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TYSTYSGRIF UWCHRADDEDIG ADDYSGU MEWN ADDYSG UWCH

POSTGRADUATE CERTIFICATE IN TEACHING IN HIGHER EDUCATION

Cylch Dysgu 2 | Teaching Cycle 2

Encouraging Engagement and Active Learning in Large Group HEI Lectures

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Teaching cycle 2: Encouraging engagement and active learning in large group HEI lectures

The issue

I had been contemplating the question of how to engage students in large group lectures (specifically, the HCI module), reflecting on previous lectures where students had seemed disinterested in the material at times. With a smaller group, it seemed easier to retain the students’ attention and get a degree of interaction throughout the lecture. The problem I faced was how to get a similar ‘feel’ to this in large group situations - how to encourage students to participate and engage with the material.

The motivation for this intervention came mainly from attending the workshops “Encouraging Active Learning and Engagement in Lectures” and “Large Group Teaching”, as well as reading the excellent and very practical Chapter 5 of Race and Pickford’s ‘Making Teaching Work’ (Race and Pickford, 2007). It was noted in this chapter that large group lectures can provide unique opportunities for learning - mass events can be highly charged and uplifting when the shared experience is memorable or emotional:

"Learning can be most effective when we engage students on an emotional level..." (Race and Pickford, 2007).

The aim, then, of this teaching cycle is to implement several ‘memorable’ lectures that encourage an active learning environment for those topics that directly tie in to assessment. This is a shift away from lectures focussing on ‘what the teacher does’ to ‘what the student does’, where deeper learning is encouraged through appropriate teaching/learning activities (Biggs, 1999).

Context

I implemented this teaching cycle for the module "User-centred design and human-computer interaction", a 10 credit, 2nd year undergraduate module. The class size was 120 students, and consisted of two one-hour lectures per week.

The course is essentially very practical; the material is intended to shape how the students think about and design user interfaces, providing them with a number of techniques to facilitate this. Therefore, it is essential that students are given opportunities to develop these skills. This is particularly important given that the skills involved are at the higher levels in Bloom's taxonomy (Forehand, 2005), for example synthesising new designs.

As stated in (Beckhaus, 2006): "Inventivity needs creativity needs space to develop." Therefore, the intervention will seek to provide an environment in which students have space to try out their ideas, make and correct mistakes, and integrate their ideas with other students.

Ultimately, the aim is to have ‘memorable’ elements within each lecture to reinforce key concepts and processes, but for the purposes of this intervention, three lectures are chosen that are strongly linked with either the examination or assignment. A substantial part of each lecture is apportioned to these group activities.
Additionally, the activities should promote a higher level of student engagement. The activities themselves should be challenging and interesting enough to retain their concentration, but also the feedback sessions should demonstrate to the students that their input is valuable and that they have grasped the concepts to the required level.

**Intended outcomes**

Through the in-class activities, students will be able to:

- Understand the course material better
- Apply the lecture material to new problems
- Synthesise new interface designs, in collaboration with other students

In addition to these outcomes, I hope to foster better communication between myself and the students through these activities, as well as better student engagement and attention during lectures.

**Existing research in the area**

In 2007, the HCIEd conference for HCI educators focussed on how to encourage participants to think about the need for both creative teaching and also teaching for creativity (Kotze et al., 2007). Creativity is an essential element in user-centred design and HCI. However, students are often blinkered by standard solutions to problems or commit to early designs, rather than thinking creatively. Several papers in the proceedings seek to force students into novel or unfamiliar situations.

The problem of engaging larger class sizes in HCI is addressed in (Beale and Lonsdale, 2004), where a class size of around 120 was considered. The HCI course was designed in a way such that traditional lectures were no longer used, with an emphasis on student-centred activities. Their approach incorporated a number of learning methods, including student presentations (something that is considered in my third teaching intervention) and provision of web-based resources. The authors found that there was a polarization between those students that understood the self-motivated setup of the course and those who did not, with the former students performing very well whilst the latter struggled. The weakness in the approach was that it was not tied in to assessment, and depended solely on piquing the students' interest in the areas covered.

Oestreicher puts forward his case for what he calls 'mind-shaking' teaching in (Oestreicher, 2007). This is somewhat equivalent to making lectures 'memorable' for students, though his emphasis is more on providing examples that make students reflect. By using good and bad design examples effectively, with elaboration, the students' mind-set is shaken. Also in this paper are some ideas for group-based exercises that have the following structure:

1. Individual design
2. Small group redesign (2 - 3 students per group)
3. Large group redesign (15 - 20 students per group)
4. Final examination/evaluation of exercise

The second and third stages involve a collaborative critical assessment of the previous design. This seems to be a good way of using larger class sizes to the advantage of the students. The smaller groups are less threatening for more introverted students and so they will be more likely to express opinions; the larger groups are good for the students as they will experience a wider-range of viewpoints and ideas, assimilate these into final designs, and also make the process of feeding back
much more manageable in a lecture context. I will adopt this approach for one of the sub-interventions.

In (Peslak, 2005), a survey is conducted in order to identify the key HCI topics in Universities, with the purpose of developing exercises that tie in to these topics. Many of the exercises are designed so that students work together in groups during lectures or seminars. The success of the developed exercises was evaluated via questionnaires, with the most popular being a task where students had to develop a unique interface for an existing product. This idea was used for two of my sub-interventions detailed later. The least popular was the journal exercise, where students had to keep a weekly record of HCI observances. Interestingly, this is at odds with the work reported in (Beale, 2007) that tasked students with blogging about HCI on a regular basis, in an attempt to encourage reflective practice. According to this research, students found the blogs useful and an effective addition to their learning.

Implementation

In (Race and Pickford, 2007) the authors recommend linking every lecture to the assessment agenda (motivating the students to pay attention) and to give students something to talk about with their neighbours in a lecture. Hence, the activities were directly linked to exam questions and involved students working in pairs or groups. The intervention itself was composed of three sub-interventions:

1) A full lecture designing a car rental interface in groups
2) A full lecture dedicated to the application of task analysis methods to a particular problem
3) A half-lecture on designing a pizza ordering system and prototyping/evaluation

Further detail on each sub-intervention is given below.

1. Car rental interface

This idea was originally proposed in (Oestreicher, 2007) and is adopted for this sub-intervention. I changed the first stage to students being in pairs rather than individuals as I believed this would be a better approach to the exercise. Some students might be stuck right at the beginning, which would be detrimental to their engagement and confidence.

The task that the students were given was to design a web interface that allows a car buyer to select from a vast number of cars on a site for used and new cars. They were to consider not just how it will appear to the user, but also how it will behave and be prepared to explain this. The selection interface was to be primarily directed towards a non-technical user while still being interesting to use for more knowledgeable car buyers. Prospective buyers have to be provided with sufficient support in order to make the appropriate choices for a new or used car. The emphasis here was on finding a good solution to the design rather than a design that covers all possible options for selecting a car.

A few general restrictions were given to make the task more focussed:
1) It should not be primarily text based, though some text may be used
2) It should be a minimalist design,
3) It should allow ‘fuzzy’ requirements or multi-valued choices in a straightforward way

The students were also encouraged to develop novel solutions to the problem, rather than regurgitating existing ideas. In this way, I hoped to get the students thinking about and applying the
design principles covered in the lectures, and synthesising new designs from these. To aid this, I included in the handout some of the key principles that would be useful to consider for this task.

First of all, students were asked to get into pairs and brainstorm interface ideas, choosing the best components to form an initial agreed interface (15 minutes). In the second phase, pairs were asked to group together (around 10 people in a group) to develop a more complete version of the interface (10 minutes). Finally, the groups were asked to report back, demonstrating how a typical user would use their interface as well as defending their design choices using some of the principles learned in the lectures up to that point.

![Figure 6: A selection of the interface designs developed by students](image)

Overall, I found that the students engaged very well with this activity. Some novel designs were generated, a couple of which were surprising. The top-left picture in Figure 2 is an interface based on the controls and display found in cars. The motivation behind this was actually quite well-defended - users would be familiar with this layout, and this approach to interaction is called an interface metaphor. However, it would be unusable in reality as many of the controls would map to arbitrary actions. A more usable novel interface can be seen in the top-right of Figure 2. Here, makes of car are in a central circle. When the user selects a make, the outer circle of models emerges. This makes use of a number of good design principles, such as visibility and mappings, as well as the direct manipulation interaction style. Again, this design was defended well by the students.

Overall, when asked to defend their interfaces the students responded fairly well, but were still reluctant to use the correct Hel terminology. Therefore, one benefit of this activity is to reinforce these principles and to get the students to see how these principles may be applied in practice. It
was also useful to point out in the top-left design that even new ideas that are based on a well-established HCI principle can be detrimental to usability.

2. Task analysis

A full lecture slot was dedicated to this activity. This process is a critical part of good user-centred design, where the problem is analysed and broken down into structured tasks which then go on to influence the design of interfaces.

For this sub-intervention, students were given the task of writing a booking and invoicing system for a friend’s car hire company. The requirements for the system were given, followed by a series of steps that students were expected to carry out; namely, building a rich picture (a graphical overview of the problem domain), identifying use cases, drawing data flow diagrams and finally devising state transition diagrams. The students were asked to complete this in pairs or individually.

For each task, ten minutes was allocated. During the task, I tried to circulate around the lecture theatre, providing guidance and answering questions. At the end of a task, there was a time of feedback where the solution was worked through together and any questions were answered. This was done due to the incremental nature of the activities - the results of one activity feeds into the next, so if a student has struggled with one activity they can begin the next from the solution worked out with the class.

3. Pizza ordering system

This activity was introduced in order to get the students to apply what they had learned about prototyping and evaluation in HCI. I was aware that the material concerning HCI evaluation was particularly dry, as a large amount of information on various techniques had to be understood by the students. This task gave the students an opportunity to not only devise paper prototypes, but also to tryout one or two evaluation methods.

A half-lecture was given to this task. The students were tasked with developing an interface for an online pizza ordering system, with a number of requirements. Having drawn up prototype interfaces, they then had to simulate user behaviour by attempting to order a pizza using their neighbour’s interface and vice versa. The neighbour would simulate the operation of the ordering system. Any design flaws that were highlighted by this process were then to be addressed in the second iteration of their design.

Upon completion of the activity, we looked at what HCI principles the students employed in their interfaces and the rationale behind them, as well as what problems had been encountered in the testing of their prototypes.

Evaluation

The students seemed to genuinely enjoy and engage with the activities. I found that the students were more willing to ask questions in the ‘normal’ lectures after the first activity. In this sense the intervention was a success (from my perspective) as the activities worked as ice-breakers and facilitated more dialogue between myself and the students. Overall, I felt that the task analysis sub-intervention didn’t work as well as the others from a student engagement point-of-view.
In order to assess how the students found the activities, they were given a questionnaire. The questionnaires were composed of five statements concerning this teaching intervention, with students asked to grade the extent to which they agreed with each statement, where 1 is strong disagreement and 5 is strong agreement. The statements, and corresponding statistics, can be seen in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Ifound the online car purchasing system design activity useful</th>
<th>Ifound the task analysis activity useful</th>
<th>Ifound the pizza ordering system activity useful</th>
<th>Overall, the in-class activities helped me to understand the course material better</th>
<th>Discussing things with other students during the activities helped me to understand the material better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>3.36</td>
<td>3.4</td>
<td>3.59</td>
<td>3.67</td>
<td>3.5</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.90</td>
<td>0.85</td>
<td>0.99</td>
<td>0.89</td>
<td>0.97</td>
</tr>
</tbody>
</table>

It can be seen that the students generally felt that the activities had some benefit. Although I had felt that the task analysis exercise had not been as successful as the other two activities, the students didn’t seem to think this. Students found that the activities did help them to understand the course material, and that there was some benefit in discussions with other students. Overall, this is quite encouraging.

In addition to the statements, there was space for comments. Some of these are below:

- Such activities I’d find useful when done in tutorial groups with more supervision and guidance
- Found in-class groups wasted a bit of time, otherwise excellent
- Some enjoyable activities
- More in class activities on drawing diagrams would be useful
- I think they were a bit rushed - not enough time. If more time was available, we could have done a more thorough job, and learnt more from them
- They are useful as they are something that you remember. Which helps to remember the material in the lecture
- Not enough time to complete tasks effectively
- Add a competitive edge. Team, points, leaderboard, and cake for the winner
- I think when designing a system many of us didn't think of available resources and technology. I think that considering them when designing a certain system may be beneficial because they would reflect real-life situations.

Two comments addressed the issue of not having enough time to complete the tasks. This is something that I will consider, but the constraints of one-hour lecture slots limits what can be done. The comment on adding a competitive edge is also worth considering. An interesting dynamic that I observed in the first activity was the competitive aspect between groups. This is another factor that can motivate the students and I may look at how this can be better used in the next iteration of the teaching cycle.
Reflection

I feel that the intervention was fairly successful overall. The activities seemed to be aimed at the right level, of interest to the students, and encouraged deeper learning through a hands-on approach to the subject matter. The students responded positively to the activities as evidenced by the questionnaire results. I attended the CPD workshop "Developing Student Motivation through Feedback" after reflecting on this intervention.

One of the comments from the questionnaires highlighted a negative aspect of having group-based activities in large group lectures - that some groups wasted time. How to supervise the groups effectively was something I had been thinking about at the start of the intervention. This was also brought to my attention from a teaching observation during the second iteration of this teaching cycle. I wanted the observer to see how well a new activity (on hierarchical task analysis) worked, and he mentioned that during the activity some students were not engaged and that this is a problem for all lecturers. He suggested a number of possible actions, including getting all students to close their laptops for the activity, which I will consider for a future iteration.

As mentioned previously, an interesting dynamic was the competitive element between groups. In (Kao et al, 2008), an approach to active learning for a computer programming course is implemented that entails both collaborative and competitive components. Most students agreed that the competitive element drove them to produce better designs. This is definitely an area I'd like to investigate for further iterations of this cycle as well as looking at how this can be applied to other modules.