A TASK-BASED APPROACH TO GLOBAL DESIGN EDUCATION

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ABSTRACT

This paper provides a new perspective for managing and delivering a global design class, and a clear alternative to the traditional joint project for participating institutes. The 'task-based approach' used to structure a Global Design class at the University of Strathclyde is described. This entailed the creation of a series of short design exercises to be run in conjunction with three partner institutions: the University of Malta in Msida, Malta; Swinburne University of Technology in Melbourne, Australia; and Stanford University in Palo Alto, USA. These exercises focussed on specific aspects of distributed working, including synchronous working, asynchronous working and digital library support, according to the location and facilities afforded by each institution. This provides a number of pedagogical and organisation benefits. Students are required to take a more strategic approach to their design work, developing a higher evaluative understanding of the tools and processes required to produce a successful design. Staff members have a greater level of control afforded by a shared collaborative class component, including assessment, timetabling and learning objectives, rather than simply having a joint project. This potentially makes global design classes a more flexible and viable option for institutions interested in participating in such programmes.

Keywords: global design project, task-based approach, collaborative design

1 INTRODUCTION

Global design team projects and classes have become more prevalent in recent years [1-3], reflecting the changes in today's product development processes. In today's global economy, multinational companies and world-wide supply networks mean that participating in distributed working has become commonplace for many engineering designers. Graduates must therefore have the necessary skills to be able to participate in these teams, both in terms of understanding the particular processes appropriate to manage distributed working and being able to use the specific tools required to facilitate effective collaboration. In order to meet this need, the University of Strathclyde has created a Global Design module for 5th year Design Engineering students focussed on

product development in a distributed environment. This paper outlines the task-based approach used to structure the class. This approach had several pedagogical and organisation benefits which allowed the class to be run effectively with? three partner institutions (Fig. 1): the University of Malta in Msida, Malta; Swinburne University of Technology in Melbourne, Australia; and Stanford University in Palo Alto, USA.

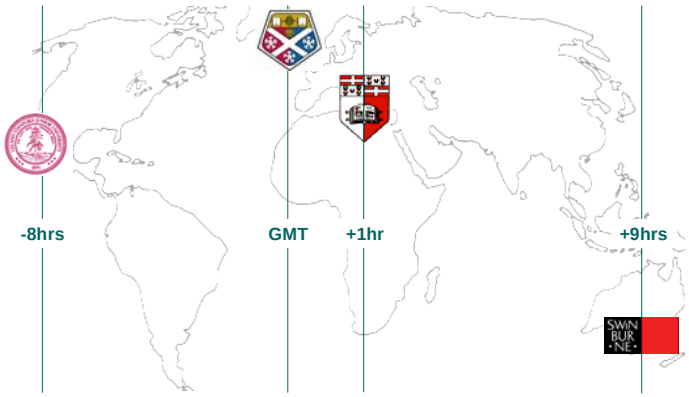

Figure 1 Participating institutions in the Global Design class

2 CLASS FORMAT

The purpose of global design classes is to help students understand the particular demands of distributed modes of working. In order to provide a useful learning experience, real global design projects are necessary to give students first-hand experience of the problems involved in managing a distributed project. Although the class at Strathclyde consisted of lectures, case studies, tutorials and project work, the project work undertaken in conjunction with the partner institutions was the key means of delivering this practical experience of working in a global team. The class took place in DMEM's Digital Design and Manufacture Studio (DDMS). This was a media-rich environment with video conferencing, data capture, CAD software and Rapid Prototyping (RP) equipment in one integrated space. The existing technologies were augmented with additional equipment such as webcams, electronic whiteboards and tablet input devices as appropriate during the class, as illustrated in Figure 2.

Figure 2 Global design class in action

2.1 Obstacles to global projects

There are several obstacles to organising and running a successful team design project across academic institutions:

2.1.1 Academic considerations

The issues involved in marrying the requirements of one or more academic institutions create large logistical overheads in terms of staff time. The processes for creating new class modules and fitting the learning objectives with the current student curriculum can be problematic. Timetabling is another major problem, with the academic calendar varying from nation to nation. All these issues mean that finding a long (e.g. 6 week) 'block' for students to work on a project is not always possible. Additionally, conflicts can arise if equal academic credit is not assigned to participants on all sides of a collaborative team: the difference in resultant motivation levels can easily lead to frustration and disillusionment. Another major issue in this area is ensuring that students are of an equivalent academic level, allowing them to collaborate on an equal footing. Obviously, the purpose of a global design project is to learn to overcome geographical boundaries. However, within distributed collaborative working, there are both synchronous and asynchronous modes. Depending on the partner institution, either one or the other of these can easily become the dominant working mode, preventing a rounded educational experience for students. This suggests that it may be preferable to have more than one partner involved.

2.1.2 Logistics

Co-ordinating use of appropriate equipment across sites is the first pre-requisite of distributed project work. This can be significant, with video conferencing, web cams and tablets as typical hardware requirements, with various groupware and communication tools on the software side. All participating locations should have near-identical configurations and students should be able to access it at convenient times – this again can be problematic if late-night work is taking place to accommodate time differences. Team formation is a critical part of collaborative projects: ensuring that the team is able to establish a rapport can assist greatly in subsequent team productivity. This must be accounted for in the class or project scheduling. Finally, many such global design projects are in small to medium sized classes. The high overheads in terms of equipment and organisation means that scaling up to more economical class sizes can be problematic.

2.2 Task-based pedagogy

These problems led to Strathclyde developing a task-orientated approach which tailored very specific design exercises according to a number of partner institutions' location and technologies. The University of Malta and Swinburne University of Technology were identified as partner institutions to address synchronous and asynchronous modes of collaborative working respectively. In addition to this, Stanford University acted as a partner institution to explore the use of digital library resources by design teams. This has been identified as a crucial tool for distributed design teams from previous research in the DIDET project [4].

Table 1 Assignation of project tasks

Mode of working	Institution	Activity
Asynchronous working	Swinburne	Design and prototype a coffee cup holder, with all design information to be transmitted asynchronously using the Socialtext wiki, Google Docs or YouTube
Synchronous working	Malta	Conceptualise and design a road race water station through synchronous meetings using Polycom, FlashMeeting or Skype
Libraries to support distributed working	Stanford	Examine the use and application of digital libraries to support conceptual, development and detailed design working

Student teams were formed to complete a short design task focussed on the identified mode of collaboration and using a suite of assigned collaborative tools (Table 1). These typically lasted three hours, and afterwards participants at each location were asked to analyse the success of the exercise both in terms of the approach adopted and technology utilised. These results were then shared across institutions for further reflection.

3 DISCUSSION

The task-based approach had two main benefits: pedagogical and organisational. These are summarised in turn.

3.1 Pedagogical effect

The more experimental approach demanded by the class structure – using a particular tool and evaluating how effective it was in the completion of a design task – encouraged students to reflect on and analyse their design practice, which was desirable given the learning objectives of the class [5]. According to Bloom's taxonomy [6], it is appropriate for final year students to be engaged in the higher, evaluative and critical modes of thinking. Unlike other design projects, students were concerned with their approach and performance both in the task as well as the final outcome, encouraging the reflection-in-action in the group studio setting advocated by Schön [7] which is typically difficult to achieve. In addition to this, post-activity reflective sessions were conducted firstly within the co-located team-mates, then across distributed teams, and then across the class as a whole. This allowed discussion of the strengths and weaknesses of different approaches amongst the class without each team having actually used *all* of the tools. Furthermore, the clear distinctions between the discrete activities (i.e. design phases, synchronous or asynchronous), and the appropriate tools and technologies used for each (groupware, video conference etc.), reinforced for the students the various modes of working and specific issues associated with each; it was a varied but focussed learning experience. These factors, in particular the segmentation of the learning elements and integral reflection, combine to make the task-based approach a clear development of the reflective approach previously suggested by the author [1].

Disadvantages of the task-based approach included short timescales for each task, which necessitated the forced extrapolation of certain issues to the longer project context. For example, in the asynchronous exercise with Swinburne, it would have been beneficial

for students to have exchanged information sets multiple times to drive out issues as projects progressed. In addition, limited participant contact, again due to the short timescales, meant that the cultural differences were not explored in the depth they could have been. Although students engaged most enthusiastically in the tasks, they indicated that they would have preferred greater depth of exploration and interaction. This was offset to some degree by the opportunity to work with a number of different institutions.

3.2 Organisational effect

Organising a class to run across several institutions can be overwhelming for staff involved. The task-based approach meant that each institution was able to construct a learning module to fit its current curricular requirements, with only the specific chunks of activity being shared across partners. Lectures, tutorials and assessment were all ring-fenced within the individual institutions, immediately overcoming a number of the academic issues which are an obstacle to institutional collaboration [8]. Because the collaborative projects were shorter, this meant staff had a greater degree of control and they were more tightly structured. Longer projects, which can drift without clear focus, require vigilant monitoring from staff to ensure they are progressing smoothly. The shorter bursts of activity meant that there was more time for consideration both before and after the event.

Problems with this approach include the requirement to identify partner institutions in particular time zones and with the appropriate technologies to participate in the applicable design exercises (e.g. video conferencing equipment for synchronous working). Also, the issue of academic credit remains an issue for even the shortest of design exercises. If it is not presented as an integral and important part of the class then it can have an adverse effect on its success, with tight project timescales meaning there is little opportunity to repeat a failed exercise.

4 CONCLUSION

The task-based approach enabled students to compare and contrast global working for different sites with very different time differences, languages, cultures and student profiles, as well as providing a focussed framework for evaluating tools and methods for different activities that constitute design, e.g. tools for distributed idea generation or tools for asynchronous communication. The traditional integrative project-based approach, however, has proven valuable for experiencing and reflecting upon team dynamics, cultural issues and transitioning between design activities. The ideal scenario may lie somewhere between these two: tasks could constitute a series of mini-projects which form a whole project activity to provide focus on tools and processes, but incorporate an adequate time frame to allow more subtle team and cultural issues to manifest themselves.

In summary, this paper has reviewed the introduction of a task-based approach to collaborative design projects for engineering students. This provides a new perspective on the delivery of global design classes, with several organisational and pedagogical benefits highlighted. Feedback from students who participated in the design exercises across all partner institutions was generally very good, and all institutions involved have indicated a willingness to run the class again next year. The greater level of control afforded by the task-based approach, rather than simply having a joint project, makes global design classes a more flexible and viable option for institutions interested in participating in such a class.

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