox" experiments

There have been experiments on whether lecture delivery skill made a difference to learning.
Hired an actor; fixed the script; had it delivered with high or low "expressiveness".
But also, tried it on 2 groups: students who expected to be tested, and students who did not.

If they thought they had to learn it, it made a difference to their ratings of the lecture but not to their learning (test scores);
If they thought they didn't have to learn it, then the well delivered lecture caused higher learning.

So in HE, student will power overrides teacher delivery lack of skill. Good delivery is good professional practice, but it isn't a bottleneck to learning.

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Neo-Vygotskian arguments

There is another type of "delivery" that may be important, but I haven't seen direct evidence about it.
Vygotsky's argument about child development was that every important pattern of thought begins with a type of conversation with, and scaffolded by, and adult. Gradually the child takes a bigger and bigger role, and finally internalises it to do it solo.
It is a very big leap to suggest this is relevant to HE. But …
Showing students types of thinking, problem solving, not knowing stuff but <u>being</u> a programmer, a psychologist, ….

The real role of a tutor: not marking work and being a walking FAQ repository, but doing pair programming with a student, …

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Role 1 of teaching: Creating knowledge. Chick sexing

To be learned: sexing day old chicks (for the egg industry)
Viewed as an implicit skill: some people could do it, but couldn't tell you how to do it yourself.
Training used to take 6-12 weeks to get a person up to speed and accuracy for useful employment. Method was loads of practice, feedback from an expert.
Then researchers worked on creating an instruction leaflet (pictures, some text). Trainees learned more in 1 minute from the leaflet than in previous 6-12 weeks.
This is an improvement of about 26,000 times.

So discovering the knowledge, and expressing it in a leaflet can be very valuable: one role of a "teacher".

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Role 2 of teaching: Learning activity design

Hake's "Interactive engagement"

Mazur's "Peer instruction"
(really, peer discussion of brain teasers)

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Carroll and Mastery Learning

In 1963-1980 the work by J.B.Carroll and then Bloom showed the irrationality (and damaging nature) of the standard attitude that school tests measure ability.

If you assume the learning and teaching must be constant, then the spread of test scores looks like a measure of learner ability.

But (they showed) if you vary the time and/or teaching method, then the spread largely disappears: so the former spread can't be a measure of learner limitations.

ML set out to give every learner the experience, not of praise, but of objective success.

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Carroll's view of the determinants of learning

J.B.Carroll's view, backed by experiment, was that learning outcomes depended on all 5 of these factors i.e. is a function of 5 variables (not on a single learner attribute):

1. Time allowed
2. Perseverance
3. Aptitude
4. Quality of instruction
5. Learner's ability to understand the instruction

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Typical test scores

Summative achievement scores

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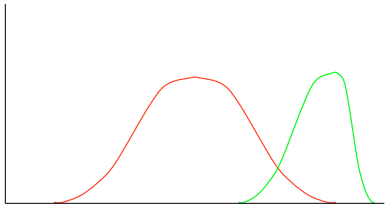
Mastery learning scores



Summative achievement scores Mastery learning scores

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The argument

Mastery Learning (ML) rests on the view that if the only tests a learner gets show differences between learners (but without comparing different teaching methods, learning actions, time taken, ….) then everyone tends to interpret them as about learner abilities.

What is poisonous about standard school and university teaching is to vary only the learner: so we are almost forced to interpret marks as about their ability. To learn effectively, instead, they need to monitor their learning after a first pass, and correct it: a totally different use of tests, with different stance on capabilities.

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Mastery Learning: the method

Mastery Learning demonstrated the same effects as the recent published studies mentioned above, more widely, 25 years earlier, using similar methods.

- Telling the students not to interpret formative tests as ability measures
- Giving them highly specific suggestions about how to improve, and the occasions to act on this.
- Showing confidence in them, based on most of the class succeeding
- Giving them the experience of success on objective tests
- I.e. basing assertions on evidence not empty words

One difference was that the first and original aim was to to change the mindset teachers have about learners: to convince them that almost all learners can succeed, and that exams are NOT there to label student performance as a measure of capability.

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Hake

Hake (1991): "The results [course feedback] showed quite clearly that my brilliant lectures and exciting demonstrations on Newtonian mechanics had passed through the students' minds leaving no measurable trace. To make matters worse, in a student evaluation given shortly after the exam, some students rated me as among the worst instructors they had ever experienced at our university. Knowing something of the teaching effectiveness of my colleagues, I was severely shaken."

So he went looking for better ways to teach physics …..

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Hake's survey

Hake (1998) published a survey of 62 courses (6,542 students) all studying the same subject, all using the same standardised test, and using it both pre- and post-.

He graphed the mean gain on each course against whether or not it had used the method of "Interactive engagement".

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See fig. 1 in:

Hake,R.R. (1998) Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses Am.J.Physics 66(1), 64-74

Hake's results

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Mazur

Crouch & Mazur (2001) published an analysis of 10 years of Mazur's MIT course.

Again, the standardised pre- and post-test.

He concludes he has doubled the amount of learning, but the graph suggests that really, he tripled it.

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See fig.2 in:

Crouch, C.H. and Mazur, E. (2001), "Peer Instruction: Ten years of experience and results" American Journal of Physics 69, 970-977

Mazur's gains

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The learning design

So more effective teaching can be achieved.

"Interactive engagement" and "peer instruction" revolve around asking students questions. These may be presented using Electronic Voting Systems (EVS).

But what kind of questions? Brain teasers.

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Brain teaser questions

The point is to provoke debate, internal and between peers.
Cf. Socratic questioning, and "catalytic assessment"

Remember the old logo or advert for Levi's jeans that showed a pair of jeans being pulled apart by two teams of mules pulling in opposite directions. If one of the mule teams was sent away, and their leg of the jeans tied to a big tree instead, would the force (tension) in the jeans be:

- half
- the same
- or twice what it was with two mule teams?

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Teachers making a difference: Recap

Teachers clearly can make a big difference to learning;
but not in the way almost everyone automatically thinks almost all the time. It is mostly not the face to face contact ….

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3 roles of teaching

(Academic jobs are typically expressed as having 3 kinds of work: Research, teaching, administration.)

But in fact, teaching has 3 facets.
And a person might be excellent at one, yet rubbish at another.
I.e. good teaching is not a single thing

1. Knowledge selection and expression.
   (The biggest recorded effect: chick-sexing; but not easy to see how to generalise it.)
2. Designing learning activities.
   (The most published research; some of it with big effects e.g. Mazur.)
3. Delivery e.g. lecturing, facilitating discussions.
   (Not a bottleneck in practice.)

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Part 3:

Homework for next week

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Homework for next time

Homework:
Read the Chi08 paper (and/or the Craig09 one). Details on the handout.
Next week will be all about this; and if you haven't read it, you'll have trouble following.
This paper touches on many of the important themes in this course e.g. should all academics be sacked and replaced by videos?

This is a long paper; and because even though it is well written, it is full of important stuff, it will take a long time to read. You will not be able to do it in half an hour at the last moment. Start early, take your time, let it sink in. Among other things, it could be taken as evidence that most university academics could be sacked and replaced by video tape. It makes us think about what use university teachers really, do they matter and how.

Part 4:

The coursework

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Main approach to this course

The main coursework is for each group to create a web page that is the most helpful possible aid to, or interesting and informed commentary about, one issue in CERE.

Actually, not a web page exactly but a document posted in Moodle for other students, but created on Google Docs.

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What is useful in a web page, in a colleague?

Over the years, I've found colleagues really really helpful, but not by writing detailed reports just for me with zero errors in. Instead, it's about orienting me, giving me a vital clue, telling me what is worthwhile and what isn't; warning me of pitfalls I'd have fallen into ....

What would you most want to know about each of 9 CERE topics?
Partly: help in choosing which topics to invest in; and then, where to start studying it.
Partly: seeing how various questions relate to the way topics were presented in the course, to help get you to think flexibly about the issues, not just in terms of frozen chunks of lectures.

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What is useful in a web page, in a colleague? (2)

People act more impatiently on the web than anywhere else, but in fact the kind of writing needed for a web page is the same as that taught to journalists, and the technique it is well if you use when writing for those you are desperate to read you e.g. funding referees, job applications.

I call this format "Pyramid writing". I.e. the title (headline) has to get the reader to read the first sentence. The first sentence has to get them to read the first paragraph, ...

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Free bonus: Graduate attributes

The coursework, then, is important to "providing" the course content; and to exercising alternative angles on the course content.

However it is also introducing you to some extra skills likely to be useful to you in future. These include:

- Posting a document on the web
- Writing in a "pyramid" style
- Working in a team you don't know and didn't choose, to a deadline, on something crucial to your career. Just like many professional jobs, then.

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What you need to do:
Now in class; and for homework

1) Homework: See handout for important reading for next week.

2) Sarah Honeychurch will now give you a brief introduction to GoogleDocs; the medium you will use to create your coursework documents.

3) You have been allocated to a group of ≈ 3 (see handout).
For the remainder of this session, we'll try to get you to meet your group; and adjust group membership.

In next week's session we'll finalise the topic each group will do. I've allocated a starter topic for each group, but you don't have to stick to that.

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Practical actions in the course

Now turn to the handout.

A. Back page: list of topics, one per student group.
B. Front page is a provisional list of students and groups.

- By name. Find your name.
- By groups, so you can see who else is in your group.

During the remainder of the time, I'm going to get you to meet in your groups in this room, and visit each group adjusting numbers. Don't leave until your group is completely fixed up.

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A place to stop

For the slides, handout etc. see:

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

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