IT OR NOT IT? An examination of IT use in an experimental multi-disciplinary teamwork situation

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Leeds Metropolitan University is well placed to carry out research into multi-disciplinary team-working, as all the design and construction disciplines are housed in one faculty. Staff have set up an experimental project, TIME IT (Team-working in Multi-disciplinary Environments using IT) which examines ways of working in the design/construction process and how IT is used when there is no commercial pressure. Four groups of four students, one graduate diploma architect, and one final year student from each of Civil Engineering, Construction Management and Quantity Surveying have been working on feasibility studies for projects that are based on completed schemes or have been devised by collaborators in the Construction Industry. Students have been asked to produce a PowerPoint presentation, in up to five working days, of a design scheme, with costs, structural analysis and construction programme. The students are not assessed on the quality of the product, but on their own ability to monitor the process and use of IT. Despite this, aggressive competition evolved between the teams to produce the 'best' design. Five projects were run in the 1998/99 session.

A dedicated IT suite has been provided; each group of students had exclusive use of a machine. They were not told how to approach the projects nor when to use the available technology, but were asked to keep the use of paper to a minimum and to keep all their work on the server, so that it could be monitored externally. Not so. They plotted the AO drawings of an existing building that had been provided on the server. They like paper - they can scribble on it, fold it, tear it and throw it at one another.

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Background

Developments in IT, such as rapid increases in computing power, reductions in equipment and software costs, and the rapid adoption of communication media, all give opportunities for more efficient and effective ways of working. There is considerable evidence that the Construction Industry has yet to exploit IT to its full potential. The DETR's Construction Research & Innovation Business Plan on Process states that "promoting and improving the understanding of best practice in the use of IT is a major priority". DETR's Information Technology Strategy, which is directing its funding in support of the construction industry, has similarly identified the need for priority to be given to the development of IT

systems, in collaboration with industry. DETR's Construction Best Practice programme incorporates an IT theme, demonstrating the need for the construction industry to be supported in achieving best practice.

This project seeks to forge a link between current understanding of good team-working practices (such as the fostering of communication and collaboration) and the latest developments in CAD and other IT systems appropriate to construction. Specifically it attempts to increase the effectiveness of collaboration between members of design teams by identifying where IT is not used because of human attitudes rather than for technical or legal reasons.

Economies are consumer lead. Clients need to know what they will get for their money. In fields other than building procurement, the customers have a much clearer idea of their own needs and of what they are buying, and easier means of redress.

In future, computer simulations will allow clients to choose a generic building form, make changes, see it on site, 'walk around' the interior, choose colours, finishes and furniture. The whole package could be planned , timed and costed, amended where necessary, ordered, delivered and assembled. Everything could be handled by the same provider, who would co-ordinate designers, subcontractors and suppliers The environmental performance would be determined and a maintenance manual would be provided with the building, which would be covered by a 5 year all parts replacement and performance warranty. The need for 'architects' would be reduced, at least in their traditional role.

In future? It's happening now in kitchen and conservatory supply.In current research projects related to design and construction, object oriented modelling, common building models, international standards for objects, data transfer and legal ownership of data are being investigated.

People involved in the TIME IT project are concentrating on tidying up the process of what is happening in the mainstream at present. Of the two architectural practices that are collaborating, one has been using CAD since 1982 and has been sending electronic drawings between offices for over ten years. The other has been using CAD for about six years. In both practices AutoCad R14 is used for all drafting and 3D Studio Viz for some, but not all presentation work. Both have in house accounting and management systems. Both have full internal and limited external e-mail and www access. Intranets are being developed. Transfer of electronic data to consultants, contractors or clients is project specific and is determined by tried and tested compatibility between systems and established level of trust. The collaborating contractors use CAD on a minimal basis, have internal accounting and management systems and relied, heavily , on paper. Since the start of the collaboration MODEMs have been introduced into site offices. The QS/Project Manager collaborators 'went electronic' in January 1999.

Experimental Projects

The first project was devised by the Contractor and was based on a recently completed housing scheme. The students were provided with a site plan in electronic form and woolly architect's plans of the house types required. The students worked on the project for one day a week for five weeks, in which time they were required to produce layouts and perspectives of the scheme, costs, full design and construction schedules and calculations for roads and drainage. The proposals were evaluated in terms of quality of design and value for money and compared with the real solution. The students became highly competitive and produced a great deal more than was expected. The students, other than the civil engineers, were not assessed of the outcomes but on their ability to monitor and assess the process. The evaluation of the process became the subject for their dissertation. The architecture students felt hampered by the construction managers who, in three out of four teams, took the lead.. One comment from an architect was 'if this is what it's going to be like in practice I do not want to be an architect'.

They were not given any indication of how and where to use IT but were asked to record their working procedures. The staff monitored process and progress..

The second project was the design of a pedestrian bridge over an urban motorway, as a landmark for the building society/bank. Again, this project lasted five working days, during which teams had to produce a PowerPoint presentation with full visualisation, calculations, costs and construction schedules. The intensity of the competition increased and discord set in. The architects ganged up with the civil engineers, united in their opinion that quantity surveyors were unimaginative, boring and superfluous. The construction managers kept their heads down; they knew less about bridges than housing. Despite the threats of homicide and retribution during the project, all the teams managed to present a picture of harmony, confidence and competence to the collaborators and staff at the final presentation.

The third, three day, scheme was proposals for the commercial development of a brown field site in Leeds. The quantity surveyors were instructed to take a lead. They found this difficult and waited for ideas from the architects. The final PowerPoint presentations were slick and professional, the schemes were realistic and the quality of the architecture was banal.

The fourth, seven day, project was a refit of an eighteenth century building which was subject to a change of use from a restaurant to a health club with a perspex swimming pool. The teams were changed. All the architects were replaced by students from the first year of the Graduate Diploma course. The built environment students could choose whether to stay on. Three out of four of the quantity surveyors and civil engineers did. Only one construction manager remained and there are three new project managers. No one was allowed to remain in the same group with anyone with whom they had worked before. Students were encouraged to work outside their professional roles.

The final project was the design of a flat-packed dwelling, which could be used as relief housing. This project was run as a three day block . The final presentation was to be a set of non-verbal instructions for transport and assembly, which were to be left as files on the server for external scrutiny.

The range of projects was devised so that if students maintained their professional roles, there would be an opportunity for each discipline to become a leader. This did not happened. Students have commented that leadership is more to do with personality than profession.

Staff and Resources

This project is expensive. There are five members of full time staff who commit at least three hours per week: one architect, a construction manager, a project manager , a quantity surveyor and a structural engineer. That is a lot of time for sixteen students. In addition, each of the five industrial collaborators has run a project, spent a day at the beginning and the end, and attended regular planning meetings.

A dedicated IT studio was set up with help from LMU, AutoDesk and Dell Computers. The hardware and software were specified to be equivalent to that used by the collaborating architectural practices.The equipment includes four GX workstations and a server running Windows NT. The NT network is administered, via a modem, by the IT managers of the two architectural collaborators. The original installed software was Microsoft Office 97, AutoCad Release 14, AEC, and 3D Studio Viz. Additional peripherals and software were provided in response to student demand. Despite all exhortations not to use paper, the students found that a plotter and a colour printer were essential to internal communications between groups. This may be, partially, because the students do not have physical access to the server nor access to e-mail or any external network services via the server, for security reasons. The IT suite is unsupervised. Students who work on the project, and who know the key code, may use the facilities at any time the building is open.

The software products requested by the students were CA –SuperProject 4.0, followed by Photoshop.

Use of IT

The project would not have run without cellular telephones. For the housing project, AutoCad R14 was used by all groups to move blocks around the site and to generate quick wire-line perspectives. The QS and project management students, did not use specialist software, but used Excel. The civil engineers used either pocket calculators, or software provided elsewhere in the university. All groups presented information in brochure form, incorporating data from other software into Word documents. Each group tended to stick to one machine. This was probably as an indication of parity of opportunity rather than for technical reasons. All groups had dedicated storage space on the server that could be accessed by all four machines.

From the second project onwards, students became more confident and competent about the use of the available software and were experimenting with various methods of visualisation including animation. Each team used a machine as drawing tool, calculator, meeting place and noticeboard. On the schemes where the architectural practices were acting a clients, there was a dialogue via the server. Unfortunately, security problems, prevented external access from the server being made available to the students. In the event this proved to be a wise decision as 'I know better than you' student decided to try to change all the file permissions, and succeeded in denying everyone access to the system.

Conclusion

This paper is about the use of IT rather than about team-working, but the two are closely linked. The project is on-going, so at present there are no conclusions as such, but there are several observations which can be made:

- ideas and non-determined problems seem to be best investigated on paper
- where the problem is defined (e.g. arrangement of a known number of house types on a site) CAD is a useful tool
- it is easier to gather round a table than a computer (this problem is eased by the development of A1 horizontal screens)
- face-to-face discussion from the outset saves time and would allow the development of a common building model. This would blur existing professional roles.
- CAD may not be the best medium for presenting ideas to clients. At one presentation the collaborators unanimously preferred a PowerPoint presentation which incorporated scanned sketches and Photoshop images to one which included an extremely good walk-through based on 3D studio.
- mobile phones with messaging facilities are more useful than e-mail.

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