An Evaluation and Comparison of the Industrial and Educational Usage of CSCW Within the Design Process

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This short paper presents the findings of three recent research projects carried out at the University of Strathclyde. Two of the projects, ICON & ICON2 investigated the usage of CSCW tools by disparate engineering design students whilst, a Design Council funded research project investigated the introduction and usage of shared workspace technology within the design process of three companies and their supply chain. This is followed by a comparative reflection of the results allowing identification of generic findings together with opportunities for cross-sectoral lessons.

ICON (Institutional Collaboration Over Networks) began in June 1997 with a weeklong collaborative design project involving four pairs of students. The students came from the Product Design Engineering course at Strathclyde University and the same course run jointly at Glasgow School of Art/Glasgow University. The students tackled different design briefs and were asked to provide a solution and present their findings at the end of the week. They were restricted to the use of network technologies such as audio/video conferencing and chat tools and were prohibited to communicate by any other means. Although difficulties were encountered through the week, the project was considered a success in that it proved virtual collaborative design projects were feasible. The difficulties encountered were also examined and resultant changes made to the system for the second project, ICON2, which ran for eight days in September 1998. This iterative process resulted in modifications being made to the system in terms of the methodological approach and project organisation, in the pursuit of ensuring future success.

The underlying philosophy to the ICON projects involved improving the accessibility of CSCW tools in order that policy makers in academia could implement similar projects easily, efficiently, and with as little as possible start up.

The industrial involvement came through the *Integration of Design Specialists Through Shared Workspaces* projects. This recently completed research, funded by the UK Design Council, investigated the introduction and usage of shared workspace technology within the design process of a number of small and medium sized enterprises (SME's). Within this context shared workspaces included video and data conferencing, real-time application sharing, shared whiteboards and file transfer.

Development and use of such technology to date has been dominated by large multinational companies. Ford, for example, have used the latest collaborative technologies to allow their seven design centres, each of which specialises in different aspects of design, to communicate effectively across great distances and different time zones.

The research approach adopted is best described as a series of industrial case studies involving a number of companies from a range of industries, specifically Product Design, Construction and Electronics Manufacture.

The general methodology adopted within each of the companies was to run successive case studies each building upon and testing the findings of the previous. Therefore, each case study followed a different methodology focusing on slightly different aspects. The first company case study commenced in May 1997 with a series of trials being carried out in Hulley & Kirkwood, a mechanical and electrical building services consultancy. This was followed by a product design company, Devpro starting in December 1997. Finally, the Keltek electronics case study began in June 1998.

Recording methods used in both projects for post-evaluation included pre and post questionnaires, support-staff logs, on-line diaries, and interviews.

The main findings of the educational research can be classified in the following areas:

- System and tool usage
- Benefits
- Barriers

It is crucial that the process of evaluation is correct in these projects, otherwise barriers and benefits will be inaccurate. Furthermore, it is important that we pinpoint 'what' to evaluate. In this research, communication,

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relationships and learning – particularly central in an academic sense, were examined and mapped to results.

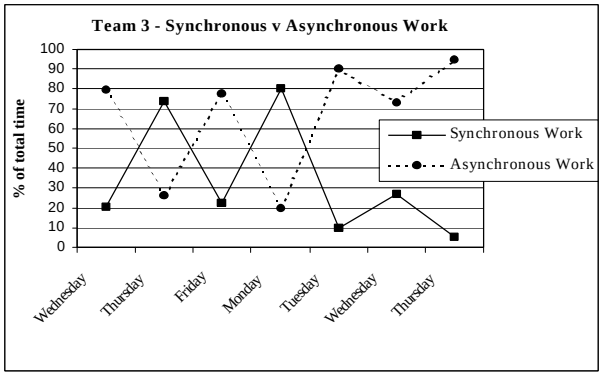

Figure 1 Team 3 Communication Cycle

The above chart evaluates communication through the daily synchronous/asynchronous split for one team in ICON2. Important questions include what is the ideal split and what patterns are required for different tasks.

Furthermore, from examination of the personal log and on-line diaries in ICON2 it became apparent that the participants, generally, displayed the same work mode at each of the various stages. By examining this it may be possible to maximise benefits and ease teething trouble in future projects. To this end, figure 2 is proposed.

S ıge	Induction	Familiarisation	Expert
A titude	Keen	Content	Frustrated/ Stressed
T ols U age	Using a wide variety	Narrowing usage	Whatever appropriate to deliverables
A titude to t ols	*"open to anything"*	*"open to what works"*	*"nothing works"*
L vel of b ck-up	Tools instruction needed	Software support only	Moderate software support

Figure 2 Work-modes and Attitudes

Barriers identified during the introduction and use of the shared workspaces in the educational *and* industrial settings can be classified under *management*, *psychological*, *technology* and *training*. In both cases the technology was used to *augment* rather than replace current activities. Implementation guidelines produced followed similar paths including the gamut of activities from identification through installation to monitoring. The majority of findings from both projects are common. However, both projects provide scope for lessons to be transferred from industry to education and vice versa.

Industry to Education:

- More barriers were identified in the industrial based projects, due to the artificial "sheltered" nature of the ICON projects. These additional barriers have been developed in to guidelines which could prove useful in future educational projects;
- Industrial case studies can be used as material within educational environments in order to provide students with a realistic overview of "the real world";

Education to Industry:

- Both ICON projects were well managed and prepared for well in advance of commencing. As a result, system usage was smoother than within the companies. Industrial case studies show that companies are keen to commence usage in order to achieve the perceived benefits and tend to gloss over the preparation and management stage, often to the detriment of successful technology implementation;
- The ICON projects showed that students adopted high levels of synchronous work to cope with short project deadlines. Results from industry showed users tended to "back off" employing technology when tight deadlines were looming often resorting to conventional asynchronous modes which are more time consuming.
- In ICON particular attention was paid to the learning process that the students went through. As CSCW technologies are new to most people in education and industry, the latter can learn from the former in methods that maximise quick and efficient uptake of the new systems - all engage in the learning process.

The role of evaluation was crucial to the iterative development of the research and formed the crucial phase prior to the creation of guidelines, barriers and benefits of the technology. However, evaluation still needs to be faster, more reflexive - able to cope with the different demands and pressures that the design process will create through the life cycle - and cheaper.

Finally, the research has shown that two main elements of evaluation are the 'what's' – specific elements of work that we are evaluating such as communication and learning, and the 'how's' – the methods by which we can achieve that evaluation. Some preliminary key features of future approaches have been identified as transparency, flexibility and interoperability.

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