Designing New Computer Laboratories: Fresh Ideas and New Layouts

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ABSTRACT

In 2002 UNITEC Institute of Technology began the planning of a new building on campus, and the School of Computing and Information Technology were to be a substantial occupier of the space. The new building was to include spaces for two new computer laboratories, so this was the ideal opportunity to rethink the design of the layout of the computer laboratories. Current literature was reviewed and academic staff and student considerations were taken into account in the development of the new layout. The initial design was then given to the project team where modifications were made and the final layout agreed upon. The rationale, design, implementation and specifications of the laboratories will be described in this paper.

Keywords

Computer laboratory layout, computer laboratory design, closed laboratory

1. INTRODUCTION

The School of Computing and Information Technology at UNITEC were fortunate to have the opportunity to expand into a new building and gained two new computer laboratory spaces. All courses taught in the school, whether they are sub-degree, under graduate or post graduate, have a lecture or theory session and at least one practical session, there are also opportunities for students to complete their course work in open laboratories. All courses also have an online component of varying degrees of complexity and flexibility. The design of the new laboratories had to accommodate courses at all levels and also meet the needs of the staff and students. Designing the new building gave us the ideal opportunity to rethink the layout of the computer laboratories so we didn't design them "because we've always done it this way". There were also other considerations that had to be taken into account, hardware, software, the culture of the school, the requirements of the staff and students and of course the budget.

Over recent years visits to other institutions have taken place and while the visits were for very different reasons the layout of the computer laboratories has been observed. A recent visit to Rennselear Polytechnic Institute in Albany, New York, showed two very different layouts that were working far more successfully than the traditional layouts. Literature searches were also carried out but there were very few references and no definitive theory or argument on optimum design and layout was obtained.

This project was started in June 2002 and the building was ready for occupation in January 2003. The laboratories were first used in February 2003 and the reaction from staff and students will be gathered at the end of semester 1, June 2003. The result is a first for UNITEC, a departure from the normal layout of computing laboratories. The new practical computing spaces were successfully completed on time and on budget within the main building contract.

2. BACKGROUND

While visiting many different institutions and viewing the teaching computer laboratories the main reason given to a question on why the laboratory was designed in the way it was, is "we've always done it this way". A second common answer was "to fit as many

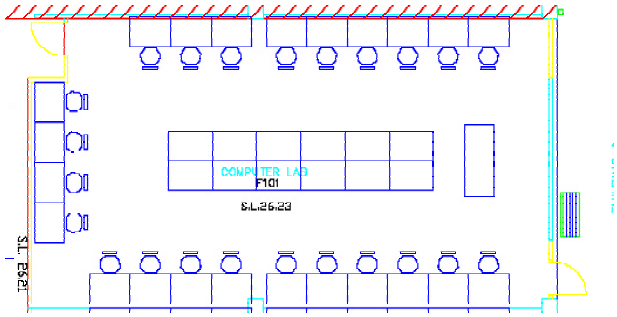

Figure 1 Current layout

workstations into the room as possible" or "we can only fit this number of computer desks into the room". Three common layouts were found, computers around the walls (the standard UNITEC layout see fig 1), computers in rows with all students facing the front, the computers in double rows with students side-on to the front of the room.

When considering the new layouts it is equally important to consider the teaching styles of the academic staff and find out what they required in a computer laboratory. Academic staff were surveyed as to their requirements and requests in the layout of computing laboratories. The findings were identified in four main themes

- the requirement for a theory space in a practical environment
- to be able to see the student screens from the front of the room
- the opportunity for students to do group work
- the difficulty of inattentive students who did other things (eg playing games, surfing the net, reading emails) during the class.

All the spaces in the new building were of the same size (110 sqm) as the building was designed in modular "bays" of these regular sizes. We therefore had to work within the restrictions of the size of the bay. After examining various options it was decided to allocate two adjoining bays on the ground floor for the two new computer laboratories. In the initial stages of the building we originally assumed the two new computer laboratories would be of the same layout as the other computer laboratories in the school (fig 1).

3. TECHNICAL DESIGN CONCEPT

3.1 Physical Layout

As there were two adjoining spaces available, after many attempts we came up with basic design of the two laboratories. They were eventually designed to have the students face the central wall, which we then made removable (See fig 2 & 3). The students face the front of the room with a theory writing space and the computer table with the computer and screen is behind each student workspace. This configuration meets three of the requirements of the academic staff; that they can see all the screens from the front of the room, the students are not facing their screens during any lecture or theory time and students, have desk space to write and room for textbooks or note books. All chairs in all computer laboratories are standard ergonomic office chairs with wheels so the students also don't have to move to a separate space for theory or practical work, they just turn around on the chair.

To enable group work and also to facilitate ease of access for lecturers to help students at their workstations, a tiered room was designed with the work stations in six groups of four, 24 students being the standard size of a class. This then met the fourth and final requirement of the academic staff, the ability to do group work in pairs or groups of four.

Once the basic room layout was resolved, it duplicated on both sides of a centre line. The result is a semi-circular theatre, mirrored about a central moveable wall. The wall can be either open and the space used as one larger theatre (48 workstations), or close the wall and use the space as two smaller laboratories (24 workstations).

3.2 Audiovisual system

The next challenge was to design the audiovisual system to allow for the acute sight lines, both for a double room, and for a single room. A demonstration theatre in a similar size space was set up to test sight angles. It was very quickly realised that one screen was not going to work, so two screens would be needed for each laboratory or space. As well as the two screens, both sides of the theatre needed to be synchronised so when it was used as one room, the image matched on all screens.

A considerable amount of work went into the development of a deliverable specification, which outlined the way in which the room was to operate and how the equipment was to be interfaced with the users. This specification was developed in

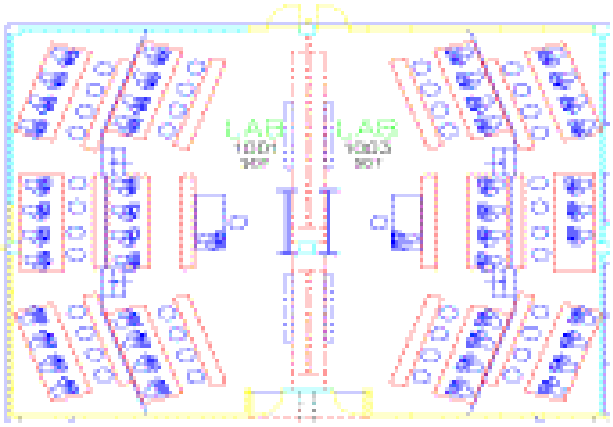

Figure 2: Two laboratories joined

Figure 3: Two laboratories joined

consultation with the end users and audiovisual/control system supplier's. The objective of the specification was to describe the standards to be achieved for both the users and equipment suppliers. It was important that this was clear and simple as the technology is extremely complex, and confusing. Adding to this complexity and confusion was the interface to the building management system that automatically turns off the room lights and air-conditioning when the room is not in use.

3.3 Project deliverables

As it was a requirement for the room to operate as two separate laboratories divided by the operable wall or function as one large theatre for 48 students it was required to have:

♦ Single point touch-screen control systems (TSCS) in each space that can operate independently or as a combined unit for the whole room with either (TSCS) able to operate as the master unit.

♦ The Environment Control System (ECS) had to interface with building management system (BMS) lights only

♦ A lectern that houses all equipment in each room

The Environment Control System also had to operate the:

♦ Motorised blinds

♦ Motorised screens

♦ Data show units

♦ Document cameras

♦ PC with inbuilt CD/DVD units

♦ Audio equipment including microphone, lapel microphone and speakers.

♦ Electronic whiteboard and infra-red (IR) for Palm Pilot connections.

♦ Walk around tablet

♦ Portable computers/laptops and guest connections were also required

The functional requirements of the touch screen were:

♦ Dual video viewing output queuing capacity

♦ 17" LCD with touch screen over lay

♦ Full control of the lighting system

♦ Interface with LAN networking and intranet/ internet systems with standard security check.

4. IMPLEMENTATION

The installation and programming of the equipment proved to be challenging as new international boundaries were set, as much of what was undertaking or successfully achieved before was a first. Considerable attention and testing was given to the detail and interface of the individual components. However, coordinating with the information technology department proved to be extremely difficult as there were so many individuals involved and getting the timing right proved to be nearly impossible. This unfortunately resulted in the complete ECS system accidentally reformatting, with a complete loss of all the data and programs, on the weekend before semester start!

Since the system has been operational and re-formatting protocols established, there has been minimal problems with the operation of the total room environment.

Figure 4 and 5: Laboratory in operation

5. CONCLUSION

The shift into a new building and the opportunity to reflect on the design of the current computer laboratories was a timely and serendipitous one. A literature search and review of current trends showed very little thought and formal attention to the layout of computing laboratories yet it is a vital part of our teaching and integral to the students learning environment. The design of the new laboratories incorporates many ideas from vast experience of teaching and the observation of teaching environments both in New Zealand and overseas.

The physical design meets the requirements of the academic staff and the cooperation between the teaching school , the project team and the sub contractors is a model that could be copied in many other projects. All this has lead to a unique space for students that meets their learning requirements and helps to make the learning space a more comfortable and safe environment. This space has only been in operation for less than one semester so formal feedback from staff and students is not available at the time of writing although anecdotal feedback suggests that not only have all the requirements been met but the design has far exceeded the expectations.

It is also important that innovative ideas such as this be published to help and support future developments and other educational institutions faced with the opportunity to design practical computer learning spaces for their students.

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