CAD AND FOSTERING CREATIVITY WITHIN THE STUDIO ENVIRONMENT

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ABSTRACT

The BA Design Products and BSc Industrial Design courses at De Montfort University, faculty of Art and Design have always thrived on an active, lively studio environment.

Working with and learning from peers has always been seen as essential in developing creativity and innovation in developing designers. It often emulates the kind of studio environment encountered within consultancy and 'in-house' design facilities.

In recent years where the widening of access for students in the UK has increased and the skill and ability levels of students is now more diverse than ever before; the studio has become an area of consistency for students.

As CAD has become more and more influential in design and design courses, we have witnessed how significantly it has affected the studio environment in recent years, ranging from the exclusivity of the Unix Workstation in the 90's to the more widely available 'NT box' in recent years.

In the late 90's and early 2000 we witnessed a significant number of students purchasing their own computers for home/lodgings use, availing themselves of often discounted student editions of CAD software or unfortunately often illegal software.

This had a dramatic impact on studio and the more 'paper based' aspects of the design process that took place within it. Why use a studio if access to computers provided by the University was insufficient and they could stay at home using their own more accessible resource?

As PC's have become very much more of a commodity item we have been able to comfortably afford a more comprehensive, more readily accessible CAD provision for our students; we are now witnessing a significant resurgence in studio use.

This paper describes this transition and how the ready access to CAD has reduced it to the tool it should be, where it is now seen as normal and expected. Creative thinking and the need for fundamentally good ideas and the 'paper based' aspects of the design process (enhanced by the studio environment) are now taking its rightful place.

We wish to progress this further by considering the eradicating the CAD lab itself by integrating CAD prevision and its teaching within the studio environment. Our thoughts on this will form the conclusion of the paper.

Keywords: Design studio, integrating CAD, creative process

1 TRADITIONAL CAD PROVISION

1.1 Dedicated facilities
Largely due to cost, the traditional provision of computer aided design facilities within Higher Education tended to revolve around serving broad ranges of students within a faculty or Department rather than being specialised toward subjects and individual courses.

The example of DeMontfort University supports this in that, until recently, a single computer 'laboratory' would provide use of software to all students within the broad core subjects of three-dimensional design. Courses ranged from jewellery design, glass and ceramic design through to industrial design. Due to this broad spectrum, the specification of hardware and software became generic rather than specific. Typically such software was used mainly for concluding project presentations such as final 'visuals' and two-dimensional technical drawings.

1.2 Geography of facilities
The generic use of CAD led to 'CAD labs' being situated in areas where they could be supported within 'purpose built' facilities, areas designed to feed this broad range of courses. The often-central position of a singular facility would become counterproductive to its use. As the use of CAD software became more and more embedded into the design process, the often-awkward geography of a singular CAD facility in relation to the design studio became a distinct negative. The need for CAD was becoming a necessity but access was often prohibitive; students were frequently driven to establish their own resource, keeping them out of the University and therefore the studio.

1.3 Traditional studios and workshops
The process of designing necessitates the use of design studios and workshops. Students use the studio environment to create and resolve ideas. The principle of keeping groups of students together supports/enhances the students learning experience. The studio is primarily used for drawing based activities, concept generation, development, realisation and ideas discussion. The need for design evaluation, verification and testing calls for the use of workshops enabling designs to improve and mature.
The type of workshops became specific to course requirements. Dedicated workshops would service particular kinds of course; kilns and glass blowing equipment would service glass and ceramic design courses. Metal machining, plastics and wood workshops would service industrial design courses.
The position of these facilities became important, as the need for integration of their use is a key tool in the creation and resolution of designs.
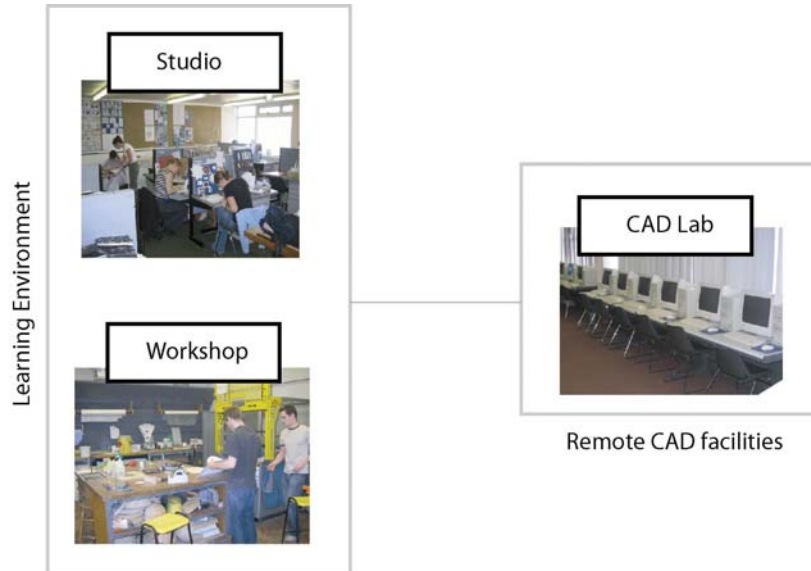
Figure 1. separation of CAD facilities

The close proximity of dedicated workshops allows the student to move freely from drawing board to workshop to drawing board, enabling effective testing and verification of designs. The studio compliments this as an area where integration can take place. If students don't use the studio they deny themselves this opportunity.

1.4 Paper Based Design

With limited access to a CAD facility, students would rely heavily on undertaking a considerable amount of paper based (concept sketch drawing and development and presentation illustration) work in the studio, complemented by access to workshops and 3D modelling.

In this context the need for a student to draw and communicate quickly and effectively by these means was essential. Students in this situation would naturally develop an intimacy with their designs; they could genuinely propose concepts freely rather than limiting their designs by what could or could not be achieved by CAD.

2   SOFTWARE AND HARDWARE ADVANCES

2.1   Hardware accessibility

In the early 1990's high end CAD usage was often confined to expensive workstations. The high cost of these machines meant that private ownership for undergraduates was prohibitive and that access within universities was limited often to researchers and postgraduate students.

Undergraduate access would have would be restricted to exercises rather than an attempt to integrate the use of CAD into the design process.

Figure 2. Silicon Graphics workstation using IRIX operating system

During the later half of the 1990's advances within 'PC' technology meant that more affordable computers became available running more widely used operating systems such as Windows NT.

By the early 2000 we witnessed a significant number of student purchasing their own computers, considerably more powerful than the dedicated workstations used in the 1990's. Although more affordable purchasing large numbers of 'NT boxes' was still often prohibitive to Universities.

2.2   Software accessibility

The use of high end CAD software was intrinsically linked to dedicated workstations, many packages would only run on particular operating systems such as *UNIX* and *IRIX*. The lack of software available for 'home' computer systems reiterated the exclusive use of CAD.   With the emergence of affordable PC's came more advanced operating systems that could run this high end software and so by the turn of the century most high end CAD packages were able to run on Windows operating systems on PC's that could be bought from a high street shop.

This, now accessible, software became copied by students to avoid the high commercial cost and freely distributed. In response to this software producers made available non-commercial versions of their software at a reduced price, sometimes for a few pounds.

2.3   Effect upon studio usage and 'paper based' design activity

Advances in hardware and software and the now affordable overall package has led to many students opting out of the studio environment.   The remote nature of many university CAD facilities and their lack of subject-dedicated software led many to work at home using their own computer systems.

However in recent years universities have also felt the same impact on students in terms of affordability.   Generic CAD facilities can now be broken down into subject areas (certainly this is the case with De Montfort University, Faculty of Art and Design), given their lower cost. Software can also be specified according to the needs of particular courses rather than the more generic needs of complete departments.   The

once specialist facilities, such as Silicon Graphic workstations have now made way for expensive peripherals such as digital drawing tablets, large format scanning, printing and rapid prototyping/printing facilities.

We have also witnessed during this period of transition students to relying heavily on CAD to realise their designs, they spend less time resolving and developing designs on paper. Designs are often limited by the level at which the student can manipulate software or the inability of the software itself to achieve the form and detail that the student designer would really like to achieve.

3   INTERGRATED USE OF CAD

3.1   Variable use of CAD

The closer proximity of CAD facilities to the traditional studio environment is enabling students to use CAD more as an integrated tool rather than as a conclusive tool, *'look at the cleverness of my design not just the way it has been computer illustrated'*.

Students move between studio and the CAD facility, using whatever particular tool is needed at the time. However, these tools still remain quite basic when compared to the industry use of CAD. We have observed that the greatest use comes when using two-dimensional packages to produce 'technical drawings' and three-dimensional packages to produce 'visuals'. Students interpret their 'sketch' work into technical drawings to allow effective modelling to take place. This demonstrates the integrated use of the three discreet facilities of studio, CAD lab and the traditional workshop. However it is not yet CAD to Rapid Prototyping
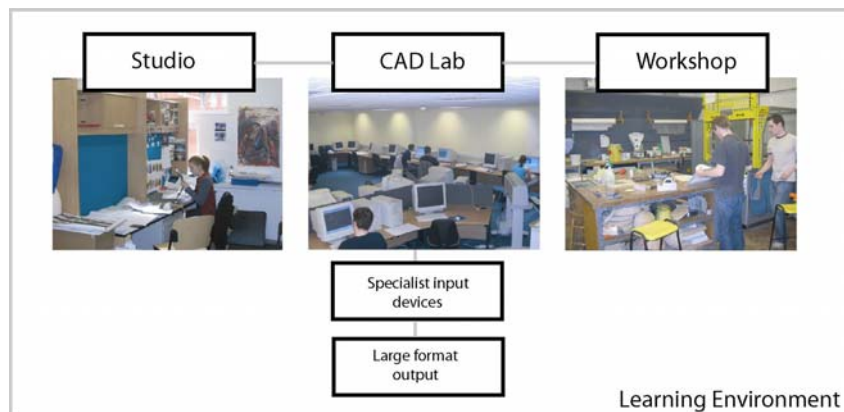

Figure 3. Combined usage of studio, CAD facility and traditional workshop

Specialist facilities offered beyond student affordability, such as interactive screens, large format printers and plotting devices help keep this expanded learning environment more effective. However we also observe that any distance between the 'studio workspace' and the CAD lab result in the systems being used in a non integrated way.

3.2 Integrated workstation

DeMontfort University design students currently use dedicated workstations (non-computer orientated). These are traditional in that they provide a large desk area, space to store models and flat work and a lockable pedestal.

We believe the next evolution to take place is to bring the computers into the studio itself, not only to be used as a tool for the students themselves in their designing, but to be taught and instructed in CAD itself and indeed a wide range of educational elements. In other words the CAD lab will disappear further enhancing the use of the design studio itself and at the same time reducing the amount of floor space occupied by a cohort of students.
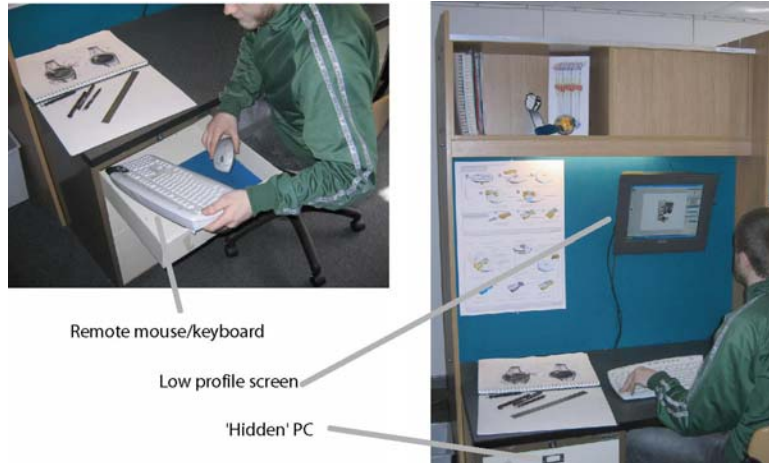

Remote mouse/keyboard

Low profile screen

'Hidden' PC

Figure 4. Integrated workstation.

To allow CAD to be fully integrated then the student must have all tools to hand. Figure 4 shows an evaluation workstation, traditional surfaces for design work are still here, but the back mounting surface also provides space to use a flat panel display. The lockable pedestal provides space to 'hide' the PC and peripherals when not in use. In this case wireless mouse and keyboard are used.

This facility provides students with the opportunity to use CAD as an industry tool and allowing it, where appropriate to for the backbone of the development process, whilst still maintaining a creative studio environment. Taught sessions can be handled more effectively and students can tackle tutorials at there own pace rather than at a timetabled slot traditionally used.

3.3 Fully Integrated workstation

Moving facilities closer to the student work place allows them to become more integrated into their design process, similar advances in software now provide students and industry with a raft of different CAD tools each appropriate to particular process. These may be based around initial concept generation, through development and presentation stages to final definition, testing, evaluation and production.

In order to help integrate this further, digital-drawing tools can be implemented to help maintain the initial creative visual spark that comes from designers drawings. Software such as AliasWavefront Studio Tools uses initial design sketched to help drive the

design. These drawings can be inputted using a scanner or by using a digital drawing tablet.

Figure 5. Fully Integrated workstation.

A more advanced workstation would incorporate a digital drawing screen as illustrated in figure 5. This same screen acts as a 'traditional' viewing screen shown in figure 4, by unhooking it from its mount it can be used to allow students to draw directly into a digital system.

4   ADVANCED LEARNING ENVIORMENT

4.1   Delivering electronic learning

We believe that studio environments help develop creative thinking and allow students to 'learn' more effectively than traditional lecture based principles. A system of networked PC workstations would allow for a more flexible learning environment. Progression through learning materials such as training tutorials can be more effectively monitored. The overall management of the students learning can be closely observed and structured, issues can be 'posted' to individual or groups of students. Team projects could be handled more effectively with groups of students working on the same projects.
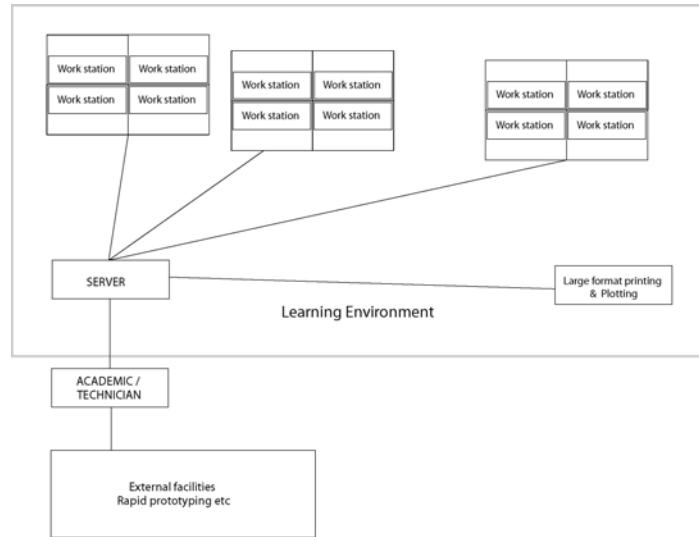
Figure 6. workstation layout.

Administration can be carried out by academics and technicians; transfer of data to external facilities, such as rapid prototyping can be verified through this controlled system as more access is made available to undergraduate students.

Control of student accounts, material accessed, posting of new projects, updated tutorials etc can all be controlled via a server control system.

Use the whole place as a teaching area? Get rid of lecture theatres?

4.2 Survey of CAD/Studio use in leading UK based Industrial and Product design based courses

A brief telephone survey was undertaken of 8 UK based design colleges offering Industrial and Product design courses both at BA and BSc level. The survey was to determine the nature in which the CAD/Studio environments were configured at these institutions.

2 institutions provide studio space dedicated to each student for 'paper based' design activity and a separate CAD lab provision.

4 institutions provide a general (but not dedicated to each student) studio provision for paper based design activity and some CAD lab provision.

2 institutions are moving away from the 'paper based' design studio completely and are relying on students to undertake their work entirely on the computer.

0 institutions provide studio space dedicated to each student, which provides for 'paper based' design activity and the same time integrates a CAD provision

5   CONCLUDING REMARKS

Ready access to affordable, powerful computer hardware and software is bringing about resurgence in studio use by our students. They are once again benefiting from a more effective working environment and learning from each other.

There is definitely scope for further development of an integrated studio, CAD provision. It is only a matter of time before 3D printers become sufficiently affordable to become similarly integrated into the same environment.

More importantly though is that this ready access and use of CAD is bringing about much greater proficiency in its use by students; the once 'slick' CAD visual or STL model is now becoming normal and passé. Design work is now once again being differentiated, as it should be by the quality of the design, not the computer visual. CAD is being relegated to the tool it should be.

It would also appear there is scope for debate on the role of 'paper based' activity in the Industrial/Product design process. Is a reliance on CAD only, merely an excuse not to provide expensive studio space?

'The ability to draw and communicate quickly on paper is still a pivotal requirement, the designer is handicapped without that ability.' Peter Philips, former director of Tangerine, now head of Product Design at the Brewery.

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