Pedagogy and Learning Spaces in IT

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In order to plan for the future, we need to understand the past and present better. There is a dearth of data on Information Technology (IT) teaching practice. This is an explorative study that documents and appraises current IT teaching practices, with a particular emphasis on the extent to which the layout of computer laboratories impact on teacher pedagogy. Recent discussion on learning spaces has focussed more on collaborative spaces or student hubs, without really addressing the needs of regular IT users – teachers and students. This paper will discuss the various challenges for IT teachers, and make suggestions for future improvements. This investigation is part of a larger study into the pedagogy of IT teachers, and how it is articulated through classroom practice. It is a qualitative enquiry that adopts a case study methodology triangulated by classroom observation, videotapes, teacher interviews and student questionnaires.

Keywords: pedagogy, IT, learning spaces, kikan-shido, teacher talk, computer laboratories

Introduction

A number of universities, in Australia and overseas, have recently invested large sums into collaborative learning spaces, 'learning commons' or 'student hubs', and outfitting them with the latest in design, furniture and technology. Sleek and modern looking, they have been purposely built with flexible areas to cater for large classes, individual and group study, as well as recreational use. This is in sharp contrast to the very traditional computer room designs used in most educational institutions, where the teacher stands at the front and the students sit in horizontal or vertical rows. Attention seems to have shifted from formal, timetabled teaching spaces to informal, personal spaces before addressing these pedagogical issues and 'getting them right' for the regular users of IT computer labs. This raises a couple of important pedagogical issues Why is it then, that in many of the universities and TAFEs, the typical design of computer labs has not really changed since the introduction of computers in the 1980s? Why do the layouts facilitate a 'stand and deliver' teaching style, rather than one that is more collaborative and social constructivist? Furthermore, much of the literature emphasizes the intrinsic relationship between pedagogy and room layout, but there seems to be little evidence- based research conducted on actual classes, and in particular, of IT classes in the tertiary sector. This paper examines a range of computer labs in several metropolitan educational institutions, and discusses them in relation to the interplay between pedagogy, learning space and technology

Methodology

This investigation uses a qualitative approach with a case study methodology (Bogdan & Biklen, 2003; Denzin & Lincoln, 2005; Merriam, 1998; Stake, 2005; Yin, 2003) as the main means of collecting information. It is a

multi-case study (Merriam, 1998; Stake, 2006; Yin, 2003) of current IT teaching practice across six universities and Technical and Further Education (TAFE) institutes in metropolitan Melbourne, some of which were nested (Merriam, 1998) within three institutions, with a total of eleven IT teacher participants. This allowed a cross-cross or multi-case analysis to be performed in line with the ideas of Stake (2006, p. 27) "to show how the program or phenomenon appears in different contexts".

A range of IT teachers were video-taped during their normal timetabled lab sessions and observation notes taken. Bromley (cited in Merriam, 1988, p. 28) writes of the importance of direct observation in natural settings, Green et al of "in-depth and first hand understanding" (2006, p. 112) and Schofield of the ability of a case study to "produce a coherent and illuminating description" (2007, p. 183). Those findings were triangulated with interviews with each of the IT teachers and questionnaires distributed to students. Two cameras were used, one on the teacher while the other was focussed on the students, to enable a full a record as possible of the lesson from the perspective of the teacher delivering the class and student reaction to it. As Miles and Huberman (1994, p. 29) state: "By looking at a range of similar and contrasting cases we can understand a single-case finding, grounding it by specifying *how* and *where*, and if possible, *why* it carries on as it does. With the interviews, there was "an opportunity for teachers to tell their stories of practice, and then to build from that telling various opportunities for reflection and learning" (Lyons & LaBoskey, 2002, p. 61). Both students and teachers were asked what they liked and disliked about the lesson, and whether they considered the lesson a 'good' one. In short, these research tools put a human face to the classroom experiences.

Literature Review

Computer labs, like classrooms, are now commonly referred to as 'learning spaces', alluding to the fact that these areas are predominantly places in which students learn and are taught by qualified teachers. There is a growing body of literature on learning spaces and it has been recognised that formal spaces such as lecture theatres, classroom and labs should have flexible layouts that support a diversity of teaching and learning approaches (P. Jamieson, 2007; P. Jamieson & Dane, 2005; Kolb & Kolb, 2005). Some refer to these as the next generation of learning spaces (K. Fisher, 2007; P Jamieson, Miglis, Holm, & Peacock, 2007; Long, 2007; Long & Ehrmann, 2005).

There have been an increasing number of reports, forums and conference presentation by some universities, here and overseas, who have re-designed, and invested heavily, in some of their formal as well as their informal physical spaces to support collaborative and project-based learning (Bulmer, Miller, Byers, Milne, & O'Brien, 2005; Hunley & Schaller, 2007; Mirijamdotter, Somerville, & Holst, 2006; Tregloan, 2007; Wolff, 2002). As Jamieson (2007, p. 19) asserts: "We need to push beyond the notion of a classroom as a uni-directional, single level, uniformly lit, rectangular box.". Universities such as Stanford, MIT, Swinburne and Queensland University of Technology have invested heavily in changing the design of physical spaces, but one wonders how likely those scenarios would be replicated and implemented for the regular IT classes that are heavy users of timetabled computer labs across the board. Furthermore, there is little on how existing lab layouts could be used in more pedagogically interesting ways, or how these traditional spaces could be used in a more student centred, and less than a teacher-directed approach, in IT classes.

There have been authors who have written about the impact of wireless computers and tablets on the design and use of learning spaces (Brown & Lippincott, 2003; Punie, 2007) and Wainer (2008) promotes the idea of 'studio pedagogy' where case-studies and projects are combined with web 2.0 tools, but frankly admits that while it is done in architectural design subjects, it is "difficult to fit into more computer science curricula" (Wainer, 2008, p. 175). As Christen (2009, p. 28) points out: "But this networked world, and the powerful learning tools it offers has yet to penetrate the typical classroom."

Recent research into learning environments has highlighted the connection between pedagogical practice and design (Brown, 2005; Bulmer, et al., 2005; P. Jamieson, 2007; Johnson & Lomas, 2005; Oliver, Harper, Hedberg, Wills, & Agostinho, 2002), however, after close reading of the literature, it is clear that many of the writers have failed to include the data on which their conclusions are based; that is, the information drawn from actual class investigations, and from the perspective of evidence-based research (Thomas & Pring, 2004) on the connection between pedagogy and learning spaces. Rather, they have been drawn from theoretical, academic critiques based largely on casual observation (Kolb & Kolb, 2005; Wainer, 2008; Wolff, 2002) in art schools, chemistry classes (Tregloan, 2007), engineering (Howell, Steer, & Radcliffe, 2008) or science (Bulmer, et al., 2005), not IT classes.

In conclusion, there seems to have been very little research conducted on actual IT practice in computer labs in

the tertiary sector. Most of the studies seem to have been carried out in primary or secondary schools, not in TAFEs or universities, and in subject areas other than IT. Extensive searches in journals and professional association have been unsuccessful in uncovering information on actual IT practice and the computer rooms in which it is conducted.

Definition of Pedagogy

Pedagogy is a term that is commonly used in teaching and learning matters, and there are a range of meanings. In this paper, it was decided to adopt the definition put forward by Alexander (2000, 2008a, 2008b), that pedagogy is both the act of teaching as well as the thinking behind it. As Alexander (2008a, p. 75) states: "Teaching is a practical and observable act. Pedagogy encompasses that act *together with* the purposes, values, ideas, assumptions, theories and beliefs that inform, shape and seek to justify it. "

Pedagogy in IT Teaching

Prior to a discussion about how learning spaces impact pedagogy, it is important to identify IT teaching practice. This will be explored through an analysis of the different types of IT lessons, teaching style and teacher talk, before the exploring the range of timetabled computer laboratories and classrooms.

Different Types of IT Lessons
Basically, the IT teaching observed within this investigation was a largely, didactic across all the institutions. and this could be clearly seen in the way in which lessons were structure. One of the key findings of this investigation was the identification of about four main types of IT lessons They are listed as follows:
- a guided example that IT teachers worked through with the class
- teacher demonstration of a problem followed by a series of activities or set tasks completed by students
- a lecture/class discussion on a topic with set tasks and activities completed by students
- a lesson where IT teachers monitor student progress on assessment or set tasks

From the seventeen classes observed, about 64% of them were teacher-led and directed to the whole class:

Graph 1 : Different Types of IT Lessons
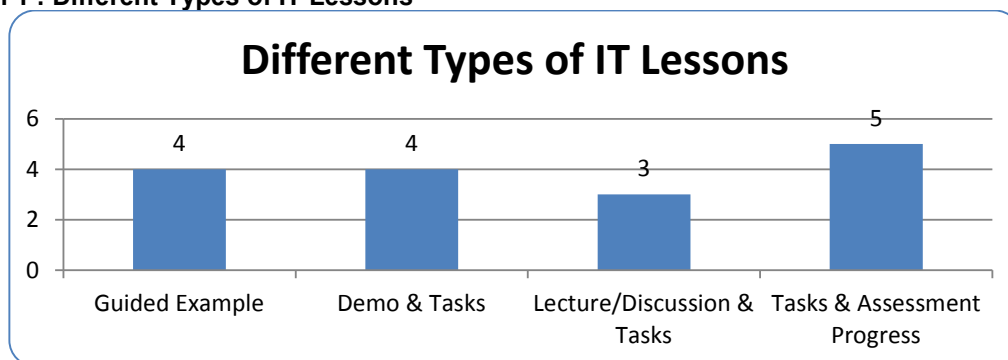
Although the dominant practice was teacher-led, IT teachers were observed constantly checking on student progress on set tasks or assessment. IT Teachers would constantly stop during their lecture or demonstrations to walk around the room and supervise how well students were following instructions. Clarke (2003, 2004) refers to this close monitoring as 'Kikan-Shido' or 'moving between desks', and according to Hattie (2003, p. 4) this type of timely feedback is the most powerful influence on student achievement. Moreover, students too seemed to appreciate this and commented in the student surveys that it gave them the opportunity to have "direct consultation with the teacher to see whether I was on the right track, "got me moving and on track" and "helped me to improve my work" Therefore, while the significant majority of lessons were teacher-led, it needs to be balanced with the fact that IT teachers would often circulate around the computer lab assisting students and solving software problems.

Didactic Teaching Style

In many of the lessons, the teacher was often positioned at the front of the classroom or lab, and guiding, demonstrating or lecturing to students. Most of the lessons involved IT TAFE teachers giving instructions on how to use a particular piece of software in computer rooms. This approach is very teacher-centred, and

conveys strongly the singular role of the teacher as instructor and as the transmitter of knowledge:

Photograph 1: IT Teachers in Stand and Deliver Mode

As most of the IT lessons involved the teacher addressing the class as a whole, the majority of IT teachers, within this investigation, were observed in this 'stand-and-deliver' style of teaching. This type of teaching imposes a certain learning style upon the students, because knowledge is seen as a quantity of information that needs to be absorbed. According to Ramsden (2003), this encourages surface learning, rather than deep understanding, because the approach to studying is narrow and minimalist.

There were various reasons put forward by the teacher-participants for adopting this as their preferred teaching method. All the IT teachers couched their practice in very simple language. One of the most apt descriptions of teaching style came from a programming teacher, who said that in the old days, it was called 'chalk and talk'. They explained that the first 15 or 20 minutes would be spent explaining the concept or task to the students, until they "got the drift", and then students would apply those techniques to a series of tasks. Their response was revealing, not only because they were able to articulate their practice better than the others, but because there was an acknowledgement that this was but one way of teaching, amongst other methods:

> Look, all I can say is that's what I have always done, and I'm very comfortable with it. Because we've got the projectors, they can see what's happening, I'll do it on the whiteboard then, we'll put on the projector, and type it into the actual interface. And then I run it and see what happens. So, basically, we're walking them through the whole process. [IT Teacher]

Another teacher agreed lecturing was used "in a big way" in IT classes, but also admitted that they didn't feel that it was very good way of teaching because of their English as a Second Language (ESL) training. His suggestion was "you have to involve students and lots of group work" and confessed they were also in the process of re-thinking their strategy: They stated:

> Traditionally, we in IT don't tend to be very good teachers. In IT, you tend to be much more focused on coming to terms with new technology, and really, perhaps explaining how technology works or ways of thinking, but not necessarily the teaching process. [IT Teacher]

As many of these veteran teachers rarely referenced educational theories during their interviews, an interesting conundrum is raised. Many, if not all, teacher training courses emphasise the importance of studying theoretical frameworks which are perceived to enhance teaching practice, and this case study demonstrates that one's practice can still be successful, as evidenced by the student surveys, despite it not being informed by theoretical frameworks.

Teacher Talk

Generally, most of the dialogue in the IT class was dominated by the teacher – 'teacher talk'. That is, teachers were observed delivering information, giving instructions or leading discussions. In one instance, an introduction to XML scripting by an IT teacher took about 25 minutes, with little opportunity for students to ask questions or interject as there were no pauses. One of the student noted in the questionnaire that although "xml was good and fun to learn, there was no room for questions".

IT 'teacher talk' was often characterised by the drilling of facts, and repetition of content, with many 'closed' questions that did not encourage more explorative or scaffolded dialogue. There were many questions that required the correct answer or those that just solicited a 'yes' or 'no' response. Questions were usually designed to test the ability of students to recall and repeat information. Often, IT teachers posed a series of questions in a row, and did not provide a pause, or enough time in which students could answer them. Fisher (2007) asserts that the quality of responses are enhanced, if students are given time in which to think, while Alexander (2006) maintains that these type of questions are representative of a subject-centred approach, contain answers already known by the teacher and are examples of lower, rather than higher cognitive engagement and interaction.

There were very few 'genuine' class discussions witnessed; where there were free and open exchanges of opinion on a range of issues such as one would find in humanities classrooms. When more open questions

using 'how' were used, the answer range was very narrow. For example, students were usually asked questions such as, "How are we going?", "What else might we ask?", or "How well have we understood variables?". Open questions would normally invite a wide range of responses, however, these do not because the choices in answers are very limited. Alexander (2005) described these types of questions as " pseudo-inquiry".   In addition, many of the student responses were short and very brief and when they did ask a questions, it was very direct and to the point. Although, student responses to class discussions were very positive,with some students commenting that " we can interact with each other", " exchange ideas", and " we had an interesting discussion", there was an overall reticence or reluctance to participate in class discussions. The interactions in the IT class support the research conducted by Smith et al (2004) that found that in many classrooms, student answers averaged five seconds, and usually contained three words or less about 70% of the time.

Therefore, when analysing 'teacher talk' in the IT Classroom, it can be seen that rote and recitation play an important role, and class discussions were used in a very limited way and were very much teacher directed.

Computer Room Layout

One reason why IT teachers may have adopted a very didactic or teacher-centred approach may have been due to the layout of the computer labs and classrooms, or 'learning spaces'. This section examines the range of computer labs used in the metropolitan educational institutions, and discusses them in relation to the interplay between pedagogy and space.

All of the classes observed as part of this study were timetabled in dedicated computer laboratories. The majority of these were very traditional in design, with the teacher located behind a workstation at the front of the room, with a whiteboard and/or screen behind them. The following photos are a representative sample from the study of the typical computer room layout found in most educational institutions and schools:

Photograph 2: Examples of Computer Laboratory Layout

| **Lab A** | **Lab B** | **Lab C** |

The students were positioned in vertical rows (Lab A + Lab B) around the perimeter, and in centre aisle/s depending on the particular room dimensions encouraging a lecture style delivery. There was one computer lab (Lab C) in which students were seated in horizontal row. Interestingly enough, when one of the IT teachers asked students to conduct an audit as part of their assessment for the Occupational Health and Safety (OH&S) component of the Training Package, they concluded that the lab with the vertical rows had the preferred layout: "They all point to the fact that there's only one lab in this joint which is functional because all the computers face the board and students don't have to crane their necks." (IT Teacher) It was quite common to find access to data show projectors, many of which were either installed in the lab or available for loan on trolleys and readily connected.

One might assume that these traditional lab layouts would work well for the Stand and Deliver style of teaching which they seem to promote. In fact, they perform this function very poorly as teachers' faces were often obscured by the computer monitor, the rooms were dark and many students who are seated with their backs to the screen have to constantly swivel around. Often the lights in the computer labs were switched off (Lab D) to accommodate the data show projector and it was usually dark. The teacher's faces are sometimes obscured by the computer monitor (Lab E + Lab F) when they are demonstrating or explaining instructions:
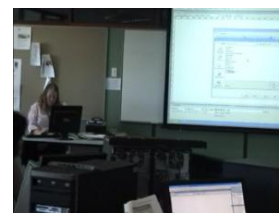
Photograph 3 : Problems with Computer Room Layout

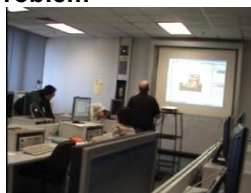

| **Lab D** | **Lab E** | **Lab F** |

One teacher had their back to the class during their demonstration because the data show was not connected to a computer or a laptop:

Photograph 4: Data show Projector Problem

Sometimes the voices of the IT teachers were not able to be heard from the back of the room, and students had to swivel around to see if they were seated with the backs to the front of the room. Therefore, the design and layouts of the computer labs used by teachers and students are not ideal, with one IT teacher commenting wryly that "probably non-practitioners designed them". Indeed, there are certain authors (Brown, 2005; Wedge & Kearns, 2005) who agree with this assertion, and recommend that pedagogical considerations should be a priority because of the potential to improve teaching and learning practice. As Jamieson et al (2007, p. 25) state: "For this reason, the process must be driven by the educational vision and the requirements of the educators."

During observation visits to a number of educational institutes, there was only one computer room that did not conform to the traditional layouts described previously. The PCs were organised in clusters of four on round tables spread around a very spacious room. Other institutions may have had layouts similar to this, but they were not seen or referenced in interviews during the course of this investigation:

Photograph 5 : Cluster Layout in Computer Lab


**Cluster Layout A**   **Cluster Layout B**

This photo (Cluster Layout A) shows where the computers are placed on a round table without students. There seems to be ample room to encourage discussion and group work, however, the height of the CPU and monitor would make discussions difficult. The other photo (Cluster Layout B) shows the computer room during a class. The spots most commonly chosen by students were, invariably, those which had a direct view of the teacher and the screen. Sitting positions such as the one in the foreground of the photo (above right) where the student faced the back of the room, were positions usually chosen last, because those students who had their backs to the teacher were required to swivel around to see the front of the room.

This type of learning space was designed so that students could work on projects collaboratively, that is, the placement of the computers in a circle around circular tables would encourage discussion and group work. However, the two classes observed within this space provided no evidence of this approach:

Photograph 6 : Use of Collaborative Learning Space by IT Teachers
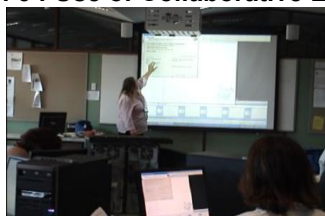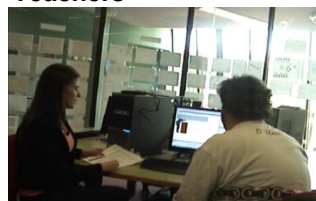
Example A   **Example B**

One class was a 'stand and deliver' on how to use Ms Moviemaker with the teacher at the front demonstrating (Example A) and students were working on their own movie clip individually. Although pairs of students were

observed offering assistance to each other when they had problems, it was a class, not a group activity. The other user of this learning space was an IT teacher (Example B) providing feedback on individual assessment. Students were not working on group assignments, and as the assignments were all different, little collaboration was seen to be encouraged. Therefore, it could be seen that the layout of the learning space was not used as it was originally intended. This learning space, where computers were arranged in groups on round tables, encouraged a collaborative, constructivist approach, at odds with the way in which the IT teachers used the room. This is an example of the change in mindset required of practitioners mentioned by Trowler et al. in their study (2003). In short, the pedagogy of the learning space was different to the pedagogy of the teacher using the computer room.

Changing Learning Spaces to Suit Teacher Pedagogy

There were only two teacher-participants who sought out learning spaces other than those in which their classes were timetabled. These actions drew attention to the relationship between learning space and pedagogy. In this section, there will be an examination and discussion of their reasons, and how this contributes to current debates on learning spaces and pedagogy.

One TAFE IT teacher moved a class from a computer room into a normal classroom for a limited period. Students had a bound copy of the notes, and read them as the teacher went through them using the electronic copy that was projected onto the wall. The classroom layout was very traditional. The desks were organised in a series of rows facing the front of the room (View A) and the teacher was situated at the front with a whiteboard behind them (View B) and with a portable data show projector connected to a lap top.

Photograph 7 : Example A of Teacher Changing Room to Suit Pedagogy
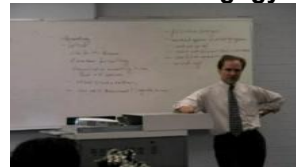
View A	**View B**

Again, the teaching practice was very didactic, very much the Stand and Deliver' type with closed questions that were designed to see if students understood the content. The main reason the IT teacher moved students into a classroom, was because he was concerned that if they were in a computer room, students would not be as attentive:

> I find that students tend to get distracted by computers. If you are up the front, trying to deliver, they are on the internet and playing games. They do get distracted with the computer. They will be doing work on the computer and, generally, they might have an assignment due and therefore tune-out of the current class and focus on work that is mark based. Sometimes a theory room is better, although there are timetabling limitations.   (IT Teacher)

Furthermore, it is important to note some of the problems with the layout of this room. If students wanted to look at the power point presentation, they needed to look at right angles to the whiteboard. The photo (below left) shows how the angle made it visually difficult for the students, because they could look either at the teacher, or the screen, but not both. It was also very difficult for the teacher who had to flick between the class and the wall (below right)

Photograph 8 : Placement of Data Show Projector

There were several supporting columns within the room that were positioned in spots that made it awkward for students to see the teacher and the electronic display easily. Therefore, when teachers seek rooms better suited to the pedagogy of the lesson, the choice is usually limited to rooms that have problems, and that is probably the reason why they are available.

Another IT teacher organized for two of their lessons to be timetabled out of the lab. They wanted to have a

class discussion, and felt that the computer room was not appropriate. They detail their concerns in the following interview extract:

> The layout of that room sucks air. Well you've got students with their back to the board and they have to turn around to watch the instructor. This is not good, because they should all be facing the front. (IT Teacher)

The choice was limited because the TAFE institution did not provide discussion rooms; they either provided standard classrooms or computer labs. Two rooms were found; one was a former staff lounge, while the other was the student lounge:

Photograph 9 : Example B of Changing Rooms to Suit Pedagogy

| Former Staff Lounge | Student Lounge A | Student Lounge B |

While the former staff lounge (above, right) was small, it contained a number of comfortable chairs as well as a whiteboard. The awkward shape was not ideal, but students were able to see each other. The IT teacher discussed the assessment for the course and the major part of the class was dedicated to students talking about their projects and exploring suitable options: This type of discussion would not have been able to take place as effectively in a lab because students would be physically separated by hardware components such as monitors and CPU cases. It is interesting to note that students seated themselves together with a clear space at the front (foreground of photo) for the teacher to sit and write on the whiteboard. On another occasion, the only room available for a class discussion was the student lounge. As evidenced in the photo (Student Lounge A) the area was very spacious, but lacked privacy because it also functioned as a walkway from which classrooms and computer labs were accessed. Again, students were seated in a semi-circle (Student Lounge B) with a whiteboard at the front. Therefore, there were not many alternative learning spaces if a teacher did not want to use a computer lab, and finding alternatives added an extra layer of complexity to their teaching preparation.

These two examples demonstrate there were limited choices for IT Teachers if they wished to include class discussion and group work within the standard layout of PC labs and classrooms, because they are inflexible learning spaces and not suitable for collaborative activities. Several regular classes were moved from their timetabled rooms to other learning spaces to better suit the pedagogy of the lesson, and this demonstrates the importance of layout and how it is directly linked to the successful delivery of certain types of activities. One may even go so far as to suggest that if an IT Teacher were timetabled into classrooms and labs previously described, it would be difficult to break out from a Stand and Deliver pedagogy, to include more inclusive strategies. Furthermore, it can be seen that even when students are in a learning space which can be configured in a variety of ways, furniture is arranged in a very traditional manner, with the teacher at the front. The layout of the space trains students as well as teachers.

Some Key Findings

Perhaps, at this stage, after examining the way in which IT teachers used a variety of different rooms and labs, some pertinent remarks could be made:

- One cannot underestimate the way in which the mindset or particular educational philosophy of the practitioner dictates how classrooms and computer labs are adapted for teaching.
- When IT teachers are timetabled into computer labs that are intended for collaborative work, professional development of staff needs to be conducted to teach them how to use them as they were intended to be used. It cannot be assumed that teachers would instinctively know how to use those spaces accommodate them within their existing pedagogy.
- IT teachers should be allowed to have a choice in the selection the computer rooms so that they are able to choose a layout that best suits their pedagogy, and is appropriate to the lesson or subject they are teaching.
- For the cluster layout to work more effectively, the computer hardware – monitors and cases – should be placed in such a way that their height does not obscure the faces or muffle the voices of the students who sit on the other side of the table, as this may make it difficult to hold group discussions. Also rather than having the teacher placed in the front of the room, they should be positioned in the middle to better reflect the collaborative nature of the room layout.

Conclusion

The 'learning spaces' in this investigation were in complete contrast to some of those showcased by universities here in Australia (QUT, Melbourne University and USQ) and abroad (Harvard, MIT and Stanford), with their flexible lecture theatres and computer labs designed for collaborative and constructivist teaching and learning approaches. Almost all of the labs were designed in a very traditional way. There was little flexibility to move computers or desks to allow for group work, class discussion or project collaboration. This in itself promotes a Stand and Deliver teaching practice and offers very little flexibility in the type/s of teaching and learning that takes place. It makes it difficult for IT teachers to engage with students in more pedagogically meaningful ways. This is in line with the findings from Jamieson et al (2007) that few give serious thought to the impact of the physical environment on the quality of the student learning experience, or how it influences teaching approaches.

It is my contention that the layout of the computer lab per se imposes a style of pedagogy on the teacher, because it encourages a certain type of teaching behaviour, a didactic style that may run contrary to constructivist or student-centred principles. That is, if one teaches IT the expectation is that the computer lab would be in a traditional manner which in turn promotes and supports a 'lecture style' approach. One key issue here was whether IT teachers are aware of this when they planned their lessons. From the evidence, it seems clear that most of the IT teachers who taught within these learning spaces have consciously accepted that this is the way it is and it never really occurred to the majority of them to question the status quo, apart from two IT teachers. It also raises the issue of whether this didactic teaching style may have become embedded in IT pedagogical practice, so that it is broadly accepted as the preferred teaching mode for IT. In an interview, one of the teachers intimated that this may indeed be the case:

> Students expect a step by step approach when IT teachers are teaching software Yes, that's fine in application processes when you learn PHP, Java or Visual Basic you need to have step by step. This is how you set up a database or this is how you create a shopping cart, and this is the code that you need. You know, that's step-by-step that needs to happen. [IT Teacher]

Attention seems to have shifted from formal, timetabled teaching spaces to informal, personal spaces before addressing these important pedagogical issues and 'getting them right'.

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