

# Flipping HCI

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## ABSTRACT

This paper presents the results of two studies involving “flipping the classroom”. Teaching material was delivered via interactive “e-lectures”, allowing face-to-face sessions to focus instead on practice. The e-lectures were designed according to standard usability principles coupled with recent research into the effect of interactivity on learning. The effectiveness of the use of e-lectures was then evaluated using an online survey. The results suggest that students prefer the flexibility offered by e-lectures compared to conventional lectures. The results contribute to our understanding of how this technology fits with face-to-face teaching in the digital age.

## CCS Concepts

**Applied Computing** – education; **Human-Centered Computing** – Human-computer interaction, interaction design.

## Keywords

HCI; Education; Flipped classroom; E-lectures; Usability principles.

## 1. INTRODUCTION

Conventional lectures in Higher Education usually involve the lecturer talking to a group of students who write notes. Typical lectures are about an hour long and whilst many lecturers try to do otherwise, often allow little opportunity for interaction. Lectures are conducted at a fixed time (e.g. 9:00hrs on Monday mornings) and in a fixed place (e.g. Sir Ambrose Fleming lecture theatre). The pace of the lectures is usually determined by the lecturer using a “one size fits all” approach. In sum, conventional lectures are *teacher centered*. The university lecture as a teaching mechanism dates back nearly one thousand years to the founding of the first university in Bologna in 1088. The lecture format is widely known for its deficiencies. In her book [6], Diana Laurillard, Professor of Learning with Digital Technologies from the Institute of Education in London, suggests:

“If we start afresh with the problem of how best to enable a large percentage of the population to understand difficult and complex ideas, I doubt that lectures will spring to mind”.

However, the lecture remains one of the most widely used teaching mechanisms in universities.

## 2. A VISION OF STUDENTS TODAY

Students in Higher Education today are very different from students of the (not so distant) past. Around 30 years ago in the UK, only 2% of 18 year-olds would go on to university as a temporary alternative to employment. They would frequently be motivated by love of the subject and the less well-off were funded by a government grant. Today, the UK government aims for 50%

of the target age group to go to university. Such students typically attend university in addition to having a part-time job. They are motivated by necessity and funded by debt. This is part of what has become known as the *paradigm shift in education* [1].

## 3. LEARNING THEORY

Not only has the nature of students changed in the last 30 years or so, but so has our understanding of the learning process. Until comparatively recently, the dominant model of learning was the information transfer model [7]. Under this model, the process of learning involves the transfer of knowledge from the lecturer into the heads of students. The mind of the student is regarded as a blank tape or *tabula rasa* onto which information could be recorded. The lecturer takes the role of an “expert” and the student a passive recipient of expertise. This model remains evident in the conventional lecture format.

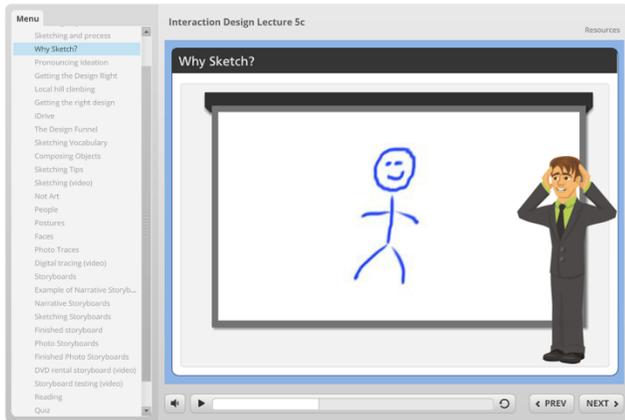
By contrast, most learning theorists today adopt a constructivist model [7]. Under this model the process of learning involves the brain selecting, organizing and integrating information. Learning is an active process by which new information is assimilated with existing knowledge, and an individual process because students have different learning preferences and prior knowledge.

## 4. INTERACTIVE E-LECTURES AND THE INTERACTIVITY EFFECT

Interactive e-lectures are digital presentations which allow a student to control the flow of information. Such lectures typically involve a series of structured slides and an audio narration. Students can choose the time they wish to learn (e.g. 2am on a Sunday morning or lunchtime) and the place of learning (e.g. the library or workplace). Unlike a video of a lecture, e-lectures structure material into topics and sub-topics. Students can thus control the flow of information by selecting the order in which the material is studied and the pace by which they go through it. They can also revisit or review existing material several times – an activity that is not possible in a face-to-face lecture. E-lectures are also particularly beneficial to students whose first language differs from the one in which they are studying. In sum, e-lectures are *learner centered*.

Interactive e-lectures were used in the studies described below. A screenshot from one of the e-lectures used in the studies is shown in Figure 1. These interactive e-lectures included interactive self-assessment questions (SAQs) which allow students the opportunity to reflect on how well they have learned. The SAQs facilitate learning as an active process by which information is assimilated with existing knowledge. Such interactive e-lectures have been shown to increase performance in deep-learning tests [3,4]. This phenomenon is known as the *interactivity effect* in multimedia learning [2]. Interactive e-lectures allow the delivery

of material outside the lecture room. This allows us to reconsider how we use classroom time.



**Figure 1. A screenshot from an interactive E-lecture on interaction design.**

## 5. “FLIPPING” THE CLASSROOM

In conventional lectures, the core material is usually delivered in the classroom. Students then try and make sense of the material outside the confines of the lecture room, e.g. in the library or their study room. Interactive e-lectures allow the possibility of delivering the material outside the lecture room and then using classroom time to help students make sense of it. The conventional relationship between classwork and homework is thus “flipped”; hence the term “flipping the classroom”. Flipping the classroom has the advantage that it allows the teacher to concentrate on helping students make sense of the material rather than delivering it. It is particularly appropriate to the digital age because students have access to large amounts of information on the Internet and the main difficulty they face is understanding it. The role of the teacher becomes one of being a *facilitator* rather than an expert. The “sage on the stage” is replaced with the “guide on the side” [5]. One way of flipping the classroom is to deliver theory through e-lectures and then use classroom time to help students put the theory into practice.

## 6. STUDY 1

### 6.1 Aim

The aim of this study was to determine whether interactive e-lectures can enhance the learning process through use of the flipped classroom model.

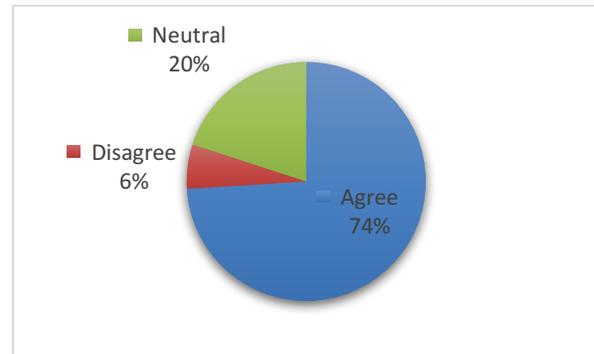
### 6.2 Participants

In this study the participants were 232 students studying a Level One course in Business Information Technology at Brunel University London. The course lasted two terms (24 weeks).

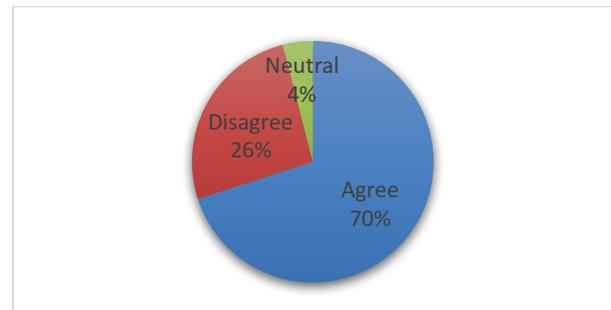
### 6.3 Method and Results

The students were given a series of ten e-lectures to study in their own time and ten weekly exercises conducted in a computer laboratory. At the end of the course students were asked to complete an online survey in class consisting of 15 mainly Likert-style questions. The scale was strongly disagree, disagree, neutral, agree, strongly agree. Key results are illustrated in Figures 2 and 3. In the figures the statistics for strongly disagree and disagree have been combined into a single “disagree” category. Similarly, strongly agree and agree have been combined into a single “agree” category. The completion rate was 98%. The survey also

included some open questions, the results of which are included in the Discussion section.



**Figure 2. Agreement levels for whether e-lectures made a valuable contribution.**



**Figure 3. Agreement levels for whether e-lectures are better than conventional lectures.**

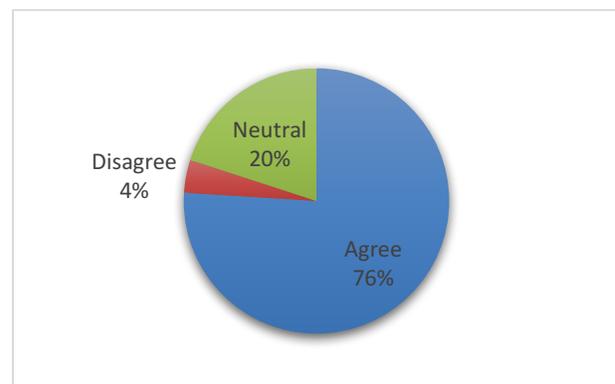
## 7. STUDY 2

### 7.1 Aim

Study 2 was conducted to assess the reliability of the results of Study One by attempting replication with students at another university, studying a different subject at a different level.

### 7.2 Participants

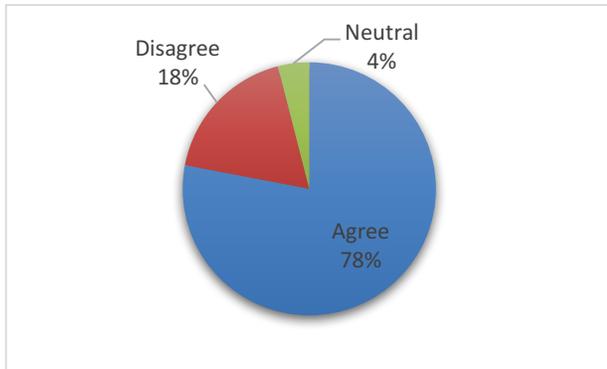
In this study the participants were 172 students studying a Level Three course in Interaction Design at University College London. 52 students attended the class in which the survey was conducted. The course lasted one term (10 weeks).



**Figure 4. Agreement levels for whether e-lectures made a valuable contribution.**

### 7.3 Method and Results

The students were given a series of ten e-lectures to study in their own time and ten exercises conducted in a lecture theatre or a computer laboratory. At the end of the course students were asked to complete an online survey in class. Key results are illustrated in Figures 4 and 5. The completion rate for the survey was 98% of those present.



**Figure 5. Agreement levels for whether e-lectures are better than conventional lectures.**

### 8. DISCUSSION AND CONCLUSIONS

The aim of the studies was to determine whether interactive e-lectures can enhance the learning process through use of the flipped classroom model. The results suggest that students value the flexibility of e-lectures in terms of studying when, where and how they choose. This is reinforced by some of the qualitative results where students said “I liked the fact you could learn at your own pace and teach yourself”; “independent learning is a fun way of learning”. However, some students commented that “we didn’t get to see much of Chris”. This suggests that students have a preference for a blended approach in which teaching combines both digital and face-to-face teaching. Human-Computer Interaction principles can be used to both inform the design of the e-lecture interface and the structure of the teaching design.

Questions remain about how best to help students to structure their learning given greater flexibility in when to learn; and how best to interact with students outside the face-to-face sessions. My current investigations explore the use of regularly spaced online tests and the use of social media for teaching. Further empirical investigation is also needed to establish the validity of the connectivist model of learning [8] in which knowledge is connected and distributed rather than individual. The outcome of these investigations could cause us to radically reassess how technology fits with face-to-face teaching in the digital age.

### 9. REFERENCES

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