



REAP International Online Conference 2007

DIDET Project Case Study: Cross Continent Assessment in Design Engineering

Caroline Breslin, Hilary Grierson, Andrew Wodehouse
University of Strathclyde

OVERVIEW

This case study examines assessment for a new 5th year undergraduate Design Engineering class in the Department of Design, Manufacture and Engineering Management (DMEM) at the University of Strathclyde. This *Global Design* class was first launched in September 2006 and is distinctive in that it requires students to undertake a collaborative design project while working in global teams; each team comprising students from the University of Strathclyde and students from one of our partner institutions in the USA. Student teams work collaboratively on a design brief, retrieving information and conducting research in order to specify requirements, generating and evaluating concepts and then building a proof-of-concept prototype model. The project concludes with reflective sessions to allow students to reflect on their practice and share learning experiences. The collaborative project is an assessed element of the class at Strathclyde; contributing 50% to students' final mark, the other 50% being assessed by examination. Although the project was conducted collaboratively, overall assessment at the three sites was controlled locally due to the differing culture, methods and focus at each institution. This Global Design case study relates to REAP Conference themes 2 and 3; Great Designs for Assessment and also Institutional Strategies for Assessment, although in this instance, it would be more appropriate to consider the case study as relevant to *Departmental Strategies for Assessment*.

INFORMATION ABOUT THE CLASS, MODULE OR PROGRAMME

The focus of the case study is assessment for an 8 week 5th year undergraduate class in Global Design at the University of Strathclyde which includes a 3-week Global Design project carried out collaboratively by students at the University of Strathclyde in the UK with fellow student team members in the USA; from Stanford University (CA) and Olin College of Engineering (MA). This new class was developed based on previous experience in the classroom (Ball et al., 2007, Breslin et al. 2006 and McGill et al., 2005) The 3 week collaborative project is carried out as a joint element of three separate Design Engineering classes at Strathclyde, Stanford and Olin.

University of Strathclyde 56521 Global Design	A new optional class for 5 th undergraduate MEng Students
Stanford University ME397 Design Theory and Methodology: Distributed Design with Digital Libraries	An existing postgraduate class at Stanford's Center for Design Research
Olin College 2260 Distributed Engineering Design	A new optional class for undergraduate students

The new class at Strathclyde and new collaborative project was introduced in 2006/2007 with a total of 30 students; 16 from Strathclyde, 7 from Stanford and 7 from Olin.



DESCRIPTION OF THE CASE

The Global Design class at Strathclyde began with 3 weeks of lectures and tutorials, 3 weeks of collaborative project activity, 1 week during which final design review presentations were held and a final week for reflection and exam preparation.

Each of the first three weeks of lectures and tutorials had a weekly topic around which the 3-hour class was based. These weekly topics were, The Nature of Distributed Design, The Management of Distributed Design and Technological Support for Distributed Design. The 3-hour class consisted of a 1-hour lecture followed by a 0.5-hour case study and then a 1.5-hour tutorial slot. An additional tutorial class was held on a Wednesday for 1 hour.

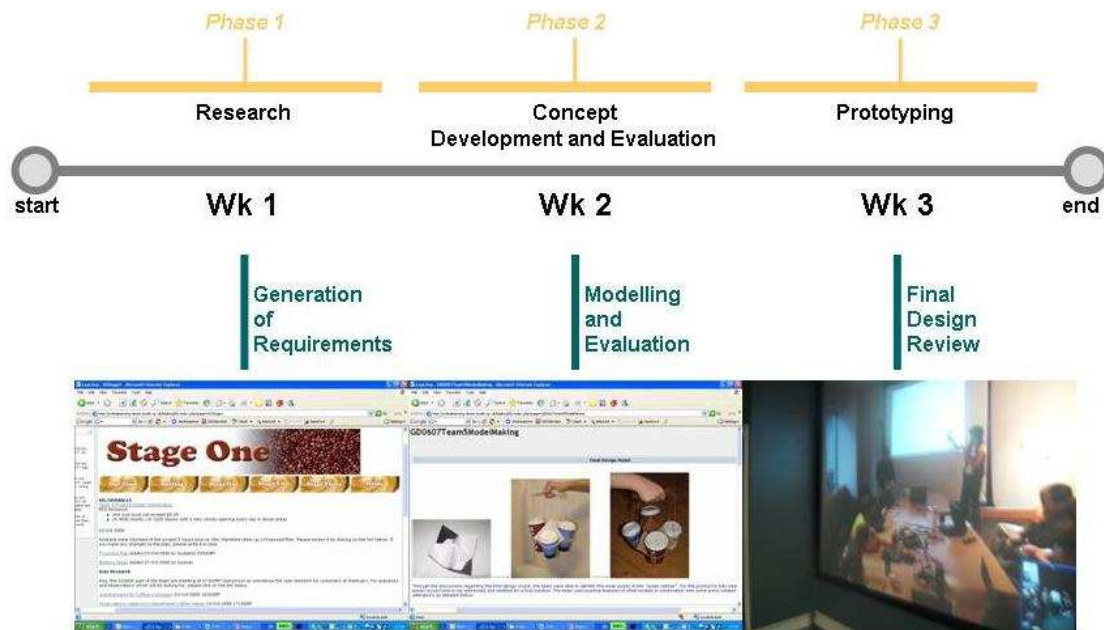
Relevant case studies were developed so that students could relate the theory of the class to practice in industry and guest lecturers presented pertinent case studies to students. During tutorials, students were tasked with finding their own case studies in pairs and presenting them to the class for discussion, facilitated by the teaching team or investigating the use of various collaboration technologies.

Throughout all classroom and project activity, students were supported by coaches; each team was assigned both a UK and a USA member of the teaching team to guide and facilitate team activity.

In week 4, the 3-week collaborative project began, although teams had been formed before this week to allow students to get to know their USA team mates prior to beginning the project. The Myers-Briggs Type Indicator personality test (Myers and Briggs, 1975) was used to create teams with maximum diversity. Figure One below shows key team activities for each of the 3 weeks of the collaborative project; each week focussed on a key stage of the design project as advocated by Pugh (1990); Research (using a range of difference resources, including the Departmental Digital Library), Concept Development and Evaluation, and Prototyping.



Figure One: Key Project Activities



Deliverables relating to each of the weekly project stages are shown in the table in Figure Two below. Student teams were expected to manage their project activity with support from their coaches in order to achieve these by the given deadline. Teams were expected to work both synchronously (using chat tools, desktop videoconferencing tools, the departmental PolyCom large screen videoconference system, etc.) and asynchronously, communicating by email and using chosen online collaborative workspaces.

Figure Two: Project Stages and Milestones

Project Week 1: Need Finding and Basic Research
Understanding and scoping the design project. User studies, sourcing, organising and sharing of project information. Product Requirements. <u>Deliverable:</u> Design requirements document with context and rationale based on research.
Project Week 2: Concept Development /Evaluation
Ideas generation and concept development through collaborative brainstorming, model making, use of cameras, videos, scanning, etc. <u>Deliverable:</u> Document presenting 2 conceptual models with design justification for each, including design evolution of how many concepts generated have been narrowed down to the final 2 selected.
Project Week 3: Prototype
Implementation via development of a final prototype and testing through collaborative teamwork, visualisation and model making, etc. <u>Deliverable:</u> Final Design Review to be given by each team via video conferencing and reviewed by a panel of teaching staff at all 3 sites (times to be arranged), <u>and</u> final prototype specification document uploaded to LauLima and linked from each Team Homepage.



The final reflective week of the project was based around a team questionnaire which encouraged students to reflect on their collaborative processes, compare theory with practice and compare distributed design with co-located team work undertaken as part of previous classes. Class discussion was facilitated by the teaching team and students were encouraged to build arguments related to working in global design teams. Throughout the duration of the project, teams were encouraged to reflect periodically and alter the management of their global team work to improve upon team working processes.

CLASS ASSESSMENT

Assessment for classes at all three collaborating institutions was kept separate due to the differing course structures and cultures at each. Stanford's class is seminar based and therefore students are awarded a pass or fail. Olin's class is more tightly structured and students were assessed on their final project outcomes and on their participation in the class. At Strathclyde, assessment for the Global Design class was based on both the collaborative project and a formal examination.

Assessment by Examination

50% of the Global Design class is by formal examination. The Global Design exam is designed to examine the students' ability to demonstrate knowledge and understanding of the following learning outcomes:

- The nature of distributed design; by explaining the concepts of distributed design engineering and discussing how the benefits and issues related to distributed design compare to those of co-located design
- The management of distributed design projects; by describing management tools and techniques for successfully managing distributed design, applying these tools and techniques to carry out distributed design project work and showing how these tools and techniques can overcome issues relating to distributed design
- How technology can effectively support distributed design activity; by describing appropriate technology and how it can be used to support distributed design, applying the use of technology to successfully carry out distributed design project work and show how appropriate technology can be used to overcome issues relating to distributed design

Project Assessment

Ideally in the department of DMEM, assessment for a group project such as the collaborative design project would be done on a group basis, i.e. the whole team would receive one mark based on their final outcome, intermediate milestones and participation. However, as this was the first year of implementation, a decision was taken to assess students individually, particularly due to the differing assessment methods at Stanford. Consequently Strathclyde students were tasked with submitting an individual report based on their group project for which they received a mark contributing 50% towards the final overall mark for Global Design. This project assessment covered two of the three learning outcomes listed above for the exam; the management of distributed design projects and the use of technology to effectively support distributed design activity. The collaboration with partners is being developed so that in future years of the class, assessment for the group project will be conducted on a group basis.

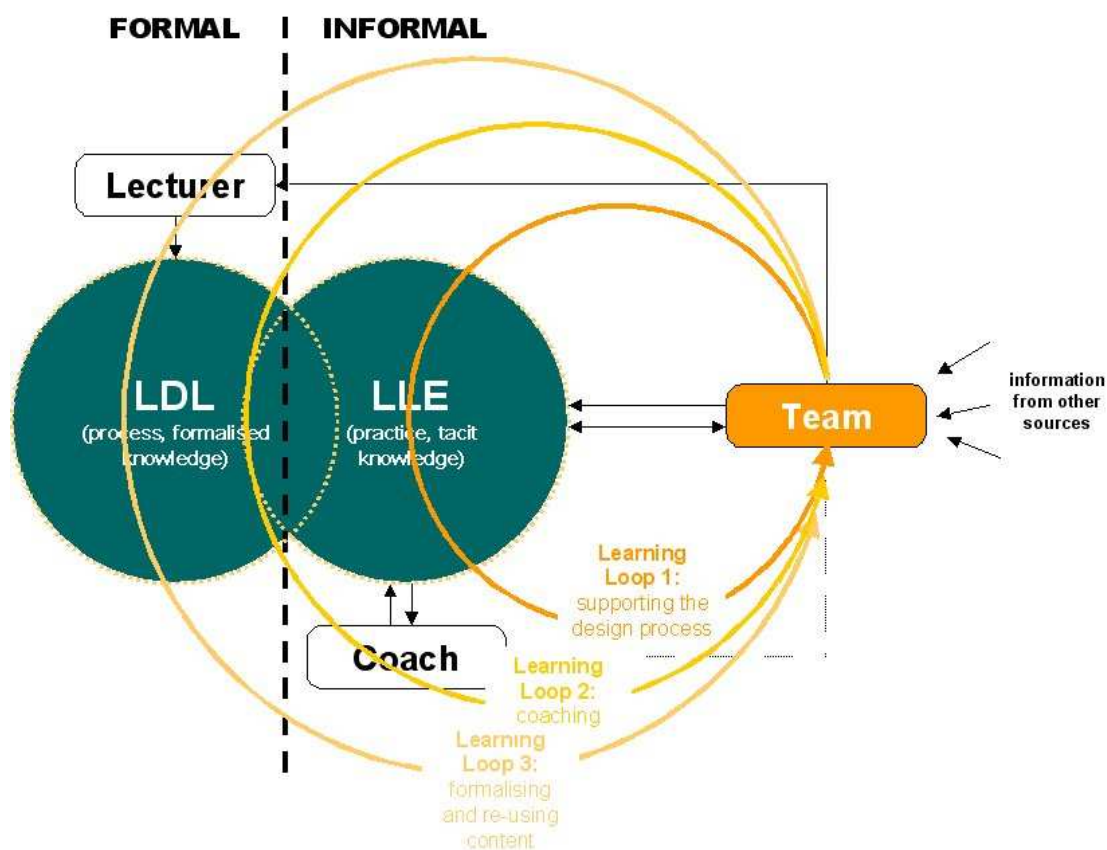


RATIONALE IN TERMS OF EDUCATIONAL IDEAS

The Global Design class at Strathclyde is structured and designed such that students learning the theory of distributed design and then put it into practice by actually working in global teams. They then have the opportunity to reflect on their management of global design and use of supporting technology during the collaborative project. The stages of the design process; namely research, concept development and prototyping are based on the work of Pugh (1990).

The classroom model is one which had been developed at Stanford University (Eris and Leifer, 2003) and has evolved as a result of the DIDET Project. This evolved 'three-loop' learning model in Figure Three shows how the students are supported in carrying out their design activity by a learning environment (loop 1), are coached by team coaches which interacts with both the learning environment and digital library (loop 2) and by formalising and reusing content (loop 3). For the purposes of the project, students had access to the LauLima Learning environment and digital library developed at Strathclyde, (McGill et al., 2005) but were free to use whatever technology they deemed appropriate for global design work.

Figure Three: Three Loop Learning Model



Reflecting on the first year of implementation of Global Design at Strathclyde, the following key principles have emerged.



- Team numbers must be tightly managed. Global Design teams were formed such that there was always more than one student at each site to prevent isolation. In addition, where possible, teams had equal numbers from each UK and USA institution to prevent any students feeling outnumbered by their transatlantic counterparts. Furthermore, our experience in 2006/2007 showed that the larger teams had significantly more collaboration issues and that we would therefore opt for 2/2 team formation where possible based on class numbers to ease management among teams.
- Students must be at the same academic level; matching undergraduates at Strathclyde, even though in 5th year, with postgraduate level students at Stanford was not desirable. Postgraduate level students often had their own research agendas and were less focussed on the design task.
- Assessment must be consistent across all institutions involved; all members of each team must be working towards the same goal with the same priorities. As 2006/2007 was the first year of implementation, Strathclyde opted to assess our students individually, however our preferred option would be to assess at a team level to keep the project truly global.
- Assessment must cover the management of and processes related to the design as well as the product design itself. Marking the design outcome will give teams incentive to perform well and will also introduce an element of competition.
- Classes of which the collaborative project is part must have a similar format and structure. In 2006/2007, Stanford's class was a 'seminar' class and Strathclyde and Olin's were structured taught classes with pre-determined learning outcomes and syllabi.
- Time must be allocated prior to project kick off for team cohesion and team selection of tools and technology for global working, i.e. communication, information storing and sharing, drawing, etc. It is preferable to have a structured exercise for this as many teams simply defer introductions until the project officially begins.
- It is preferable to have a common time slot for classes so that there are set opportunities for concurrent working with a coach from each site available for support. Note that time differences for particular global collaborators may make this impossible during office hours.

Formal coaching feedback was given after each weekly deliverable during the group project so that teams could revisit their work so far and improve on it before continuing onto the next stage.

EVALUATION

Evaluation of the new Global Design class and collaborative project has included the collation of staff and student views using class consultation procedures and questionnaires and surveys.

Confidence logs were also distributed at regular intervals during the class. Students' level of confidence increased over time for all of the 9 sub topics for the class.

Reflective discussion with students revealed that all were pleased with what they had learned during the class and also that they felt it had provided valuable experience for future employment. Overall students felt that the Global Design class and collaborative project it was worthwhile and should even be made compulsory for subsequent 5th year students.

Reflective discussion among the teaching team has revealed that planning, organisation and running of the class was very labour intensive in the first year, primarily due to the collaborative project. The class is expected to be less so in subsequent years as we will



have the first year's experience and teaching materials to build on (this has been proven with previous new innovative classes in the department) and the Department of DMEM has committed to running the class on an annual basis.

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