Cognitive Science of Learning
Rats and humans refine their movements over multiple trials

The Learning of Cognitive Science

My teaching
Active learning
Theory

Action essential to learning

Exploration and variability as engines of discovery
Practice: flipped classrooms

PSY243 a large enrollment (200+) cognitive psychology course. Strategy
1. Pre-lecture material
Forgetting is as important to study as remembering. Which of these are true?

- Forgetting is always a failure of storage, never of encoding or retrieval
- The rate of forgetting is initially rapid and then slows with increased time
- The primacy effect is stronger than the recency effect

Define metacognition (one sentence). Give an example (one sentence)

Leave any comments here (they will be read, I cannot guarantee a response)
3 levels of criticism

Level 2: Specific weaknesses

- not enough people
  - e.g. if there was a difference between conditions but not enough evidence to support a difference (i.e., lack of statistical power)
- unrepresentative study population
  - e.g. students and sleep habits
Practice: flipped classrooms

PSY243 a large enrollment (200+) cognitive psychology course. Strategy
1. Pre-lecture material
2. Transparent purpose
Valuing Autonomy and Respecting Persons: Manipulation, Seduction, and the Basis of Moral Constraints*

Sarah Buss

Whether we are writing poetry or constructing arguments, playing sports or baking cakes, we human beings are governed by laws we impose on ourselves. But of all the forms that self-government takes, one has been singled out for special philosophical attention, perhaps because it appears to underlie all the rest. This is the self-governed (and self-governing) activity we call “making up one’s own mind about how to act.” It is generally agreed that our capacity to do this is quite a marvelous evolutionary achievement. Indeed, many believe that being
Practice: flipped classrooms

PSY243 a large enrollment (200+) cognitive psychology course. Strategy
1. Pre-lecture material
2. Transparent purpose
3. Shared objects

Karpicke & Roediger (2008). Analysis
Analysis of this paper, for PSY243

https://prezi.com/01qlxokv3cg-/
Practice: flipped classrooms

PSY243 a large enrollment (200+) cognitive psychology course. Strategy
1. Pre-lecture material
2. Transparent purpose
3. Shared objects
4. Cheap tricks
Cheap tricks for starting discussions in lectures

https://medium.com/@tomstafford/cheap-tricks-for-starting-discussions-in-lectures-c6baecd4a6c8#.rhhqp04wd

1. Paired discussions
2. No straight questions
3. Positivity
4. Technological fixes
Add your questions here:

Why did they use Swahili words as the test materials?

Can you explain the graph again

Are my lessons done?
Jupyter notebooks

**PSY105 Lecture 1: Emergence, levels of description and the brain**

This is a notebook, a way of looking at python code that shows comments (like this here) the code you run (below) and the results (below each piece of code).

Python is a free programming language. This means you can compute things.

Like this:

```
In [1]: print 1+13
14
```

Programming languages work on assigning values to particular letter-words strings. These are called variables

```
In [3]: my_name = "Tom"

print "Hello " + my_name
Hello Tom
```

```
In [4]: x=1

print x+1
2
```
Feedback
Errorful learning
Radical uncertainty & specificity of training
  + curse of knowledge
Avoidance learning / confirmation bias
Practice

Individualised feedback emails

http://www.tomstafford.staff.shef.ac.uk/?p=372
Here is a record of your activities:
Weeks 1-9, concept checking quizzes completed (out of 7): 4
Week 1-10, asked question via wiki or discussion group: NO
Week 3, submitted practice answer: NO
Week 7, submitted answer for peer review (compulsory): YES
Week 8, number of peer reviews submitted (out of 3, compulsory): 3
Week 10, attended seminar discussion: NO

We can combine these records to create a MODULE ACTIVITY ENGAGEMENT SCORE.

* * * Your score is 57% * * *
Restate purpose
Notes on assessment
Model answer (only on answered question)
Individual feedback
PSY105 Lecture 1: Emergence, levels of description and the brain

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```
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print x+1

2
```
Evidence from education

What works, at what cost
Effectiveness and cost of education strategies

<table>
<thead>
<tr>
<th>Effect in additional months’ progress</th>
<th>Relative costliness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback to pupils</td>
<td>9 $</td>
</tr>
<tr>
<td>Meta-cognitive strategies*</td>
<td>8 $</td>
</tr>
<tr>
<td>Peer tutoring</td>
<td>6 $</td>
</tr>
<tr>
<td>Collaborative group learning</td>
<td>5 $</td>
</tr>
<tr>
<td>Reducing class size to &lt;20</td>
<td>3 $ $$$</td>
</tr>
<tr>
<td>Individualised instruction</td>
<td>2 $</td>
</tr>
<tr>
<td>Mentoring of pupils</td>
<td>1 $ $$$</td>
</tr>
<tr>
<td>Teaching assistants</td>
<td>1 $ $$$</td>
</tr>
<tr>
<td>Improving school buildings</td>
<td>0 $</td>
</tr>
<tr>
<td>Streaming by ability</td>
<td>-1 $</td>
</tr>
</tbody>
</table>

Source: Education Endowment Foundation
*Helping pupils think about their own learning more explicitly

Teaching the teachers, The Economist, Jun 11th 2016
Peer support
Theory

All of cognition is social
Group reasoning
Practice

Seminars
Peer tutoring - 3rd year
Peer review college
Writing for others
Main Page

Contents

1 Links to other modules
2 PSY241 Cognitive Psychology
3 Topics and Discussion
4 Study groups
5 Frequently Asked Questions
6 Useful Links
7 Using a wiki

Links to other modules

PSY242 Social & Health Psychology

PSY241 Cognitive Psychology

Reading maketh a full man, conference a ready man, and writing an exact man.
- Francis Bacon (1561-1626) 'Of studies'

You must log in to edit this wiki.
- Your username is your university username (e.g. p123456) in lower case letters and the password is your date of birth in the form dd/mm/year (e.g. 01/01/1991)

Course overview document is here when it is ready (ie Monday of Intro week)

http://psy241.group.shef.ac.uk/psy241wiki/index.php/Main_Page
Evidence-based Education?
The evidence is against student led learning

http://www.oecd.org/pisa/
Do students know what’s good for em’?

Effectiveness can anti-correlate with evaluations

See also:
Arthur Poropat *Students don’t know what’s best for their own learning* and Jules Holroyd & Jenny Saul *Will the Teaching Excellence Framework be sexist?*
Evidence and generalisation

‘Causal density’

Evidence-based vs Evidence-informed
Open science model

Classrooms as models of scholarly community
  Peer support
  Accessible debates
  Common procedures/tools
  Transparent outcomes

Open syllabus  opensyllabusproject.org/
t.stafford@sheffield.ac.uk
@tomstafford

http://www.tomstafford.staff.shef.ac.uk/
END
Don’t show these slides
Don’t show these slides
I had nothing to offer anybody except my own confusion.

- Jack Kerouac
I am not a writer, a philosopher, a great figure of intellectual life: I am a teacher.... I don’t want to become a prophet and say, “Please sit down, what I have to say is very important.” I have come to discuss our common work.
Intrinsically Motivated Cumulative Learning Versatile Robots

Practice: spacing
How to learn: Spaced vs blocked practice

Theory
**Decision making**
- Bayes, Cost functions, evidence accumulation [1]
- Representation in LIP, Switching in BG
- Speed-accuracy trade-offs, discounting, prospect theory

**Learning**
- Reinforcement learning, hebb rule
- Cortical plasticity, RPEs in BG
- Learning curve, spacing, decay, consolidation, exploration-exploitation
<table>
<thead>
<tr>
<th>Environment</th>
<th>Exploit</th>
<th>Explore</th>
</tr>
</thead>
<tbody>
<tr>
<td>safe</td>
<td>Suboptimal discovery</td>
<td></td>
</tr>
<tr>
<td>risky</td>
<td></td>
<td>Costly discovery</td>
</tr>
</tbody>
</table>
Example consequence:

Confirmation bias in negative evaluations

Other
Brain network: social media and the cognitive scientist

Tom Stafford* and Vaughan Bell**

1 Department of Psychology, University of Sheffield, Sheffield, UK
2 Department of Clinical Neuroscience, Institute of Psychiatry, King’s College London, London, UK

Cognitive scientists are increasingly using online social media, such as blogging and Twitter, to gather information and disseminate opinion, while linking to primary articles and data. Because of this, internet tools are driving a change in the scientific process, where communication is characterised by rapid scientific discussion, wider access to specialist debates, and increased cross-disciplinary interaction. This article serves as an introduction to and overview of this transformation.
