Paper 5:

# Physical Universities Can Apply Virtual Technologies too: The Use of Networked Technologies to Support Collaborative Learning

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## Introduction

- There has been an extensive use of networked technologies to support learning by post-graduates, particularly MBA students (Wheeler and Krapfel, 1996). There appears by contrast to have been relatively less application of such technologies to support undergraduate students. This paper reports on the application of an innovative computer supported collaborative learning methodology in parallel in two universities. It draws on this empirical work to examine the implications at institutional level for a greater use of such networked technologies that have also been strongly advocated for use by 'virtual universities'.

## Physical versus virtual universities

- Although the title of this paper is posed somewhat confrontationally between two apparent polar extremes of higher education delivery environments, in reality there is a spectrum of interim positions. Many distance learning courses are in fact provided by institutions who also have substantial interests in face-to-face teaching. And even distance learning courses may well have elements of face-to-face learning built in whether via tutorials or summer school, for example. The term 'physical university' as coined here is therefore often already an amalgam of both face-to-face and distance learning methods, even though there is likely to be a dominance of the former. So too in reverse for the 'virtual university', an organisation that specialises in distance higher education. These can take various forms, but many are visibly physical in terms of their own buildings and infrastructure even if these are not the locations for most students to visit.

  Contrasting physical and virtual universities assists, however in considering them as competitors and in reviewing the IT implications of that competition. For this purpose, we draw on McFarlan's (1984) grid as in Figure 1. This was developed for strategic positioning of computer applications. Our particular interest is positioning networked technologies within the physical university. Networked technologies are frequently currently seen as a 'factory' application - a basic piece of the IT infrastructure, or perhaps merely as a 'support' function. What we are reviewing below is the extent to which they could be seen as 'turnround' applications, serving as the basis for future strategic systems.

**Strategic Impact of Existing Operating Systems**

| Strategic Impact of Application Development Portfolio | High | Low |
|---|---|---|
| High | **Strategic** Applications which are critical for future success | **Turnaround** Applications which may be of future strategic importance |
| Low | **Factory** Applications which are critical to sustaining existing business | **Support** Applications which improve management & performance but not critical to the business |

Figure: 1

## Authors' assumptions

- It may be appropriate early on to articulate the authors' key assumptions and personal beliefs. The first is that both physical and virtual universities are essential to UK higher education in the twenty first century. We believe that overall the distance and open learning dimensions are still relatively under-valued and under-resourced, and that face-to-face education can be enriched by use of methods originally devised for distance and open learning. However, we do see limits to the deployment of distance learning methods. Our overall view is that even though UK physical universities have been admittedly slow to adapt to date, this adaptation could accelerate shortly. Potentially the physical university could by adapting provide an excellent location to take advantage of the very networking and other technologies that are believed by some in physical universities to be currently threatening their very existence when deployed by virtual universities. Our paper examines in particular one of the key barriers to such adaptation.

## Critiques of the physical university - an assessment

- The protagonists of the virtual university paint optimistic pictures of physical institutions being largely replaced by virtual ones. Some develop sophisticated arguments based on extensive experiences (Daniel, 1996). Other are more apocalyptic in tone e.g. Ferguson (1998):

> 'In 50 years, people will probably look back on all this with amazement. Why, students will ask, did our grandparents put up with cramped and dingy halls of residence and depleted libraries when they could have stayed at home and achieved nearly all of their academic objectives by electronic communication?
>
> It is a question we ought to be asking now. There is not much I do for my students that could not be done just as easily using the internet - not to mention older technologies such as the telephone, audio cassettes, video tapes and video-conferencing. I might even do the job better if I did not have to waste time on committees devoted to maintaining college buildings and non-academic facilities.'

Some extracts from Hutchison (1996) similarly illustrate the most evangelical dimensions of such optimism:

> 'Creating online resources for the normal curricula will 'in the long run turn out to be a dead end ... a minor monument to institutional timidity.'
>
> 'Traditional universities will become CLRC public points of presence providing community access to the open learning environments' ... 'access centres for costly research facilities' and ... 'courseware developers'.

There are inevitable weaknesses in any form of educational evangelism, including that which can equally only conceive of traditional face to face learning systems as valid. Before going on to examine teaching and learning technologies, there are several generic responses to those such as Hutchison who criticise the traditional physical university:

### 1. Diversity of learning and personal styles

As Pask (1975) and others have shown, learners tend to have diverse learning styles, e.g. from serialist to holistic. These learning styles each have corresponding appropriate learning methods. More general personal characteristics also play a part, for example, distance learning is well suited to mature and well-organised learners. It could be expected that even if only due to a diversity of learning styles, higher education will continue to have a variety of delivery channels, rather than the replacement of one by another.

### 2. Diversity of learning objectives

At undergraduate level, in particular, there are wider objectives than the course syllabus. Socialisation objectives of various sorts are at the very least implicit, as well as a range of inter-personal skills. Some of these are very difficult to support virtually, at least at present.

### 3. Practicality of learning environments

Not all learners are willing or able to participate in any given learning environment, even when it suits their personal learning style. Much of the growth of higher education distance learning has undoubtedly arisen from inflexibilities of many kinds by traditional universities. It has also arisen because individual students are not able, physically or financially, to attend face-to-face courses. Equally there will be a significant cohort of students for whom distance learning will not be desirable or practical.

4. Current diversity of delivery methods

The evangelistic critics of the traditional university often concentrate on the lecture as the object of greatest derision. But despite its dominance in many face-to-face courses, it is only one of the face-to-face learning approaches used. The physical university already uses a wide variety of delivery methods, often interchangeably and informally. It has the potential for versatility in switching between these, especially at very short notice. The physical university also has advantages over remote delivery in that it will almost always allow for concentration of high-value equipment and facilities, which are not likely in the foreseeable future to be economic for distance learners.

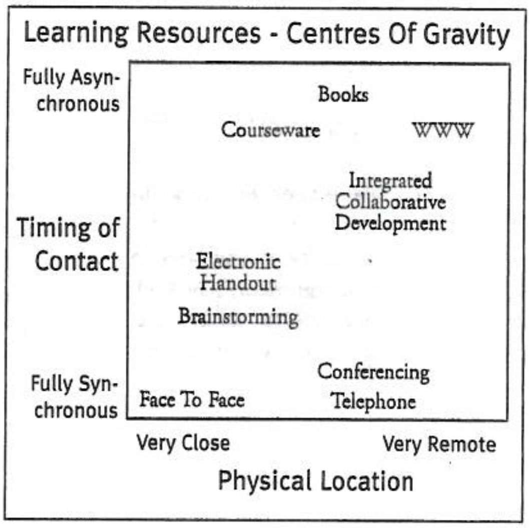


Figure: 2

## Computers in teaching and learning

- We have developed a framework within our research programme which illustrates the scope for deployment of electronic technology in business education. This framework (Holtham, 1996) also has been accompanied by parallel work outside the educational field (Klimis in Wallis & Choi, 1996). The framework was explicitly developed to allow positioning of a wide variety of traditional and electronic media (Figure 1). On the horizontal access is the remoteness of the student from either the data or the human. On the vertical axis is the timescale in which responses are required or expected.

In terms of learning resources, the centre of gravity of physical universities has tended to be in the South West quadrant, with some use of the North West. The centre of gravity of virtual universities has tended to be across the two Eastern quadrants in particular.

We have already argued above that, as a result of their preferred learning styles in particular, there will continue to be a need by many students for the 'instant' experience represented by a face to face class or lecture. However, given the availability of new and even stimulating information transmission media, students may well have more specific and higher quality expectations from the face to face experience than at present.

The most attractive strategy for many educators in physical universities will be to achieve a breadth of resources right across Figure 2. This means that a variety of student learning styles can be catered for. It makes for alternative possible media for reaching the same educational goal. It also makes for the stimulation (for most learners, anyway) that comes from a variety of educational approaches.

## Empirical work: educational context

- The two exercises involved firstly undergraduate computing students at a new university, and secondly business studies undergraduates at a more traditional university. For convenience we have given the two groups the acronyms CS and BS respectively. The methodology involved students firstly carrying out individual research and analysis, which was then published to small groups of students. In the second stage, students were required to discuss their individual work in two phases of asynchronous groups, and reach collective agreement on answers to a number of questions. Figure 3 outlines the structuring of the collaborative exer-

| | CS | BS |
|---|---|---|
| Total students | 34 | 90 |
| Number of groups | 4 | 9 |
| Individual Study Topic | Groupware product merits | Business IT exploitation |
| Case Input | Relatively unstructured | Highly structured |
| Max Comments of a group | 129 | 129 |
| Min Comments of a group | 65 | 45 |

Table 1: Basic dimensions

cises. All such work was assessed wholly individually. Table 1 summarises the basic dimensions of the groups and their work.

## Co-operative Learning

- There is an extensive body of theory on co-operative learning, much of it developed in primary and secondary educational research, though still largely relevant to tertiary education (Sharan, 1990). The subset of Computer Supported Collaborative Learning (CSCL) has developed more particularly in higher education, not least as networked technology has become widely available (McConnell, 1994; O'Malley, 1995). Much of the historic evolution of CSCL has been rooted in the needs of distance education (Mason and Kaye, 1989).

The underlying principle of both the CS and BS work was that students can benefit from systematic and structured sharing of their own work with colleagues, and that the process of collaborative learning can increase the quality of learning by the student. There were two other dimensions to the exercises. Firstly, there was an explicit requirement to prepare face-to-face students for work in virtual teams, hence the use of asynchronous network technology. Secondly, in both cases there was a requirement (greater for CS students) for direct exposure to the mechanics of groupware technologies.

## Learning

- For the BS students, in the most effective teams, learning appeared to be greatly enhanced due to peer collaboration. In the least effective teams behaviour which would be invisible to the course leader in face to face meetings became all too visible: two teams had particular problems both on time management and on getting adequate levels of input at the right time. In these cases it was left to a small sub-group to ensure anything at all appeared on time. The CS students learned considerably more about groupware via its live use in peer

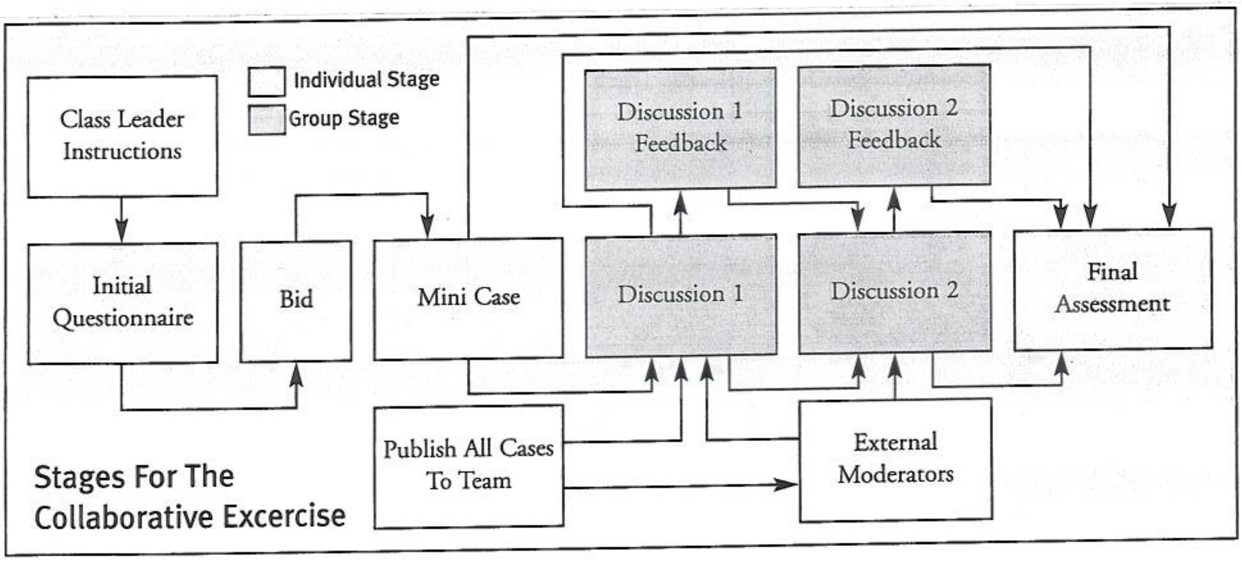


Figure: 3

collaboration. There was relatively less interaction concerning the actual content. Yet, both CS and BS students felt even if sometimes painful, the experience was overall worthwhile.

A major benefit to the lecturer of asynchronous course work is that the contributions being assessed are all physically visible. As a result group work can be marked on a wholly individual basis. There was nothing to prevent students discussing matters face-to-face, and it was clear that the most effective groups were also actively using both e-mail and sometimes face to face meetings, but there could be no marks allocated for such discussions.

## Practical problems

- The single most significant problem was the amount of time required by academic staff. Our assessment is that the total input on these two exercises is in the order of five to ten times more for staff than for equivalent 'manual' coursework. Even allowing for the learning curve for staff in the first year of operation, this is still a significant barrier to the routine adoption of this type of technology.

There are also time overheads to the students. They have learning curves both in relation to acquiring basic technical skills, and then in learning how to exploit a new medium of communications. Specific problems faced at both universities included problems with PC's and network downtime, and this induced a level of frustration in students. For the BS students the coursework was in the last third of the term, at the point when university PC laboratories generally were fully occupied continuously. It also has to be said that for a minority of students who habitually tend to hand in material at or near deadlines, the time management and tight weekly or even more frequent deadlines ran counter to their customary working style.

Some students were relatively disillusioned, primarily due to

- insufficient training in the processes of virtual working
- need for more training in the actual software
- the technical problems
- computer access problems

Obviously, aspects of these can be, and have been, overcome in subsequent asynchronous exercises, particularly the training aspects. It is however noteworthy, that the pressures of the undergraduate timetable, and especially the near capacity use of existing rooms, meant that were not able to achieve in practice the versatility alluded to above.

There were then technical and access problems. The access problems were much greater for the BS students - the CS students had available dedicated laboratory facilities. We want now to focus in this particular problem.

## Re-thinking the computer laboratory in the face of competition

- All physical universities face growing problems of access to computer facilities. The historic rationale for providing these was that computers were expensive, and it was therefore economic and physically necessary to provide student workstations. The Dearing Committee (1997) rightly pointed out the inevitability of moving to students providing their own PC's over the next decade. This then leaves an important issue over the rationale for current computer laboratory facilities. It was clear from this intensive use of networked facilities that students were competing for seats with students carrying out work that did not require such facilities e.g. basic personal computing, or making less intensive network use e.g. e-mail. Asynchronous collaboration and web access, by contrast demanded more intensive use. Returning to the McFarlan grid in Figure 1, laboratories are perceived as 'factory' facilities - essential but not a direct source of advantage. Under the logic emerging through the work presented here, the laboratories could firstly be conceived only as 'support' e.g. for any residual group of students without their own facilities, who might be expected to use them on a standby basis or at unpopular hours.

But then the major role of the laboratories would shift right out of the 'factory' dimension, instead to provide initially 'turnround' and subsequently 'strategic' facilities. Examples of the facilities that are not likely to be available economically to distance learning students mostly centre around high bandwidth communications applications e.g. gigabit networks, commercial standard video-conferencing, as well as specialised facilities, particularly involving multimedia.

The laboratories also need to be reconceived in physical form to take advantage of being in a physical university e.g. to become electronic classrooms, or electronic group discussion areas, not laboratories as such. This enables the electronic media to be fully integrated into the face to face experience, including use of both synchronous and asynchronous networking software.

Faced with competitive pressures from virtual universities, physical ones need particularly to catalyse the combination of face to face and electronic methods. This will require some difficult priorities, which run counter to many conventional practices relating to the on-campus provision of computer facilities for students. It will also require re-design of some of the physical estate to enable richer electronically supported learning environments which are not simply aircraft hangars full of single-user PC's, but rather allow flexible combinations of face-to-face and computer facilities.

## Conclusion

- The overall conclusion was that students' learning has generally been both deeper and broader, but that the effort required by academic staff to achieve this was extremely high. In current discussions on the use of IT to support undergraduate study, both the technical and workload implications of computer-intensive approaches appear not to attract as much attention as the undoubted academic benefits.

The application of networked technology was wholly geared to use with face-to-face students. It has been argued here that there is considerable scope for networked-based learning in conventional higher education environments. Physically based universities are likely to have superior networking facilities to virtual universities for at least a decade, and this type of approach appears to offer a promising response for physical universities to competition from new providers and distance methods in higher education. But for physical universities to rise to the challenges posed thorough effective use of IT by distance learning universities, they will need to re-think not only their computing policies, but also in particular the relationship between physical learning spaces and those policies, necessary to achieve the key objective of versatility.

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