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Connecting: the Semantic HCI Textbook and Cross-Institutional Learning Analytics

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Abstract

Open education materials related to the author's HCI textbook were released in 2013 as a MOOC, published on interaction-design.org, and used for flipped classroom teaching. Work is in progress to link these free open educational resources including substantial video and quizzes (some tutor-only) together with the (paid-for but open-to-all) book, to create a 'semantic textbook'. The author is also interested in the way learning-analytics can be used to create actionable insights, at the appropriate time for the academic. Bringing these together offers the potential for analytics using rich relationships across different educators and institutions use of the same material.

Keywords: HCI, human–computer interaction, interaction design, education, peer learning, MOOCs, learning analytics, open education, OER, flip classroom.

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1. Introduction

This paper discusses a number of issues on both sides of the confluence of HCI and educational technology:

- *use of novel education in HCI* – The author is also an author of a major HCI textbook [2] and so wishes to find ways to produce materials for others to use in HCI teaching, using novel technology where it is appropriate.
- *applying HCI to novel education* – The author is also a researcher at Talis seeking to understand the way technology can better serve pedagogy and how appropriate design can improve the life of both academics and students.

These concerns come together as in the author's teaching of HCI and the provision of materials to teach HCI, which create an opportunity both to use and to research state of the art materials and methods, including software developed at Talis.

2. A HCI mini-MOOC … or maybe not so mini?

In 2012 the author created a HCI mini-MOOC that was delivered in early 2013. This involved the production of over 30 hours of video as well as supporting material. This and associated multiple-choice questions and other resources are now available as open education resources (OER [12]) at interaction-design.org.

This had its own educational value in HCI, but additional aims of producing this materials were:

- to understand the challenges in producing and delivering relatively low-cost distance educational material

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- to understand how this kind of material can be produced to help others teach whether online or face-to-face

The course was modelled after a typical one semester course with 2-3 hours of lectures per week plus exercises. Given the nature of HCI as a subject, the exercises were principally in the form of topics to address individually or as groups in an online discussion forum. Students registered via Google login, the materials were organised using Talis Aspire Reading Lists (TARL) and the videos were hosted at Vimeo and only available to access via the course pages. This meant that per student click-through data was available on each resource (through TARL), on the discussion forum (pilot Talis software), and video-by-video viewing statistics (through Vimeo). This was used to drive an engagement-based progress score that combined the material viewed (as measured by clicked through), the amount of comments entered into forums and the level of replying to other participants' comments. Open Badges (http://openbadges.org/) were also integrated into this so that students who completed the course could receive these if they chose, but in practice so few students completed they were not used.

One of the first lessons is that while the very earliest MOOCs mirrored face-to-face course volume and pace, the vast majority, even by 2013, were much more recreational and the volumes of material they cover correspondingly less. We decided to only use 60% of the material in the first phase of the course and reserve the rest for a later, more advanced, phase. However, even this proved far too much.

While we were expecting a high level of attrition, the experience was less that students dropped out, and more that they kept engaging, but only in the first two units of the course, originally meant to be about 2-3 weeks of material. Right to the end of the run of the course we saw continued viewing of this material, suggesting that students stayed engaged and were benefiting from the course even though they did not 'complete' it. The first unit was just a brief introduction to the whole course, but the second unit was a short introduction to interaction design based on chapter 5 of the HCI textbook [2]. In a face-to-face course the latter would be taught over one, or at most two weeks of lectures, but clearly could have been the whole MOOC.

In fact this accords exactly with the volumes of material reported in other MOOCs. For example, Glasgow University published a very useful report of their first two FutureLearn MOOCs [11]. These each comprised just 2-3 hours of video material for the entire course, albeit split into 2–3 minute segments.

3. Flipping and face-to-face use

As noted, one of the aims of the MOOC was to understand reuse by others in online or face-to-face learning. In pursuit of the latter, and to make use of this large body of video material, the MOOC materials were used in the author's own classroom teaching. As well hoping this would be valuable pedagogically, this use in face-to-face classes is important for MOOC production to amortise some of the costs of production [3,10].

Flip teaching has become a buzzword during the last few years [7,9] building on long-term work on blended learning. Over a number of classes from 2014 on, the video materials were used in various forms of flip class teaching (fig 1).

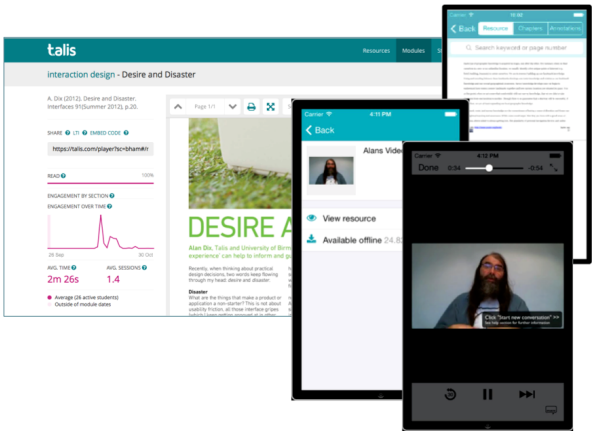

Figure 1. MOOC materials presented in Lighthouse universal player

One of the most fascinating observations was that while proponents of flipped class teaching each suggest a single model (albeit each proponent different from each other), the author's experience was far more varied, even within a single style of content [6]. Some classes were true flipped class, with videos viewed beforehand and more discursive in-class sessions (well as discursive as possible given 100+ undergraduates in a lecture hall). Some used pre-viewed 'remedial' material as the class came from different backgrounds, and so more basic material was delivered (only) via videos for revision or catch-up, and the lecture slot used for traditional chalk-and-talk teaching, but of more integrative material. Finally in some cases the video material and lecture slot covered the same material, except that in the face-to-face lecture it was possible to skim past some material and focus on those aspects where the face-to-face treatment was most beneficial.

For these courses the overall course structure was organised in the University VLE, Canvas; however, the videos and other resources including PDFs of articles, and Power Point slides, were stored and viewed through a universal media player as part of a Talis pilot project Lighthouse (https://talis.com/lighthouse/). The Lighthouse player includes a mobile app and provision for off-line viewing. We had expected substantial use of the latter, but in fact the mobile player was hardly used, indeed not even downloaded. Maybe this was because it

was only used for small portions of courses, and so students did not feel it worthwhile installing an extra app for a small number of classes, or maybe the links to the mobile access were not sufficiently salient.

4. Detailed learning analytics

Lighthouse integrates into the VLE and the university SSO (single sign on) and collects not just click-through analytics, but also detailed frame-by-frame and page-by-page viewing data.

Currently this is presented in a small analytics dashboard, which can be seen by the tutor as they view either individual courses units, or resources (see fig. 2). Although the author initially doubted the value of this level of analytics, in fact he found it quite captivating.

Figure 2. Lighthouse per-resource learning analytics

The dashboard shows for each resource, how many students have engaged with the material (as in any form of viewing at all), how many sessions on average, the average proportion the document viewed (available in several platforms) and a histogram showing for each part of the document the number of students who have viewed it. The latter makes it possible to tell the difference, for example, between all students viewing half of a document vs. half the students viewing it all, and half opening it on the first page and giving up straight away. This can be particularly valuable for identifying 'hot spots', points in the document or video where students give up, or maybe repeatedly re-read or re-view.

For many purposes the raw engagement figures (equivalent of click-through) were sufficient, but the added salience being attached to the resource and module pages, meant that these were actually consulted. Click-through stats are available in most VLEs, and certainly in Canvas, which is used at the University of Birmingham. However, the author had never previously viewed them when delivering a face-to-face course; the salience and ease of availability had a marked impact on behaviour.

Typically about 1/3 of students engaged in detail with most of the resources labelled as essential, 1/3 engaged with some of this material, and 1/3 had minimal engagement … until exam time! These figures were pretty much as expected; we all know that many students skip any material that is not immediately needed for assessment, on the assumption they can catch up later. Although, on the face of it, seeing the actual figures was disappointing, it also gave a sense of control. With increasing pressures of academic life, stress is a growing problem; and while the greater student autonomy offered by flipped class teaching sounds pedagogically beneficial, it further separates responsibility and control – a recipe for increasing stress. Having, information available, whether good or bad, helps reduce this and improve academic well-being.

In some case the more detailed analytics were used, for example spotting that students were typically just reading the beginning of a journal article (stretching material for undergraduates), so making it possible to point out that there is a particularly useful section towards the end even if they skip the material between.

In recent months we have been more deeply analysing the raw trace data, in particular creating (anonymised) student-by-student profiles showing exactly which pages were viewed when and for how long [5]. This has started to reveal complex and diverse patterns of reading combing skimming, speed-reading and in more in depth reading (fig 3). Not surprisingly the majority of 'pauses' in skim reading are where there are diagrams and pictures. Perhaps unexpected, but on reflection quite sensible, is 'backwards reading', students skipping to the end and then skimming backwards, clearly seeking out the discussion and conclusion sections of documents (fig. 4).

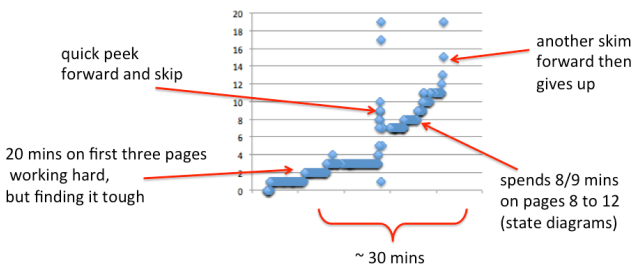

Figure 3. Individual student trace through document: complex behaviour: both detailed reading and forward 'peeks'

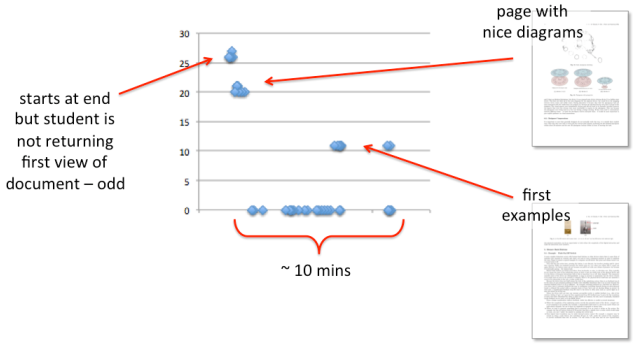

Figure 4. Individual student trace through document: skim back from end and view pages with diagrams

5. Cross-institutional learning analytics

MOOCs and other forms of large-scale online learning have created new research challenges for pedagogy and assessment, often focusing on automation and peer support. The scale also enables the use of 'big data' techniques to make detect patterns and so inform pedagogy and personalise leaning.

However, there are hundreds of millions of students in face-to-face higher education institutions worldwide [14], a figure expected to grow by over 40% in coming years [1,8]; indeed in China a new university opens every week [13]. In Talis alone, we serve over 85 institutions worldwide including over half of UK universities, especially the larger institutions. Current use includes half a million reading lists and twenty million resources in those lists.

A critical question we are considering is how to reap some of the benefits of 'large scale learning' found in MOOCs and online courses for the vast numbers of face-to-face students in higher education worldwide [5].

This creates new challenges of diversity with different kinds of universities, myriad relatively small (20-200 student) courses across different disciplines and of course very different individual student learning styles. This creates algorithmic and analytic challenges in order to make sense of large-scale heterogeneous data, and also issues of privacy and intellectual property as both students and institutions begin to realise the personal and commercial value of increasingly detailed and pervasive learning data.

6. Learning analytics – fitting into the academic life

At a more theoretical level, although reinforced by reflection on my practical experiences, we have been trying to make sense of the way learning analytics can fit into the 'big picture' of academic life. This builds on the broad learning analytics literature and the author's own past work on visual analytics and the broad nature of time, triggers and processes in human interaction.

The term 'actionable analytics' is frequently used: how to make sure that analytics are not simply numbers and graphs on pretty dashboards, but can actually be used to influence pedagogic decisions. However, for action to occur there needs to be some trigger that suggests that action is needed and the resources need to be available (information, materials, and critically time) that make action possible. Triggers come in many froms from notification by email, to spotting anomalies on a dashboard; however, if they do not occur when action is possible for the user, they will have no effect [4].

One surprising result of both our review in the educational literature and discussions with long-term researchers in the area, is just how little is known about academic life. Maybe this is because it seems 'obvious' that we know what academics do (as researchers tend to be academics themselves); maybe because academic life is just so diverse; or maybe because it is harder to study peers in one's own institution, especially as that might be mistaken for management interference. This is an area that would benefit from cross-institutional collaboration.

Based on what little is available, and analytic reflection on institutions we have known, we proposed a series of timescales of academic life, from the 10 minutes before a lecture starts to seasonal reviews and updating of materials [4]. This allowed us to look at the kinds of actions that might be needed at each point and the kinds of trigger that might be appropriate. Of critical importance is 'Micawber Management' (useful procrastination), basically ensuring that there are means so that if the trigger for action occurs at an inappropriate point it is easy for the academic to put it off until later, but not forget it entirely.

7. The semantic textbook

There is now a large body of video material (most created for the mini-MOOC) related to the HCI book, some connected to chapters of the paper textbook, some connected to additional online material. In addition there are many MCQs (multiple-choice questions), some produced many years ago as teaching resource for the textbook, some produced recently for the interaction-design.org use of the materials. In addition on the HCI textbook site there are worked exercises, slides for all chapters, examples, links and additional online text and case studies.

Note, that these include both digital and physical materials; most are open, some require login but free, and some (the book itself) not free. This mix is of course typical, but also challenging as often open resources are seen as in some way in opposition to closed resources. We need ways to deal with this form of 'mixed ecology' of educational resources.

These materials are in the midst of being annotated so that they can be interlinked more easily; for example, each MCQ is coded to the corresponding sub-section of the textbook, effectively a semantic topic (fig. 5). The aim is encode the videos similarly so that timed segments connect to the slides they were covering and the individual slides, coded down to detailed topics covered, like the MCQs.

The aim is that this will be a useful resource to aid other educators teaching with the book, for other researchers to use as part of educational studies, and to act as an action research platform to understand the rich interplay between digital and physical, open and closed materials.

```
{
    "id": "e3-5-1",
    "kind": "CHOICE",
    "text": ["Trade-offs are important in design because:"],
    "options": [{
        "id": "A",
        "text": "the user is always right"
    }, {
        "id": "B",
        "text": "there may be conflicting goals"
    }, {
        "id": "C",
        "text": "e-commerce is becoming increasingly common"
    }],
    "answer":"B",
    "tags": ["e3:ch.5", "e3:sc.5.2"]
}
```

Figure 5. Multiple-choice question tagged to corresponding textbook topics

8. Connecting

The semantic textbook has obvious potential for linking materials, for example, to be able to navigate from a point in an eTextbook, to video materials on the topic. There are also interesting issues in linking the physical book and digital materials.

When combined with detailed analytics there are additional possibilities. For example, if previous analysis has shown that particular behaviours, such as dropping out of a video at a particular point, are associated with poor performance in a topic, then it may be possible to suggest to the student diagnostic questions and alterative materials.

If you would like to use any of these materials in your own teaching or for educational research, additional information is available at:

http://alandix.com/academic/papers/hcied2016-connecting/

Please also feel free to contact the author.

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