Teaching as a Design Science: Tools to support an evidence-based professional culture

Diana Laurillard
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The challenges of teaching MOOCs

The issues

• Global demand for HE
• The roles of TEL
• Delivery? ✓
• Support? ✗
• The role of the teacher
• Modelling the benefits and costs
The global demand for HE

By 2025, the global demand for higher education will double to ~200m per year, mostly from emerging economies (NAFSA 2010)

UK universities offer TNE, including online distance learning for 75/100k students – 5.3% of undergraduate population (BIS 2011, UUK 2012)

The new UNESCO goals for education:
Every child completes a full 9 years of free basic education ...
Post-basic education expanded to meet needs for knowledge and skills ... (Draft for UNESCO post 2015 goals)

- Implying significant teacher training needs for HE

1:25 staff-students??
The roles of TEL and teacher time

- Access to expositions – lectures, guides
- Automated grading – MCQs, inputs to models
- Online master classes for vicarious learning
- Guided TEL resources, tools, simulations, models
- Guided individual activities
- Orchestrated peer collaboration activities
- Peer discussion forums
- Peer group discussion forums
- Peer grading against criteria
- Tutors’ FAQs and FOGs
- Tutored discussion forums
- Tutored group activities
- Qualitative feedback
## MOOC delivery and support of learning

### Delivery
- Access to expositions – lectures
- Automated grading – MCQs
- Online master classes for vicarious learning
- Guided TEL resources
- Guided individual activities
- Orchestrated peer collaboration activities
- Peer discussion forums

### Support
- Peer grading against criteria
- Tutors’ FAQs and FOGs
- Tutored discussion forums
- Tutored group activities
- Qualitative feedback

<table>
<thead>
<tr>
<th>Delivery</th>
<th>Prep costs</th>
<th>Support costs</th>
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<tbody>
<tr>
<td>Access to expositions – lectures</td>
<td>High</td>
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<tr>
<td>Automated grading – MCQs</td>
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<tr>
<td>Online master classes for vicarious learning</td>
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<td>Orchestrated peer collaboration</td>
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<td>0</td>
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<tr>
<td>Peer discussion forums</td>
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<td>Low</td>
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</tbody>
</table>

| Support                                         |            |               |
| Peer grading against criteria                   | Low        | Low           |
| Tutors’ FAQs and FOGs                           |            | Med           |
| Tutored discussion forums                       | 0          | Med           |
| Tutored group activities                        |            | High          |
| Qualitative feedback                            | 0          | High          |
The role of the teacher in HE

The purposes of higher education:

- To inspire and enable individuals to develop their capabilities to the highest...
- To increase knowledge and understanding for their own sake...
- To serve the needs of an adaptable, sustainable knowledge-based economy...
- To play a major role in shaping a democratic, civilised, inclusive society (NCIHE, 1997)

How could mass HE achieve that nurturing of the individual, while reducing the current 1:25 staff-student ratio for student support?
Modelling the benefits and costs

• We need to understand the pedagogical benefits and teacher time costs of online HE

• What are the new digital pedagogies that will address the 1:25 student support conundrum?

• Who will innovate, test, and build the evidence for what works at scale online?
TEACHERS!
Teachers: with the tools to support an evidence-based professional culture

Tools for constructing, analysing, testing and sharing innovative learning designs

Convivial tools are those which give each person who uses them the greatest opportunity to enrich the environment with the fruits of his or her vision. (Illich, 1973:21)

A pedagogical front-end to the VLE or MOOC platform
Tutorial: Using a search engine
Learning Outcome: A clear understanding of the role of the critical factors in the system
Summary: through preparing their own account of using a search engine, to demonstrate the role of the critical factors, using the Library guidelines; presenting it to their group; defending it against questions and comments; and revising their account in the light of the tutor’s summary of the discussion

Tutorial: On a system or process
Learning Outcome: A clear understanding of the role of the critical factors in the system
Summary: through preparing their own account of the system/process, to demonstrate the role of the critical factors, using the resources provided; presenting it to their group; defending it against questions and comments; and revising their account in the light of the tutor’s summary of the discussion

Tutorial: The water cycle
Learning Outcome: A clear understanding of the role of the critical factors in the system
Summary: through preparing their own animation of the water cycle, to demonstrate the role of the critical factors, using the OER cycle; presenting it to their group; defending it against questions and comments; and revising their account in the light of the tutor’s summary of the discussion

OER Library
• 1st teacher specifies their design
• Once happy with it, submits to an online library of learning designs
• Editor produces a generic version, removing content specific parts
• 2nd teacher downloads generic version, populates with own content
Sharing learning designs 2

Tutorial: Using a search engine
Learning Outcome: A clear understanding of the role of the critical factors in the system
Summary: through preparing their own account of using a search engine, to demonstrate the role of the critical factors, using the Library guidelines; presenting it to their group; defending it against questions and comments; and collaborating to produce a better account to post on their website

Tutorial:
The water cycle
Learning Outcome: A clear understanding of the role of the critical factors in the system
Summary: through preparing their own animation of the water cycle, to demonstrate the role of the critical factors, using the OER cycle; presenting it to their group; defending it against questions and comments; and collaborating to produce a better animation to post on their website

OER Library
• 2nd teacher improves the design
• Once happy with it, submits to online library – families of learning designs
• Editor produces a generic version, removing content-specific parts
• 1st teacher imports improved generic version, populates with own content

…Everybody wins
Sharing learning designs in a MOOC

OU-IOE+ collaboration on a MOOC, now running at www.olds.ac.uk

Week 4: Connect

31 January – 6 February 2013

Twitter hashtag: #oldsmooc_w4

This week we assume that the 'teacher-designer' - Peter Goodey's term (see his webpage http://fp.edsw.ualy.edu.au/users/pgoodey) - knows roughly what the conceptual focus is. The 'Connect' concept is similar to what in one recent project became known as 'BOTWOO' - Building On The Work Of Others. Not an elegant acronym, but strangely memorable. This is what we all do as researchers, but do much less as teachers. Teachers don’t find it that easy. Even the OER (Open Educational Resources) movement is still struggling to make this idea catch on widely among teachers, although it’s been around for a while. But this week the idea is to start not with the content as the object of reusable design knowledge, but the teaching pattern (or pedagogical pattern, or learning pattern, or lesson plan, or teaching plan). We’ll be looking at ways of tackling that issue, with practical activities to illustrate how it might be done. The week is led by Professor Diana Laurillard of the London Knowledge Lab with Dr. Niall Winters also of the
Teachers as designers need the tools for innovation

To find or create new ideas

Adopt

Adapt

Test

To collect learning analytics

Redesign

Analyse

Collaborate

Creating knowledge about effective online pedagogies

Tools for teachers as designers

**Pedagogical Pattern Collector**

**Welcome**

The Pedagogical Patterns Collector suite of tools enables teachers to share their good teaching ideas. It is intended to help a subject teacher see how a particular pedagogic approach can be migrated successfully across different topics. There are sample patterns to browse and edit, or you can design your own from scratch. This is an output from the TLRP-TEL research project on a learning design support environment for teachers and lecturers, funded by the ESRC-EPSRC.

**‘PPC Browser’**

offers a collection of generic pedagogical patterns, and their associated instances, which you can redesign for your own teaching practice.

**‘PPC Designer’**

presents the pedagogical pattern template to help you describe your own teaching idea for a session (e.g. student preparation, class activities and homework).

‘PPC Abstractor’ is a tool that helps you abstract your teaching ideas, expressed with PPC Designer, into a generic, more reusable form.
Tools for teachers as designers - PPC

A library of patterns to inspect

Learning Outcome - Students will be able to: Evaluate differing interpretations of an event, artefact or

Context (e.g. historical monument, building) Altar of Pergamon

Interpretations (e.g. Classical Historian, Archaeologist etc.) an archaeologist, a classicist, and a modern historian

Key aspects (e.g. origin, purpose, meaning etc.) origin, purpose, meaning, references

TLA 1 - Briefing

- Read/view the text/presentation illustrating the importance of interpreting an artefact (Investigate - 10 minutes)

TLA 2 - Exploring to compare multiple interpretations of the context

- On your own explore multiple perspectives from an archaeologist, a classicist, and a modern historian (Investigate - 25 minutes)
- On your own work through the exercise to test your understanding of the different perspectives on origin, purpose, meaning, references of the Altar of Pergamon, where the feedback will refer you back to the different interpretations (Practice - 10 minutes)
- On your own, produce an outline of the critical differences between the interpretations (Collaborate - 10 minutes)

TLA 3 - Collaborating to reflect on the comparisons in terms of the key aspects

- In pairs, discuss your outlines and agree a joint outline of the critical differences between the interpretations (Collaborate - 10 minutes)
- Discuss with the whole group the ways to appreciate multiple interpretations, making use of your notes from previous activity (Discuss - 25 minutes)
Learning Outcome - Students will be able to: **Evaluate differing interpretations of an event, artefact or**

Context (e.g. historical monument, building) - Altar of Pergamon

Interpretations (e.g. Classical Historian, Archaeologist etc.) - an archaeologist, a classicist, and a modern historian

Key aspects (e.g. origin, purpose, meaning etc.) - origin, purpose, meaning, references

**TLA 1 - Briefing**
- Read/view the text/presentation illustrating the importance of interpretive pluralism (Read/Watch/Listen - 10 minutes)

**TLA 2 - Exploring to compare multiple interpretations of the context**
- On your own explore multiple perspectives from an archaeologist, a classicist, and a modern historian on origin, purpose, meaning, references of the Altar of Pergamon, and note down the key points made (Investigate - 25 minutes)
- On your own work through the exercise to test your understanding of the different perspectives on origin, purpose, meaning, references of the Altar of Pergamon, where the feedback will refer you back to the different interpretations (Practice - 10 minutes)
- On your own, produce an outline of the critical differences between the interpretation (10 minutes)

**TLA 3 - Collaborating to reflect on the comparisons in terms of the key aspects**
- In pairs, discuss your outlines and agree a joint outline of the critical differences between (Collaborate - 10 minutes)
- Discuss with the whole group the ways to appreciate multiple interpretations, making previous activity (Discuss - 25 minutes)

**Tools for teachers as designers - PPC**

- Colour-coded text identifies content parameters
- Black text expresses pedagogy design
Category of learning type and duration in minutes

Tools for teachers as designers - PPC

Learning Outcome - Students will be able to: **Evaluate differing interpretations of an event, artefact or**

Context (e.g. historical monument, building) - Altar of Pergamon

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**TLA 2 - Exploring to compare multiple interpretations of the context**
- On your own explore multiple perspectives from an archaeologist, a classicist, and a modern historian on origin, purpose, meaning, references of the Altar of Pergamon, and note down the key points made (Investigate - 25 minutes)
- On your own work through the exercise to test your understanding of the different perspectives on origin, purpose, meaning, references of the Altar of Pergamon, where the feedback will refer you back to the different interpretations (Practice - 10 minutes)
- On your own, produce an outline of the way different scholars interpret the interpretations (Collaborate - 10 minutes)

**TLA 3 - Collaborating to reflect on the interpretations**
- In pairs, discuss your outlines and agree on any differences between the interpretations (Collaborate - 10 minutes)
- Discuss with the whole group the way you agree to the interpretations, making use of your notes from previous activity (Discuss - 25 minutes)
Learning Outcome - Students will be able to: **Evaluate differing interpretations of an event, artefact or**

**Context** (e.g. historical monument, building)  
Altar of Pergamon

**Interpretations** (e.g. Classical Historian, Archaeologist etc.)  
an archaeologist, a classicist, and a modern historian

**Key aspects** (e.g. origin, purpose, meaning etc.)  
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**TLA 2 - Exploring to compare multiple interpretations of the context**
- On your own explore multiple perspectives from an archaeologist, a classicist, and a modern historian on origin, purpose, meaning, references of the Altar of Pergamon, and note down the key points made (Investigate - 25 minutes)
- On your own work through the exercise to test your understanding of the different perspectives on origin, purpose, meaning, references of the Altar of Pergamon, where the feedback will refer you back to the different interpretations (Practice - 10 minutes)
- On your own, produce an outline of the critical differences between the interpretations (Collaborate - 10 minutes)

**TLA 3 - Collaborating to reflect on the comparisons in terms of the key aspects**
- In pairs, discuss your outlines and agree a joint outline of the critical differences between the interpretations (Collaborate - 10 minutes)
- Discuss with the whole group the ways to appreciate multiple interpretations, making use of your notes from...
Learning Outcome - Students will be able to: **Evaluate differing interpretations of an event, artefact or**

Context (e.g. historical monument, building)

Interpretations (e.g. Classical Historian, Archaeologist etc.)

Key aspects (e.g. origin, purpose, meaning etc.)

**TLA 1 - Briefing**
- Read/view the text/presentation illustrating the importance of interpretive pluralism (Read/Watch/Listen - 10 minutes)

**TLA 2 - Exploring to compare multiple interpretations of the context**
- On your own explore multiple perspectives from a set of views on a set of aspects of the context, and note down the key points made (Investigate - 25 minutes)
- On your own work through the exercise to test your understanding of the different perspectives on a set of aspects of the context, where the feedback will refer you back to the different interpretations (Practice - 10 minutes)
- On your own, produce an outline of the critical differences between the interpretations (Collaborate - 10 minutes)

**TLA 3 - Collaborating to reflect on the comparisons in terms of the key aspects**
- In pairs, discuss your outlines and agree a joint outline of the critical differences between the interpretations (Collaborate - 10 minutes)
- Discuss with the whole group the ways to appreciate multiple interpretations, making use of your notes from previous activity (Discuss - 25 minutes)
Transferring the pedagogy across topics - PPC

Learning Outcome - Students will be able to: **Evaluate differing interpretations of an event, artefact or**

**Context (e.g. historical monument, building)**: child

**Interpretations (e.g. Classical Historian, Archaeologist etc.)**: a teacher, an educational researcher, and a neuroscientist

**Key aspects (e.g. origin, purpose, meaning etc.)**: likely causes of the classroom behaviour

**TLA 1 - Briefing**
- Read/view the text/presentation illustrating the importance of interpretive pluralism (Read/Watch/Listen - 10 minutes)

**TLA 2 - Exploring to compare multiple interpretations of the context**
- On your own explore multiple perspectives from a teacher, an educational researcher, and a neuroscientist on likely causes of the classroom behaviour of the child, and note down the key points made (Investigate - 25 minutes)
- On your own work through the exercise to test your understanding of the different perspectives on likely causes of the classroom behaviour of the child, where the feedback will refer you back to the different interpretations (Practice - 10 minutes)
- On your own, produce an outline of the critical differences between the interpretations (Collaborate - 10 minutes)

**TLA 3 - Collaborating to reflect on the comparisons in terms of the key aspects**
- In pairs, discuss your outlines and agree a joint outline of the critical differences between the interpretations (Collaborate - 10 minutes)
- Discuss with the whole group the ways to appreciate multiple interpretations, making use of your notes from the exercise (Collaborate - 10 minutes)
Teacher adopts and adapts a design

Add link to an OER, e.g. a digital tool for practice

Specify the duration of the activity in minutes

Adjust the type of learning activity. Edit the instructions.

Export to Word [Moodle]

Check the feedback on the overall distribution of learning activity

Represent the teacher as present or not

Share the pattern

Adopt – Adapt – Import resources - Test and re-design – Share what works
Modelling the pedagogic benefits

A computational representation can analyse how much of each activity has been designed in

**Conventional**

**Blended**

Analysis shows more active learning

Categorised learning activities
Modelling the teaching costs

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<th>Conventional</th>
<th>Online</th>
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<td></td>
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<tr>
<td>Student numbers</td>
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</tr>
<tr>
<td>Teacher hrs per student</td>
<td>3.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Total teacher days</td>
<td>12</td>
<td>6</td>
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</tbody>
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<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
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<td>30</td>
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<tr>
<td></td>
<td>1.6</td>
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<td></td>
<td>6</td>
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Modelling the costs for increasing student cohort size

A higher proportion of fixed costs and scaling up improve the **per-student preparation** costs.
Modelling the costs for increasing student cohort size

Scaling up will *never improve* the per-student support costs… unless…

The cost of commenting, advising, marking for each student
Modelling the costs for increasing student cohort size

... we come up with some clever pedagogical patterns that support at better than the 1:25 ratio

The question is – what are they, and how do we develop and share them?
The global demand for HE requires investment in pedagogic innovation for MOOCs to deliver TEL-based pedagogic innovation must support students at a better than 1:25 staff-student ratio.

Teachers are the engine of innovation – designing, testing, sharing their best pedagogic ideas.

They need the tools to design, test, gather the evidence of what works, and model the benefits and costs.
The Learning Designer A TLRP-TEL project

The project partners

**Oxford**
Liz Masterman (CoPI)
Marion Manton (CoPI)
Joanna Wild (RF)

**IOE/LKL**
Brock Craft (RF)
Diana Laurillard (PI)
Dejan Ljubojevic (RF)

**LondonMet**
Tom Boyle (CoPI)

**Birkbeck/LKL**
George Magooulas (CoPI)
Patricia Charlton
Dionisis Dimakopoulos

**ALT**
Seb Schmoller
Rachel Harris

**LSE**
Steve Ryan (CoPI)
Ed Whitley
Roser Pujadas (PhD Student)

**RVC**
Kim Whittlestone (CoPI)
Stephen May
Carrie Roder (PhD Student)

Project website at [www.ldse.org.uk](http://www.ldse.org.uk)
PPC at [web.lkldev.ioe.ac.uk/PPC/live/ODC.html](http://web.lkldev.ioe.ac.uk/PPC/live/ODC.html)
Notes on the meeting

Investigating business models of MOOCs for integration with current university models
There will be efforts to monetise MOOCs – awarding credits?
Free, public good – but charging??
How will MOOC methods impact on traditional pedagogy?

Diana Oblinger
Use the best the technology has – immersive collaborative environment
Virtual client simulation, medical simulations – avatars can have intelligence and with webcams can monitor your reactions, by collecting data about you. Instructors using a dashboard to monitor.
With massive information it tells you how students learn and the different rates they learn. That enables you to do predictive analytics. Nudges and alerts to students, etc. Assistance in making good choices. Educational pathway tools – find the programme you need when you need it – reduces graduation time - ???
Private providers’ products are being accepted by HE. They take a % of tuition fee. Other models identify mentors in the place of business.
Notes on the meeting

Edwin
Huron Consulting, Chicago