A Collaborative Virtual Design Technology Learning Environment

Dr. Angela Stone, Eur. Ing. David Whitworth, David Cheshire

School of Engineering and Advanced Technology,
Staffordshire University,

ABSTRACT

The Collaborative Virtual Design Technology Learning Environment project proposes to enhance the student learning experience by posing design problems to include real time collaborative design between teams of students working on different aspects of a project. The design projects will be devised in conjunction with local companies, to give a more realistic approach.

The project is still in its infancy with a completion date of May 2003. The project is a result of a bid for funding from Staffordshire University, Teaching and Learning Committee. Therefore, this paper will present an assessment of the current teaching methods, the proposed pedagogy and the interim findings of the project.

1. INTRODUCTION

Increasingly sophisticated collaboration software and computer networking technology are making possible collaborative design sessions between remote design sites, either synchronous or asynchronous, with interactive project management being used to decrease the design time.

‘Collaborative Product Commerce (CPC) promises to revolutionise product innovation by leveraging internet technology to connect the entire product lifecycle.’(1)

This is the way forward for industry and therefore design educators should be giving students the transferable skills required to work in this fast moving environment. The aim of this project is to give students these skills by exposing them to collaborative projects within their design education.

The current virtual design environment at Staffordshire University (EDNET: http://www.staffs.ac.uk/engs/des/design.htm) incorporates the main elements of the design process with a distributed database of design information and networked communications, including video conferencing capability. This virtual design environment also makes use of additional learning opportunities created in Lotus Learning Space (LLS), an IBM/Lotus notes package for structuring distributed learning material. The environment is essentially a database of learning resources.
The new approach is intended to integrate design into the mainstream of the degree by linking a significant number of modules via one project as part of the assessment making a more coherent approach for the student and less repetition between modules.

In industry the use of a virtual design environment allows cross-disciplinary design teams to function across continents. In the context of design education, a collaborative virtual design environment with appropriate design projects will allow students to work together in new and exciting ways and at the same time provide them with the skills needed to work as the next generation of design technologists. Eventually the design project can also be cross-disciplinary. To facilitate this interaction a collaborative software package is required that can easily be incorporated into the student experience.

Jami J. Shah et al (2) go further and create a virtual company. ‘Students must learn that there is more to product design than technical calculations. They must learn that they cannot make a design change unilaterally, without effecting someone else. Above all, the product must be built; understanding why something does not work as it was supposed to, and getting it to work, is also an essential part of engineering… All of these ingredients can be incorporated by creating a fictitious company within the university, through which the students can engage in the collaborative design and manufacture of a real and complex project.’

2. INDUSTRY

Design within industry is undergoing rapid changes and is no longer seen as an insular activity within a company. The integration of design with manufacturing, marketing, suppliers and customers is now seen as a necessity to make the product development process quick and cost effective and to give the company a market edge.

Specific elements of the design process no longer need to be kept in-house, the specialist knowledge or labour intensive processes can be bought-in as and when required. Another change has been the inclusion of subcontractors into the design process itself rather than just working from supplied drawings. Time zoning is occurring where project teams positioned in different time zones around the world allow the design process to become a 24-hour phenomenon. All this results in considerable data exchange and data management. Accountability due to product liability requires that an audit trail for the design process is transparent.

Marconi Services have strong views on what they require of the design process:

‘…. to be able to design, manufacture and provide support services globally, exchanging information internally and externally through a common interface….we need an audit trail to reflect the exchange of data between sites and office and the final as-built situation….we will be able to see not only what changes we made, but why we made them and who requested them,’ (3)

Sharing of design data can take place in two ways, synchronous or asynchronous. Synchronous exchange is an exchange of information where people could be in the same room looking at the same information or at different sites, looking at the same information through the use of a network platform. However the people involved in a different site
meeting should be able to interact as if they were in the same room. Asynchronous exchanges are akin to the day-shift leaving the night-shift a list of things to do and information they might require to complete the work. However this same process needs to be able to work for teams who are spread about the globe all working from the same information; this is where secure networked file storage and data exchange becomes important.

Therefore, industry requires the following for their design process to be effective:

- Synchronous meetings between design sites
- Asynchronous data exchanges
- Data Sharing
- Decision tracking
- Product data management
- Levels of security
- Interactive design modifications and reviews

Industry also requires graduates with the ability to participate in the design activity at any level. With company mergers and the drift of staff it is also not feasible to expect the design team to be the same throughout the project let alone from one project to the next. Therefore some information tracking system must be in place to prevent project members from reinventing the wheel every time they start on a new development. This again will save time and reduce the development costs.

At a recent SEED workshop (4) the graduate knowledge requirements within Jaguar Cars was presented. To make an immediate contribution graduate engineers need to exhibit an understanding of the following:

- The importance of customer verbatims,
- Quality in Design,
- The elimination of problems through customer field feedback,
- The importance of brand-image in the market place,
- Internal customer satisfaction,
- Future legislative trends.
- Team-working
- Engineering knowledge

Above all industry wants the student to be able to see the broad picture and not compartmentalise theory as can happen within the current learning methodology.

3. PRESENT STUDENT EXPERIENCE

At Staffordshire University a modular framework is used to organise the student learning experience. The teaching year is split up into two semesters and in each semester a student will experience six distinct modules of study.

At present the design experience that students gain is very insular. Since the module is not seen to be taught in conjunction with other modules it seems to be difficult for the student to
see the true relevance of design. Further the projects are small blocks of twelve weeks with little chance for the students to develop their skills. No build and test is required and therefore the whole experience can seem quite flat. Team working and data sharing seem to be difficult for some students to achieve. This is illustrated by the fact that although EDNET has the facilities for each student group to have a home file in which they can save all the project information and their report, this is little used by the majority of students. Therefore the relevance of data logging and information sharing needs to be addressed.

The main problem is that students have had little or no relevant industrial experience and so need to be forced to act in a company manner. Unless all students take this on-board group working can be extremely difficult to achieve. Students also find that a modular framework makes it difficult for them to see how the different subjects interact and that the information they gain from e.g. materials or mechanics modules can actually be used within the design environment.

Students also have trouble with the concept of gaining customer feedback and the importance of initial market research. If they do the research they do not necessarily feed it into the design specification. This is another area that needs to be addressed.

At present students are allowed to pick their own groups, thus stick with their mates, rather than choose a group to involve all the group dynamic elements that are required. This ‘choosing’ of groups can either result in a lot of conflict or alternatively produce a group that is gelled and work well together but may have a narrow experience range. The groups where there is conflict do not get that much from the experience and it can put them off design.

Feedback of the present student experience will be collected and analysed during May and June of this year. This information will then be used to compare with the new environment the students will experience.

4. PROPOSED PEDAGOGY

The proposed pedagogy is based on the following needs:

- Design, make and test projects
- Industry related
- Virtual company
- Collaborative software
- Inter-modular assessment

Within the School of Engineering and Advanced Technology we are re-vamping the design modules to run through a collaborative software package produced by Centric Software. This package provides visible mapping of the design process and student task delivery. A member of staff can monitor the group progress throughout the project and be alerted if the project falls behind time. The collaborative software will also store all the files that the students produce whether documents or drawings. This will enable the group to progress even if a group member is absent due to sickness or not pulling his or her weight. The originator of the work will be known and so individual contributions within the group can be monitored and marks awarded accordingly.
The project will also interact with other modules e.g. materials selection, rapid prototyping and mechanics. The assessment for these modules will be linked to the project work, this will not only highlight the interaction of knowledge required to undertake the design process but also reduce the assignment load for the students due to less repetition of work.

Local industry will be contacted to give advice and information to set up industrial standard projects and also to give the interaction between company and customer to give a more realistic feel. Goal posts and expectations should be fluid within the project thus giving students experience of a ‘real-life’ situation. Students should be given specific ‘job titles’ to give them ownership of a part of the project. Through the use of the collaborative software students will be forced into using synchronous and asynchronous design exchanges and better data management will be achieved.

Finally a competitive edge can be given with the industrial partner providing feedback through an exhibition and, of course, a ‘winner’ can be selected.

A prototype environment is to be ready by July 2001, with the live version ready for September 2001. The project is being funded by money that has been bid for from the University, Teaching and Learning Committee. The following academic year will trial the new environment and assess the improvements in group interaction and the standard of the design work. A second group will then be introduced to the design environment to confirm the improvements. The final findings are due to be published in June 2003.

5. CONCLUSIONS

As stated this paper is an introduction to a University funded project that is in its infancy and this is therefore a work-in progress document.

At present the Collaborative Virtual Design Technology Learning Environment Project is still in its infancy. The results of the project will not be known until June 2003.

REFERENCES

1. Professional Engineer, Vol 14, no 3, pp34-35
4. ‘Design Education. What has changed and where are we going?’ Outcomes of a SEED Workshop, Coventry University, 29 March 2001.