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# **Learning spaces for the 21<sup>st</sup> century**

## A review of the literature

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***“By day, a lifted study-storehouse; night  
Converts it to a flattened cube of light.  
Whichever’s shown, the symbol is the same:  
Knowledge; a University; a name.”***

Philip Larkin, 1983, on the University of Hull’s Brynmor Jones Library, from *Collected Poems* (1988).

**Acknowledgements**

I acknowledge with gratitude the assistance provided in the preparation of this study by the project steering group, consisting of Professor Sir David Watson and Professor Ronald Barnett from the Institute of Education, and Ms Elaine Payne from the Higher Education Academy.

Ms Ourania Filippakou undertook most of the work in compiling the bibliographic database and also contributed significantly to the preparation of the report: I am most grateful for her careful work and thoughtful comments.

The first version of this review was submitted to the Academy in March 2007. This is the revised version, taking into account comments made in the peer review process and benefiting from discussion with the teams working on the three parallel literature reviews on behalf of the Academy. I gratefully acknowledge all these contributions.

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July 2007

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## Executive summary

- 1 The aim of this review is to inform the future design of learning spaces, in order to facilitate the changing pedagogical practices needed to support a mass higher education system with its greater student diversity.
- 2 The interactions between higher education's built environment and the activities of teaching and learning, and research, taking place within and around it are not well understood. Where connections between the environment and educational activities are made, the basis for doing so tends to be casual observation and anecdote, rather than firm evidence.
- 3 Space issues in higher education have usually been considered *either* in the context of space planning (the aim of which is to provide appropriate amounts of space for defined uses, and to maximise its use once provided) *or* as part of campus planning and building design. There is only a limited literature that aims to relate space issues to teaching and learning, or to research, in higher education. In the schools sector, however, there is a more extensive literature relating space design to learning in schools, reflecting debates that have developed over the last half-century or more.
- 4 This review occupies, conceptually, the territory between abstract theorising about space issues and technical questions related to building design and construction. The literatures on which it focuses are concerned with: the use of space in teaching and learning, and research; related space design issues; campus design, insofar as it relates to learning; and organisational and managerial issues relating to space and learning.

- 5 University space may be thought of as: the campus; the university in the city; a community; individual buildings; spaces intended for teaching and learning; and other spaces.
- 6 Some large claims are made for campus design as physically embodying the university's mission to knowledge and society. There are rare instances of university architecture providing space that is both functional and may offer inspiration to learners and their teachers. However, most university buildings do not possess these qualities, and the vast bulk of the higher education estate consists of a legacy of buildings of varying designs and qualities.
- 7 While treating these claims that buildings may embody a mission with caution, there is a broad acceptance in the literature that the design of the "the learning landscape", around the campus and within buildings, can help to create a sense of belonging, as well as facilitating peer-group discussion and thus informal learning. These social features of higher education appear to be bound up with student retention and progression in complex ways. Many of the physical features, inside and outside buildings, which are thought to support these benefits are small-scale and low-cost. *Clear technical recommendations are needed on the best ways of providing such features in different university settings.*
- 8 A related matter is community-building at the university, which is believed to support students' learning in various subtle ways. It is suggested that community-building can be helped by, for example, governance and management arrangements that involve students effectively, provision of social spaces (neither work nor living spaces) and residential accommodation of kinds appropriate to differing student needs. *Further research is needed on the uses of social spaces and how they may be most effectively provided.*

- 9 We need a better understanding of the role of space in the dynamics of creating more productive higher education communities (potentially involving considerations of institutional academic and managerial organisation and their part in social capital formation, as well as space design and maintenance issues), and its connections with learning and research. *This should be the subject of further research.*
- 10 Well-maintained and cared-for premises appear to provide benefits of psychological security and support feelings of belonging, and thus commitment to learning. Good environmental conditions - temperature, humidity, noise control and lighting - are also prerequisites for learning. *This apparent connection between day-to-day maintenance and learning should be a concern of institutional managements.*
- 11 Building designs and internal layouts – in general teaching, specialist and administrative areas – that are sensitive to the work-patterns of their users seem likely to produce better outcomes for both learning, and staff and student satisfaction. Although the literature draws attention to the need to respond in design terms to the development of student-centred teaching, few concrete proposals are put forward. The design approaches seen in new learning resource centres are the most obvious responses, where student group work is encouraged in an ICT-rich environment. The creation of more flexible teaching and learning spaces, capable of being laid-out in different ways, and better micro-design (for example, of seating and other furniture) are further examples of responses to new pedagogic requirements. Impressive new buildings are, on their own, no guarantee that improved learning will be achieved; although they may be useful in marketing terms, by helping to brand the institution.
- 12 A substantial proportion of the literature on higher (and other) education space issues makes unsupported, or at best, anecdotal claims about the benefits of new designs or new configurations of existing space. Where they are presented, empirical findings are often

flawed, as they either tend to report changed student attitudes (rather than learning outcomes), or, where learning outcomes are reported, they fail to take account of observer effects of various kinds. The difficulties in designing research that can distinguish inputs to learning from the physical environment from inputs arising from other sources are formidable, and do not appear so far to have been seriously addressed. *A methodological study should be carried out to consider how the effects of space on learning might be rigorously evaluated.*

- 13 Newly-designed learning spaces are usually described in positive terms in the literature, as encouraging informal student and student-staff contacts, therefore supporting social cohesion and thus (it is assumed) learning. These accounts usually fail to describe the impact on academic staff time (as ready student access to teaching staff is assumed), or to assess the costs with regard to floor space utilisation. No rigorous evaluations have been found of the improved learning said to result from facilities of these types. Efforts should be made to *conduct evaluations that provide guidance as to the learning benefits, and associated financial and other costs, of new-style learning spaces.*
- 14 Technological change is said to be affecting the nature of learning itself, as well as the ways in which it takes place. The implications for the design of learning spaces seem to be minor, however: flexibility in space design should be the priority. The rapid (and unanticipated) growth over the past few years in the use of wireless-enabled laptops using broadband networks has meant that the need for specialist ICT spaces is probably declining. Further technological change will be equally unpredictable. *“Future-proofing” in space design terms can best be achieved by providing comfortable, welcoming spaces which can be used in a variety of ways and adapted to new uses at reasonable cost.*
- 15 Surveys of student satisfaction in higher education internationally show a clear pattern of space issues scoring low as student concerns: course content, teacher availability, workload and similar matters show

up as the most pressing student concerns. It is staff members who tend to express concern about physical facilities. The literature throws almost no light on managerial decision-making about space issues affecting students or staff: *this is a topic where further work would be useful.*

- 16 Space, learning and the effectiveness of the university more widely, are intimately connected. Untangling them completely is perhaps impossible, as well as unprofitable. Nevertheless, greater sensitivity to their interactions should be worthwhile: relatively small improvements in space design are likely to be amply rewarded in learning and other institutional benefits.

### **Key recommendations in summary**

- Clear technical recommendations are needed on the best ways of improving “the learning landscape” in different university settings.
- Further research is needed on the uses of social spaces in supporting learning, and how they may be most effectively provided.
- The role that space plays in the dynamics of creating productive higher education communities is not well understood, and needs further study.
- The apparent connection between day-to-day buildings maintenance and learning should be drawn to the attention of institutional managements.
- A methodological study should be carried out to consider how the effects of space on learning may be rigorously evaluated.
- Efforts should be made to conduct evaluations that provide guidance as to the learning benefits, and the financial and other costs, of new-style learning spaces.
- “Future-proofing” in space design terms can best be achieved by providing comfortable, welcoming spaces that can be used in a variety of ways and adapted to new uses at reasonable cost.

- Little is known about managerial decision-making about space issues: further research is needed here.

## **1 Introduction**

### **1.1 Aims and objectives of the review**

This review was agreed for funding by the Higher Education Academy in July 2006. The aim of the review is to inform the future design of learning spaces, in order to facilitate the changing pedagogical practices needed to support a mass higher education system with its greater student diversity. It was anticipated by the Academy that issues arising might include the implications for learning space of changing student demands, new pedagogies and technological advances. The design of learning spaces in other educational sectors and in other countries should be considered, and criteria identified to inform the design of learning spaces in the future.

In our own thinking about this study during its planning and execution, we saw its particular objectives as being:

- to identify the main types of literature relevant to learning space design, and the main conceptualisations of space issues in these literatures;
- to draw from this work implications for policy and practice in learning space design, its use and management, and related activities;
- to identify areas for further empirical or methodological study.

This study is supported by a bibliographic database of some 500 references, available through the Higher Education Academy

<http://www.heacademy.ac.uk/ourwork/research/litreviews>

### **1.2 Background to the review topic**

The study of learning spaces in higher education has not historically attracted a great deal of attention from scholars or researchers: teaching and learning in higher education has, implicitly, generally been considered as taking place independently of the spaces in which it was located. Perhaps this is not surprising: in Britain and America at least, “an old image of the core activity of the university, coined at Williams College, [is] the image of ‘Mark Hopkins<sup>1</sup> on one end of a log and a student on another.’ All that is really needed for education is a great teacher and a ready student” (Keohane, 2006: 54). Although it did not take thinking much beyond this image, modern consideration of space in British higher education may be thought of as beginning with the Robbins report and its consideration of “methods of teaching” (Committee on Higher Education, 1963: 185). The report began to draw the distinction between teaching and learning (paragraphs 566-73) that underlies much current thinking in this field.

In contrast with the schools sector, where the design of learning spaces has been a continuing preoccupation (see the survey by Clark, 2002), several standard texts on teaching and learning in higher education (for example, Light and Cox, 2001) do not mention the nature of learning spaces, even in passing. From a different perspective, studies aiming at broad coverage of the management areas of higher education may also fail to mention space (as in CHEMS, 1995). The Society for Research into Higher Education’s *Abstracts*, which reports work on higher education from a wide range of journals as well as from research reports and similar publications, lists only five publications that might strictly be considered to be about learning spaces (excluding publications on the university estate in general and on distance learning) since 2000 – although this study reveals this to be an under-reporting. Of the 123 sessions on offer at the Higher Education Academy’s 2007 conference, only one – based on the present study – focused on the physical environment of learning.

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<sup>1</sup> President of Williams College, Massachusetts, 1836-72.

In work that specifically highlights “the learning environment” (as in Lizzio, Wilson and Simons, 2002), the meaning is usually related to the ways in which teaching and learning are conceptualised or organised, rather than to physical arrangements. Consideration of space in higher education has commonly taken place either in the context of space planning, or in the context of campus master-planning and architecture, rather than being seen as a resource to be managed as an integral part of teaching and learning, and research, activities. More recently, the idea of strategic planning of the university estate has emerged, linking decisions about the estate to wider issues of institutional strategy, but here the dominant concerns have been ones of space utilisation and financial effectiveness (Avery, 1994; HEFCE, 2000).

The present study is one indication that this situation is changing: other recent notable indications are, in the UK the report by JISC and the study commissioned by the Scottish Funding Council (JISC, 2006; SFC, 2006), and a recent body of work from the United States, Australia and elsewhere.

This relative neglect of space matters seems not to be unique to higher education: a study of real estate strategy in the corporate sector argues that its significance as an input to the production process has often been neglected by firms, at least in the UK (Weatherhead, 1997: 4).

### *University space planning*

The technical/administrative specialism of university space planning is concerned with determining the appropriate amount of space to be provided for defined academic, administrative and other purposes, and maximising its use once provided, by using various space management techniques (Abramson and Burnap, 2006; SMP, 2006a). In the UK, from the 1960s, a set of figures calculated from time to time on behalf of the University Grants Committee from survey data, showing non-residential floor space requirements per full-time equivalent (FTE) student by subject and level of

study – the so-called “UGC norms” (UGC, 1978) – dominated space planning decisions in universities (Kenny, 1985; SMP, 2006b). These figures effectively determined the size and, to an extent, the design of new buildings in the period of expansion of higher education post-Robbins and beyond. Even when the UGC norms ceased to have official recognition once central funding of capital projects largely ended (and their formal status was only ever that of guidance), they continued to provide university planners with a defensible basis for making judgements on space needs.

The UGC norms offered guidance on total floor space requirements by subject, on the mix of specialist and general teaching areas where this applied, and on space provision for libraries, staff offices and other functions. The norms obviously had to make assumptions about student contact hours, teaching day and term lengths, and other issues where curricula and space issues intersected (space and time being on a continuum, here as elsewhere), but there is no evidence that consideration was given to the effects of space on teaching and learning: the aim was to minimise space provision and to maximise its use.

The day-to-day work of university space planners is about ensuring the efficient use of space within their institutions (Murphy, 1994; Robinson, 1999). As currently the average cost of space in UK higher education – taking into account capital, depreciation, maintenance and operating costs – is nearly £200 per m<sup>2</sup> (SMP, 2006c: 6), achieving the most effective use of this valuable resource must clearly be a key management task in all higher education institutions. However, the straightforward aim of maximising space use quickly runs into conflict with a range of other institutional objectives, notably those to do with teaching and learning, but also with research and the provision of internal and external services. Settling these conflicts is an unglamorous but essential management task throughout higher education. This aspect of space management is certainly related to teaching and learning, in that priorities are set, explicitly or implicitly, for certain teaching and learning uses as against others, regarding the type of space provided, its location and the time when it is made available (if it is made available at all).

There is, however, little evidence that such decisions are usually informed by an understanding of the relationships between space and the teaching and learning that will go on within it (Barnett and Temple, 2006: 11). The micropolitics involved in these allocation processes have received little research attention, although Morley (1999: 94) considers some of the gender issues that may arise in space allocations.

Control of space usage through “space charging” – internal re-charging of space costs to users on a formulaic basis – has developed as another space allocation technique (Downie, 2005). However, the rather limited spread of such techniques within higher education suggests that the costs of operating such re-charging systems do not always produce commensurate benefits (Thompson, 2002), but can “lead to a lot of inter-departmental paperwork” (Murphy, 1994: 57). An outcome of a space charging regime could be that subjects that recruit well occupy space at the expense of less-favoured subjects. Although the balance of space use within institutions obviously changes over time, the literature does not suggest that this is driven to any significant extent by space charging.

### *Campus design and teaching and learning*

The other main arena where consideration of space issues in higher education has taken place has been that of campus master-planning and the design of university individual buildings – where the opportunity arises “to express the mission of [the] university in built form” (Edwards, 2000: 3); or, as an American study puts it, to “communicate an institution’s purpose, presence and domain” (Dober, 1992: 3). However, thinking about spaces specifically to meet teaching and learning needs appears generally to be hidden from view in most accounts of campus design. Edwards argues that 20th-century British campuses reflect a struggle, not between different views about teaching and learning, but between “place making and the expression of rational, technologically pure architecture” (2000: 37) – the 1960s campuses of Sussex

and York Universities being presented as examples of the former and latter tendencies respectively.

Whatever the strength of this distinction, it is the case that York's first development plan examined the issue of teaching space from a space planner's perspective – almost entirely regarding the *amount* of space needed to meet the requirements of the proposed curriculum, with one short paragraph describing the actual *types* of space to be provided (University of York, 1962: 34) – and this despite there being a clear educational goal underlying the University's planning. At Sussex, an account by Asa Briggs, one of the University's founders and its second Vice-Chancellor (1967-76), of the new “map of learning” that was to provide the basis for the University's academic structure, does not mention space at all (Briggs, 1986). These accounts, however, are of planning for what would now be considered elite institutions, and perhaps a similar approach would be taken today in the design of equally academically exclusive institutions.

A critical analysis of American campus design (Whisnant, 1971) comes closer to asking questions about how the spatial organisation of the campus affects learning, arguing provocatively that campuses are, in effect, designed to exacerbate “division, tension, alienation and strife” – although these comments relate mainly to inter-departmental rivalries. While Whisnant (radically, for the time) advocates giving students greater autonomy in organising their learning, his proposals for physical changes to improve learning centre on breaking down barriers between the campus and the “uncampus” outside, and mixing teaching, research, administrative and social spaces within it to create a better sense of community.

This mixing and community-building was, in fact, one of the objectives in the planning of several of the UK's 1960s universities. Ideas about teaching and learning were, contrary to Edwards's view, central to this planning. The master-plans of both the Universities of York and Kent, for example, were based on assumptions (not obviously supported by any evidence, incidentally) about teaching and learning being enhanced by staff and students living

together, and to an extent working together, in colleges. At York, a distinctive view of higher education guided its early planning: “Care will be taken to avoid the association of a particular college with a particular subject. This might...work against the mixing of different interests and skills which is one of the chief purposes of university education” (University of York, 1962: 10). A similar view was expressed by the founding Vice-Chancellor of the University of Kent, that each of its colleges should be “a microcosm of the whole University” (Martin, 1990: 130). Other 1960s universities took different planning approaches, but each had what would now be called a model of teaching and learning at the centre of its planning, which influenced campus design and space use. Warwick, for example, like Sussex, planned for interdisciplinary schools of studies created around core subjects, rather than the then-usual single-subject honours degree courses (Burgess, 1991: 96).

These ideas of how a university should organise itself academically certainly affected the ways in which campuses were laid out; the learning spaces created by the campus itself – a point we discuss later – could therefore be considered as products of different models of teaching and learning. However, it is noteworthy that accounts of the development of most universities, new or old, offer few clues as to how learning spaces were conceived. For example, the published history of the University of Hull provides a lengthy account of the acquisition of its site, the appointment of an architect and his conceptualisation of the campus – “a series of detached blocks” (Bamford, 1978: 225) – but offers no information about what was thought would be the processes that might go on inside the new buildings, and how these processes might be reflected in design. Even an architectural practice as distinguished as Casson Conder felt able in 1958 to submit a master-planning proposal for the University of Birmingham that made no reference to the academic processes of the University which the plan was intended to serve (Casson and Conder, 1958).

This study will examine other work on university design, and in particular consider possible connections between campus design and teaching and learning effectiveness. It will also consider what the literature says about how

existing, legacy space – and this is the overwhelming majority of university space of varying ages, designs and qualities – can be used more effectively.

## 2 Outline of methodological approach

### 2.1 Defining the review topic

This review is located conceptually between, on the one hand, literature that undertakes abstract theorising about space, and, on the other hand, works on technical questions regarding its construction and maintenance. It aims to cover the territory between these two poles, and, if possible, to integrate the material found there. This literature comes from a range of disciplinary and professional perspectives, including those related to pedagogy; architecture and design; institutional and space management; and the student experience. So far as the material to be found at the two poles is concerned, our aim is to do no more than simply outline its nature.

There is no consistent, overarching narrative to be found in the material reported here, although we think that there are narratives within some of the particular literatures, as we shall show.

One of the most influential theoretical writers on space has been the French sociologist Henri Lefebvre, whose *La production de l'espace* was published in 1974 (references here are to the English edition, 1991). Lefebvre sought to establish a “science of space” by creating “a unitary theory of physical, mental, social space” (21). Taking a Marxist perspective, and being sharply critical of structuralists and post-structuralists such as Foucault and Derrida, Lefebvre argued that “producers of space have always acted in accordance with a representation [a theory]”, while the users of a space “passively experienced whatever was imposed upon them” (43). One of the radical aims of the proposed science of space was to see if it was possible for spaces to be “decoded” by their users and “read”.

Lefebvre’s work has been widely cited by other theorists of space and architecture (for example, Park, 2006; Whyte, 2006), and it is surely possible

to conceive of a body of work that applied his ideas on decoding and reading space to educational settings. (Some of the research considered later, which questions users of buildings on how their surroundings affect them, might have been made more rigorous by applying some of Lefebvre's theorising.) However, we have found no such examples of Lefebvre's ideas being translated into practical applications of space design, although they have been used, as we shall see, in further theoretical or speculative design studies. This largely abstract level of theorising has been placed beyond the scope of this review.

Similarly, more specifically architectural theorising on space, as distinct from applications of architectural theory, was considered to be beyond the scope of this study, although some examples of this work (such as Haldane, 1999) are included in the database. These theories mainly examine how people may conceive space and react to particular manifestations of it, and, in particular, how architects may use these perceptions in their designs. We have seen nothing in the literature that relates this abstract work directly to the design of learning spaces. The architectural theorising on space seems mainly to consist of post-hoc attempts to explain what it is that architects are doing when they design spaces: it is not clear that such theorising actually guides architects in their work. Leslie (2003), to take an example of a study of a research building, speculates on the conceptual influences on the architect Louis Kahn, the designer of the Salk Institute in California (and an architectural theorist himself), but struggles to show any direct link between these ideas and the actual completed building. Certainly, Leslie's account suggests that the various technical challenges involved in the construction of the Salk Institute exercised a far greater influence over the final result than did any purely theoretical ideas.

Literature dealing with space as a metaphor, as in "space for reflection", "conceptual space" and so on (the most common usages of "space" found in literature searches in the social sciences), was excluded. Green (2005), in a paper titled "Spaces of influence", offers a categorisation of many of these metaphorical usages.

There are suggestive ideas, and experimental results, from the field of cognitive neuroscience on how learning occurs and how it may be influenced by environmental factors – even if the experimental subjects are mice. Although some of this work is referred to here (Eberhard and Patoine, 2004), we have considered this literature to be generally beyond our scope, as it needs to be assessed within the framework of a study focused on findings from neuroscience and psychology. Such a study, conducted by a team combining expertise from these areas with educational expertise, is worth further consideration – although it seems likely from the literature in this field that the unsurprising findings would be that learning takes place best in quiet, comfortable, temperature-controlled, well-lit spaces, having what one commentator described as a “nice sort of quality” (Mitchell, 2003). It is, however, claimed (although evidence is not presented) that “the use of yellow, beige or off-white surface colours can stimulate learning...[and] certain scents can aid problem solving, for example peppermint, basil and lemon...” (DfES, 2002: 36). Testing these claims in a higher education setting would surely be possible – providing that the experimental subjects could be persuaded to take their tasks seriously.

Studies of purely technical aspects of building design, unrelated to specific points about requirements for learning, were also excluded, although some general accounts of the requirements of higher education in building design and maintenance terms have been noted (HEFCE, 1998; UNC, 2004). Studies on environmental issues (noise, lighting, temperature and humidity control) were included where a relationship with learning (as distinct from accounts of good practice in building services design) was postulated. Although there are some accounts of this sort, albeit of variable quality (Slessor, 2004; Williams, 2005), this work is usually about schools: relatively little work appears to have taken place in relating design and environmental issues to various space uses in higher education, although this is now changing (Scott-Webber, 2004; SFC, 2006). The differences between schools and higher education in these respects are probably in any case small. De Almeida’s study (1994) of environmental conditions in higher education is

relatively unusual for its UK context; Wolff (2003) offers guidance from a US perspective. Other aspects of the physical design of learning spaces are considered in section 4.

These then, are the boundaries – abstract and highly theoretical in one direction, and largely technical in the other – within which the main part of our study is located.

Our planning of this study provisionally assumed that two main fields would produce most of the relevant literature: the broadly pedagogical (although we had indicated in our proposal that most standard works on teaching and learning in higher education ignored space issues) and what we termed the managerial. Despite efforts to locate relevant literatures in other domains, we were forced back to our original suppositions, although we found less relevant literature from a managerial perspective, broadly defined, than we had anticipated.

The core of the material that we examine in this study derives from work on:

- teaching and learning and its use of space (such as the implications of the greater use of group work, and “blended learning” involving face-to-face and ICT-based work)
- related design issues (how spaces may be re-conceptualised and configured, as in new-style “learning spaces”, or in library/learning resource centre settings; and related technology issues)
- campus space as it might relate to learning (the teaching and learning implications for the way buildings are designed and placed on a campus, and the possible learning uses of spaces of all kinds, inside and outside)
- organisational change as it might affect teaching and learning spaces (including space management issues, how student views on space are obtained and reflected, and how findings on the learning/space nexus may be put into practice).

## 2.2 Methodology used

A preliminary search of relevant databases was made, confirming our supposition that the majority of the uses of the term “space” in the education, and wider social scientific, literatures were metaphoric, unrelated to physical spaces. A search of architecture-related databases also confirmed our supposition that most studies of educational buildings made from a built environment perspective did not consider teaching and learning spaces, and their specific design requirements, in any meaningful way. (It is remarkable that a number of architectural accounts of university buildings might almost as well be discussing a public monument, say, rather than a place where a large number of people will be interacting around such complex tasks as teaching and research.)

The main focus of the review was therefore identified, as indicated above (section 2.1), as lying between the abstract and the technical, and seeking to identify relevant material that could inform design in higher education.

A systematic search was then made of educational and related databases as follows:

- AEI Database of Research on International Education
- Australian Education Index
- British Education Index
- Conference Papers Index
- Current Educational Research in the United Kingdom (CERUK)
- Design and Applied Arts Index
- Distance Learning Database
- ESRC Society Today
- Educational Research in Scotland
- Education-line
- Electronics and Communications Abstracts
- ERIC
- Index to Theses
- Information Technology Case Studies

- International Bibliography of the Social Sciences (IBSS)
- JSTOR
- Library and Information Science Abstracts (LISA)
- Sociological Abstracts
- SRHE Abstracts
- SwetsWise
- UK Official Publications (UKOP)
- UNESCO Documents and Publications
- ZETOC

Potentially relevant literature was classified in a schedule in which, as well as including the abstract (where available), we noted the work's research question, its theoretical perspective, its disciplinary basis, the evidence drawn on, the key argument, and references to be followed up. This schedule provided a valuable reference source for the preparation of this report, allowing subject areas with concentrations of literature or sparse coverage to be identified, and trends in the literature to be discerned.

Simultaneously, the same material was entered in an EndNote database, together with other items not included in the schedule on the grounds of peripherality to the preparation of the report.

As the report took shape, areas where the literature in the database seemed inadequate were identified, and further searching was undertaken, either to obtain additional material to allow the database to be strengthened, or to confirm that little or no other material could be found.

In summary, the literature that was examined may be classified in the following way, by topic and by perspective (the cells with the darkest shading indicate 50 or more references found, the palest cells indicate ten or fewer):

literature topic	literature perspective					
	theoretical	policy	empirical	professional	historical	descriptive

		statement		practice		
teaching and learning						
built environment						
student experience						
institutional organisation						
space management						

### 2.3 Justification of method

Considering the time and resources available, and the nature of the research question, our approach seemed to us appropriate. As we had anticipated, very few quantitative studies have been undertaken that would allow a systematic review approach: and those that do exist were often poorly designed. Further, the wide range of disciplinary perspectives and theoretical methods in the relevant literature meant that only a method that allowed an overall view to be taken of the quality of each item, and of the value of its conclusions to the overall study, would be likely to result in a useful outcome.

### 2.4 Other methods considered

As we noted in our proposal to the Academy (May 2006), the wide variety of research types involved meant that a meta-analysis or a systematic review analysis methodology would be unlikely to succeed: the nature of the material to be examined cannot realistically be subject to the formal processes that these approaches require. Our subsequent work has confirmed this view.

### 2.5 Reflections on the methodology

We consider that the methodology chosen was appropriate to the nature of the task. In particular, the range of the literature involved (from sociological theory to building construction), and the variety of methodologies encountered, meant that no single review technique would capture the key points arising.

The use of a project steering group, which brought to bear a wider range of expertise and insights, proved valuable. The opportunity to present interim findings to a wider professional group would have been helpful, although this would probably have been difficult to organise given the time pressures on people in higher education and the project budget. A meeting with the other literature review teams working on teaching and learning topics, at a late stage in the preparation of our respective reports, might also have been valuable.

### **3 Identification, selection and analysis of the literature**

#### **3.1 Method of selection for inclusion**

It was considered inappropriate to set specific selection criteria (inclusion of only empirical studies, for example). The topic encompasses diverse types of literature, approaching the problem from many different standpoints, and to exclude some of these standpoints as a result of *a priori* theorising would, we felt, be unhelpful. Material with apparent methodological weaknesses was included, not least in order to indicate the scope for improvement in work in this field.

Material for inclusion was selected by examining literature in the broad categories noted in section 2.1, and identifying items that appeared to relate to questions of space.

#### **3.2 Method of analysis**

From a reading of an initial sample of the literature, the conceptual framework presented in section 4 was constructed. This framework then guided the selection of further literature, as it helped to highlight areas with inadequate initial coverage. Some of this further material led to developments within the framework – and so a heuristic process was established.

#### **3.3 Overview of included literature**

An overview has been given in section 2.1.

#### **3.4 Explanation of excluded literature**

Reasons for exclusion or limited coverage, of certain categories of literature have been given in section 2.1. Items that were essentially repetitive of material already included were not added to the database.

## 4 Conceptual perspectives

### 4.1 University space: an overview

We may think of university space in the following ways:

- the campus
- the university in the city
- a community space
- individual buildings
- spaces intended for teaching and learning (including libraries)
- other spaces

All these categories of space may, in different ways, be thought of as spaces for learning. The first three of these categories are considered below.

#### *The campus*

Although the terms of reference for this study are about “learning spaces”, the definition of such spaces is problematic. If a “learning space” is a space in which learning may take place, then a wide vista is opened up. Some writers have argued that the university campus, in the sense of a defined area within which a university is physically located, is a thing of the past: the learning spaces of the future will be found in workplaces, shopping centres, cultural venues and so on, taking advantage of advances in ICT (Harrison and Dugdale, 2004). This approach is now sometimes thought of as “m (mobile) learning”. Literature of this kind may be seen as an updating of work that proposed that the “e-university” would largely replace the physical campus – or at least, be the way of meeting future growth in demand for higher education – with distance learning of various kinds superseding face-to-face

learning (Daniel, 1998; CVCP/HEFCE, 2000). This literature did not see the physical form of the university, as such, as having significant benefits. The continued development of physical campuses suggests that this argument has not been persuasive.

The role of the campus as a learning space appears from time to time in the literature, but is under-conceptualised: “among the many methods employed to foster student learning and development, the use of the physical environment is perhaps the least understood and the most neglected” (Strange and Banning, 2001: 30). Edwards offers one bold conceptualisation:

“Taking a broad sweep of nearly a thousand years of university construction, it is possible to draw one significant conclusion. Of all building types none more conspicuously links new ideals of design and innovative technologies to the mission of development than the university. The exacting agendas of intellectual inquiry, of scientific experiment, and refined taste, are historically to be found in the design of many university buildings. For example, the sense of scientific rationalism is embodied in built form in the ancient universities of Oxford, Cambridge, Paris, Bologna and Turin. The ideals of democracy find expression in the layout of universities from Virginia to Cape Town....the campus has never been an ordinary place.” (Edwards, 2000: 150).

Other writers (Whisnant, 1971; Crook, 1990) have similarly noted the signals that both campus design and the architecture of individual university buildings might send: many of these signals are about learning, broadly defined – as Edwards noted above, about a sense of the special, a seriousness of purpose. This point perhaps deserves some elaboration, as it relates to a type of learning: what is meant when claims are made about epistemologies being “found in” building designs? What is presumably to be understood here is that designers of university buildings may aim to reflect their own understandings of a building’s purpose in its outward form. This form is then interpreted by observers in the light of their own understandings of the building’s purpose, or

through their skills in de-coding the socially-constructed meaning of neo-classicism, say. If this analysis is correct, it must cast doubt on the sweeping claims writers such as Edwards make on behalf of university architecture: a university building is no more distinctive in this respect than, say, a Victorian town hall. This seems to be the view taken by Dober (1992) in his study of the (mainly, American) campus, when he notes that university “landmark” buildings “are cultural currency...charged with allegorical significance and perceptual connotations and meaning” (5). University buildings seem important because people think that universities are important places.

It is certainly true that, around the world, campus architecture is now seen as a means of delivering an institutional strategy (Kenney, Dumont and Kenney, 2006) and as an important marketing tool in increasingly market-oriented higher education systems (Edwards, 2000: 5). The “iconic building” seems now to be a feature of every current campus master-planning project. When the English polytechnics gained university status in 1992, one possible difficulty was thought to be that “polytechnics...do not *look* like universities; environmentally, they remain a quantum leap away from a university campus culture” (Price, 1992, original emphasis): because buildings and purposes were seen here as being interdependent, new universities might not function as old universities did, because they did not look like them. This suggestive idea has, seemingly, not been developed subsequently.

Campuses and individual buildings as symbols or allegories may have a significance in supporting learning, where “the physical and the emotional become inextricably intertwined to form an almost palpable ‘sense of place’, one that has profound if not always clearly understood meaning to many members of the campus community” (Kuh et al., 2005: 93): but there seems to be little evidence on this point. Indeed, more broadly, what university leaders and their architects think people think about their buildings also seems largely unsupported by evidence. When university staff members and students are actually asked about the impressive new buildings in which they are working, their responses tend to fall short of ringing endorsements (CABE, 2005).

It is surely the case that, around the world, the vast majority of university buildings are simply functional standard units, constructed to the designs and standards of other comparable buildings of their place and time: they have no grand message to send. What is now the University of Hull may have been more typical of the reality of university space in most times and places: rather than having had the good fortune of exhibiting Edwards's "exacting agendas of intellectual inquiry", it was to a large extent reliant on the temporary wartime buildings of an ex-army camp, from 1946 until the late 1960s (Bamford, 1978: 137). Such "inherited" buildings will also impose limits on the creation of new spaces.

More recent thinking on "flexible" learning spaces – spaces in which different groups may be undertaking different activities simultaneously and which lend themselves to a variety of uses (Chism, 2006; JISC, 2006) – has suggested how campus and building design can be used to facilitate learning, particularly informal learning. On the basis that much effective learning takes place as a result of interactions between students, designs need to provide a variety of spaces in which they can work and socialise together (Kuh et al., 2005: 206). (We may note that the design of primary school classrooms and play spaces has been seen in this light for about half a century (Maclure, 1984), and that current advice on school design continues in this direction (DfES, 2002).) However, cost-driven pressures in higher education to maximise space utilisation may have the unintended effect of reducing the opportunities for informal learning. For example, improving space utilisation by the central timetabling of space previously "owned" by departments, where teaching took place and academics worked, reduces the possibility of casual encounters between academics and students (Barnett and Temple, 2006: 10). We later give an example of a space redesign intended to reassert this unity.

The importance of creating human-scale learning environments features in the literature. "Through buildings, signs, and the landscape of the campus, the physical environment communicates messages that influence students'

feelings of well-being, belonging, and identity” – and so aids learning (Kuh et al., 2005: 106). These writers provide a number of case studies:

“Although Miami university encompasses more than 1900 acres, it was designed to feel small. One can traverse the campus on foot in any direction in about 15 minutes. The campus is organized in quadrangles that enclose, and are separated by, green space...The feeling of smallness also is attributed to the use of Georgian architectural style...few buildings are more than three stories...Miami is a campus, not a group of buildings in close proximity to one another. As one staff member observed, ‘We have a mindset here that we’re not as big as we are.’” (Kuh et al., 2005: 106)

Another example, drawing attention to the importance of campus design detail in promoting learning, is the description of “seven decades of [different designs of outdoor] seating arrangements to promote contact, communication, and informal social life in pleasant surroundings...melding contemporary art and function” at US universities (Dober, 1992: 215). This level of fine detail is easily overlooked when making major planning decisions. It is part of creating “the learning landscape”; one writer considers that typical university “common rooms, foyers and gathering areas...would need relatively little enhancement to become social learning spaces” (Somerset, 2006).

More work is needed by architects, interior designers and educationalists in collaborating to identify what these informal opportunities on the campus are, and how their benefits may be achieved in practice. We return to this point later.

### *The university in the city*

Around the world, many – perhaps most – important universities are embedded in the urban fabric of major cities. In both developed and developing countries, universities are now usually seen as major sources of

high-quality human capital, and as such, important contributors to the economic and social vitality of city (and so to national) life, as several recent studies have indicated (Goddard, 1999; ODPM, 2006). What has been described as “the asphalt intelligentsia” (Elliott, 1994: 65) can both contribute to, and benefit from, urban social and economic structures. Post-industrial cities, in particular, now realise that they depend for their wealth almost entirely on the knowledge and the “soft” skills that a highly-educated workforce brings (Florida, 2004).

A recent development of this line of thinking has been the notion of the “ideopolis”, the knowledge city-region (Jones et al., 2006). Such areas are said to have unusually high levels of “knowledge intensity”, and universities play particularly important roles by developing mutually beneficial relationships with other organisations in the city.

Universities in capital or other major cities often point to the learning opportunities that their city offers through its libraries, museums and galleries, for example, but also the ready access afforded to professional and business networks and the resources associated with them. For example, the undergraduate prospectus of the London School of Economics tells potential applicants that:

“The School's location in central London is fundamental to its identity. When you choose to be an undergraduate at LSE, you are choosing not only a course of study, but a place to live and work for three years. LSE looks out over the London skyline, rather than over green fields. It is stimulating, cosmopolitan and very much a part of the 'real world'...[there is an] easy interchange of ideas between the School and the world outside - Government, Parliament, the business and financial institutions of the City, the Law Courts and the media are all on the School's doorstep” (LSE, 2007).

The city itself, then, as an ideopolis, may be seen as a learning space for higher education, in the same way that it is sometimes seen as a resource for

schools (Dobson, 2006). There may be opportunities for learning, for example through student placements, or by bringing practitioners into the teaching process. There are ways in which the university can encourage the development of, in effect, city learning spaces, by working with other organisations such as local and regional authorities, community groups, other educational institutions, hospitals, and so on, as described in the UK by Watson (2007: 126) and in the US by Kuh et al (2005: 102).

### *A community space*

“Institutions of higher education are not merely places of instruction. They are communities”, claimed the Robbins report (Committee on Higher Education, 1963: 193); we have seen (section 1.2) how some campus designs have had community-building as an aim. One American university president makes the point by arguing that universities are (or at least, should be):

“intergenerational partnerships in learning and discovery, with compelling moral purposes that include not only teaching and research but also service to society...we are not just collections of loosely affiliated persons with convergent or conflicting interests, but institutions that make a difference in the world...I emphasise the fellowship here among students as well as faculty members” (Keohane, 2006: 2).

That is to say, universities are communities with special purposes. Other writers have argued that a collegial style of university organisation and management is crucial to the successful achievement of these purposes (such as Shattock, 2003: 88). Dismissing the notion of “the student as customer” as “one of the least convincing metaphors” of higher education, Shattock goes on to identify effective student participation in institutional governance, “seeking out formally and informally their views” (94), as an important component of successful university management. This is a form of network-building, and social capital theory offers a means of analysing how

social networks, perhaps developed in this manner, can support educational aims (Field, Schuller and Baron, 2000). Similarly, it has been suggested that the ability of universities to create and apply social capital is a significant factor in understanding their overall effectiveness (Temple, 2006).

How do these ideas of community and participatory governance in higher education, and their possible contributions to social capital creation, relate to teaching and learning, and to space? This is an under-researched, but potentially important field. It has been proposed that the physical form of the university is important in supporting its integrated nature, intellectually and socially, and that it is “the preservation and development of this integrated form, with its dense network of connections, that provides many of the management and planning challenges in higher education” and which supports institutional effectiveness (Temple and Barnett, 2007). Physical space and intellectual space (for teaching and learning, and research) may, then, be connected through the operation of social networks.

While standard accounts of teaching and learning in higher education argue that learning is a way of interacting with the world, and that knowledge is created by the student’s approaches to learning (Biggs, 2003: 13), almost nothing is said about how these approaches may be affected by how students feel about their place in the institution of which they are temporarily a part: is students’ learning perhaps helped by their involvement in the creation of social capital, and their uses of it? It seems plausible that one of the influences at work on students, if only to a modest extent, is that of their physical surroundings: Rutter et al’s 1979 study of secondary schools argued for a link between well-kept buildings, the school as an effectively-functioning social institution and improved learning outcomes. Rutter’s team did not naïvely claim that a better physical environment would of itself lead to better learning, but suggested that it played a part in standard-setting generally and so helped to create a more effective social grouping (we might think of this as concerning social capital formation), which in turn led to improved learning. It is surely plausible, as Strange and Banning (2001) argue from a US university perspective, that similar interactions are in play in higher education; but we

have found no convincing studies on this interplay between physical and social capitals, and learning. We propose that this is an area worthy of further empirical examination.

It is worth emphasising that Rutter et al's finding related to cleanliness, tidiness and day-to-day maintenance – the small change of institutional life – rather than to the longer-term issues of building design or quality. The 2005 CABE study, however, argues that these larger issues *do* matter, as we shall discuss later.

Discussions of *individual buildings*, and of *teaching and learning spaces* and *other spaces*, appear in the following section.

## **4.2 Perspectives on university space**

This study suggests that learning spaces may be considered by means of four intertwined perspectives: *meaning*, *engaging*, *supporting* and *living*. This draws on the approach to understanding the university curriculum proposed by Barnett and Coate (2005).

### **4.2.1 Space as *meaning***

There is an extensive literature around the idea of “buildings as texts”: that buildings and the spaces within them should convey particular meanings (Sklair, 2006; Whyte, 2006). We have noted Lefebvre's notion that buildings need to be “read”, though as Whyte observes, the practical demands of construction, not to mention the client's budget, may severely limit the scope of the architect's attempt to impart meaning (although a different meaning may, presumably, be imparted thereby). In higher education, as we have noted, there has been a long-standing wish to create buildings that seem to

offer messages related to the underlying objectives of the institution (Edwards, 2000: 150), a wish realised in different ways at different times. Although we have suggested that this message-sending idea is potentially misleading, it may be the case that campus and building design can, in various ways, “serve to convey...some of the core values that shape institutional culture” (Strange and Banning, 2001: 100). There is some very limited empirical evidence that both the aesthetic and functional components of university architecture can have positive effects on student satisfaction, however the link to learning outcomes, while plausible (satisfied students are better learners), is far harder to demonstrate (Wiers-Jenssen, Stensaker and Grogard, 2002; CABE, 2005). This effect, we may note, does not necessarily involve sending messages, via architecture, about Edwards’s “agendas of intellectual inquiry”.

Designing buildings and other structures in order to make some kind of statement – even if to express a power relationship, rather than to make an epistemological point – goes back at least to ancient Egypt (Fletcher, 1975: 13). Little is said in the literature on medieval universities about their design from an educational perspective, but it is surely conceivable that, in the minds of the creators of these buildings, there was a link between outward expressions of grandeur and the importance of the learning that was to go on within. It is certainly the case that the principal craftsmen employed on the construction of Oxford and Cambridge colleges in the middle ages were the equivalents of today’s famous architects, having often worked on major projects for the Crown (Cobban, 1999: 144). The design of medieval college quadrangles, borrowed by Oxford and Cambridge from monastic and other religious buildings, and used at other universities such as St Andrew’s (founded in 1413) and later at Durham, sought to encourage interactions in a limited space and had a community-building function: they offered “the enclosure of community but also protection from change” (Darley, 1991) – a learning aim of a particular kind. (The oldest university building in Britain still in use for university purposes today, incidentally, is thought to be the University of Oxford Divinity School (1427-85).)

University architecture in Britain in the 18<sup>th</sup> and 19<sup>th</sup> centuries often made reference to classical civilisation – the University of Cambridge Senate House (1722-30) by Gibbs, and the University College London buildings (1827-28) by Wilkins, are fine examples (Fletcher, 1975: 961, 1069). The socially-coded message was clear: that these buildings had a higher purpose was signalled by the implied links with ancient Greece and Rome and hence to classical scholarship. The founders of the first London University in 1825 explicitly wanted “a palace” that would bring to mind “the porticoes where Socrates sat, and the laurel-groves where Plato disputed” (quoted in Crook, 1990). Here, architecture was linked with educational values and with a mode of learning: it was a visible, architectural rejection of the “medieval, ecclesiastical, obscurantist and restrictive” traditions of Oxford and Cambridge (Crook, 1990). The slow process of academic modernisation in Britain – begun, perhaps ironically, by the opening in 1828 of the Graeco-Roman building that would become University College London (Harte, 1986: 67) – may be seen also as eventually encouraging a form of university architecture that seemed to look forward, rather than one that looked back to a lost age.

Signals may also be more subtle than those supposedly sent by grand architectural gestures. Strange and Banning (2001) suggest that what might appear as a minor design detail – the way that kerb-crossings for wheelchairs are constructed, for example – may suggest the extent to which an institution takes seriously its commitment to the needs of people with physical disabilities, including their learning needs.

Of course, it is not just the architecture of higher education that may seek to send a message. One writer argues that the medieval design of London’s Inns of Court is an example of “architecture [as] the vehicle of myth” (Evans, 1999), in this case by the presentation of the law as a semi-mystical creation served by acolyte lawyers. A perhaps more relevant analysis shows how exterior and interior design features of US legislative buildings serve variously either to project authority or to allow debate and dissent (Goodsell, 2003). We shall return to some of these points in the university context later.

### 4.2.2 Space as *engaging*

From the end of the 19<sup>th</sup> century in Britain, architects and their educational clients began to understand the need to provide buildings that met defined educational needs: modernism had arrived. From this point onwards, we may begin to think of university spaces as engaging learners and teachers in the social processes that constitute learning.

#### *Form and function in learning spaces*

The most architecturally significant individual building in Britain that was designed for a higher education purpose and is still in its original use today is, without much doubt, the Glasgow School of Art (1896-99). Its architect, Charles Rennie Mackintosh, created a building that was (and remains) highly functional for its educational purpose, but which also – by mixing what Nikolaus Pevsner calls “deliberately fantastical” and “playful” features with a “simple, almost austere” façade – suggested ideas about creativity and imagination (Pevsner, 1960: 166). Pevsner also draws attention, we may note, to Mackintosh’s ability to create a “transparency of pure space”, and to his “keynote” achievement in the School’s Library, with its complex perspectives used to create a space with abstract forms of lasting beauty (1960: 168).

Mackintosh incorporated the new technologies of his day – electric lighting, central heating and plate glass – into a highly functional design, which allowed the redivision of studio spaces as the changing needs of the School’s curriculum required, with important fixed spaces (such as the Library) placed at the ends of the building, and the Director’s room on the central axis (Macmillan, 1989). It was a purpose-built, imaginatively-conceived learning space constructed to the highest contemporary standards, down to the last detail of its fixtures and fittings.

Its particular significance as an educational building – indeed, simply as a building – was that it marked a definitive break with the tradition that held that buildings needed to make a reference to something else (usually antiquity) in order to express their seriousness of intent: “The School’s importance...lay in its manifest rejection of ‘stylism’, in its demonstration of the possibility of an architecture having its sole genesis in its use and its construction” (Macmillan, 1989: 66). Mackintosh was, as Pevsner (1960) observed, a forerunner of the modern movement in Europe and America, a movement that may be seen as reflecting changing social and economic conditions and ideas at the start of the 20<sup>th</sup> century. Ideas about new learning spaces may, then, be seen as emerging from a much wider set of changed circumstances.

Nearly 30 years after the construction of the Glasgow School of Art, and a century after the completion of its first Graeco-Roman buildings, the University of London turned to modernism of a sort. In 1927, the Vice-Chancellor, William Beveridge, began to look for an architect “who can embody [the very idea of a university, imperial and modern] in stone and steel and marble – not too much marble” (quoted in Crook, 1990). The search resulted in Charles Holden being appointed to prepare a largely unrealised master-plan for a university campus in Bloomsbury, representing “a new architecture of functions and pure form” (Crook, 1990). Whatever the limitations of Holden’s approach – only the Senate House (1933-38) was built in the form envisaged by him (and even that was not fully completed) – it was at least an attempt to create buildings that met defined academic needs, while also signalling the existence of an imperial institution.

In America, at a slightly earlier period, William Welles Bosworth’s 1913 design for the Massachusetts Institute of Technology (MIT) also applied modernism of a sort to the university campus. Bosworth provided “a prototype building which would be easily adaptable to meet new needs...[and also] declare the...aesthetic attitudes of those who sponsored and designed the buildings...function and flexibility were given precedence over stylistic allusions” (Dober, 1992: 21). The design took account of changing learning needs by providing corridor walls that were load-bearing, allowing lateral walls

to be easily moved for new room configurations. The demands of learning space design were taking over from the grand architectural gesture.

### *New ideas about learning spaces*

What might be the 21<sup>st</sup> century equivalents to these innovations in designs for higher education? While there are attempts (as we shall show) in the literature to answer questions about environments for teaching and learning, little is said about environments for another kind of learning, that involved in knowledge production. This is perhaps surprising, considering the extensive interest by policy-makers and researchers in the subject (Gibbons et al., 1994; Nowotny, Scott and Gibbons, 2001; European Commission, 2003). One writer who touches on this question is Knorr Cetina, who argues that science changed as “laboratorization” affected social relations, both within scientific communities and between them and the lay public (Knorr Cetina, 1999: 30). She points out that laboratories are social and political structures, “objects of work” in themselves which participate in the “lifeworld” of the discipline in question (38). There is an interplay between the type of science carried out and the social and physical organisation within which it takes place: space is not intellectually neutral.

Some work suggests that spatial arrangements importantly affect the ways in which organisations operate, and that an “architecture of complexity” should be sought (Kornberger and Clegg, 2003). Drawing on some of Lefebvre’s (1991) ideas, Kornberger and Clegg argue for “generative” buildings, ones designed by, or at least with, the people who live or work in them. They contrast these with “monumental” buildings, ones imposed on their inhabitants by outsiders. Borrowing from Foucault, Kornberger and Clegg go on to propose that such buildings should be designed with “heterotopia” in mind – “a space for experimentation and temptation, where discussions about existing orders of things and discourses can happen...a place where one can

hear voices that are not normally heard...[where one] could restructure an organization's image of reality". This sounds a promising agenda for learning space design, but unfortunately, other than some suggestions about "neutral zones" and more social spaces, these authors do not offer any clear view on what a heterotopian building would look or feel like. Even so, the idea that we should take a different perspective on the internal designs of buildings from which radical developments are expected to emerge is a valuable one.

A case study of the creation of, arguably, a generative building with heterotopian characteristics is Taylor's (2002) account of the Open University Business School building in Milton Keynes. Rather than providing an office building with cellular or open-plan spaces, the building was planned in conjunction with its users keeping flexibility in mind, and having spaces for different activities – individual work, meetings, socialising and so on. The understanding that different sorts of teaching and learning, and the work to support it, may need a variety of space types designed to meet specific demands is only now being reflected in space planning (JISC, 2006; SFC, 2006).

However, a recent development at the University of Sussex intended to provide flexible space for "the creation of collaborative and innovative research environments" has reportedly contributed to tensions among academic staff, with complaints about working in "a call centre-type environment" (Baty, 2007). As we shall see later, staff typically seem to be more sensitive to space issues than do students – a factor that needs to be considered in any university space-planning project.

### *Specialist learning spaces*

Of the main types of university specialist learning spaces – libraries (or learning resource centres, or in America, information commons), laboratories, workshops, art and design studios, and performance/practice areas for the performing arts – it is libraries (as we shall call them for the sake of

convenience) that have received most consideration in the literature regarding their changing roles in enabling learning. The library has traditionally been thought of as being at the heart of a university – and often placed there physically. Despite some predictions that the growth of on-line services would lead to a reduced demand for physical libraries, their development continues (King, 2000). There is relatively little literature on changes to other types of specialist space, other than on technical design matters

Particularly in teaching-oriented universities in the UK, the learning resource centre places “the emphasis on space and computer-based access, rather than on books and shelves...[the aim is] to provide an exciting and flexible space in which students can...study at their own pace, in their own time, using a variety of learning styles” (Edwards, 2000: 90). This is one of the most noticeable space developments to reflect the learning needs of students studying what may be non-traditional curricula by new methods. A particular design challenge in such buildings is to allow for student group work, perhaps working with computers at a “pod”, while also providing quiet space for private study (Barnett and Temple, 2006: 11). The JISC study shows how a learning resource centre might try to do this and be integrated with other learning spaces, allowing students to begin their work in one area and move on to another (JISC, 2006).

This observation from an American university gives an idea of how such spaces can be used:

“Walking into a busy information commons on a weekday evening, an observer would likely see groups of students clustered around computers, some chatting, others talking on cell phones, some with headphones listening to audio while they work on computers, and some working on their own, perhaps on a laptop, with coffee and snacks, books and notebooks spread out on a table. It would be difficult to tell, without peering over their shoulders, exactly what types of activities the students were engaged in, particularly whether they’re recreational or academic. Are they playing computer games? Buying

things on the Internet? Sending and receiving instant messages? Or are they involved in more scholarly pursuits, such as accessing journals licensed by the library, using art image collections, writing papers, editing videos for course projects, or accessing assignments through a course management system? The students probably are doing some of each. Today's students mix academic and social activities. Some see their multitasking as a troublesome lack of ability to concentrate, but it is a logical strategy for students who grew up in a world with media in many formats at their fingertips 24 hours a day. Information commons, with their large numbers of computers, range of software, and spaces configured for groups, provide an ideal environment for students to collaborate with others and multitask. Developing spaces where students can collaborate outside class provides support for an increased emphasis on teamwork, both in and outside higher education." (Lippincott, 2006: 12)

The merging of what might once have been thought of as separate student activities, and the implications for the spaces in which these activities take place, is a theme of some current writing on learning spaces (see section 4.2.4).

Recent studies show how more traditional academic libraries may also be changed to take account of new approaches to learning – for example at Monash University, in Australia (Jamieson, 2005), and in the redevelopment of the Perkins Library at Duke University, in the US:

"The Perkins Renovation Project is far more than an expansion of the library's space - it signals a complete reconsideration of the academic library as a physical place and a qualitative experience. The older Perkins reflected a traditional concept of the library as gatekeeper. Its interior spaces were devoted primarily to the processing, preservation, and security of printed collections, and its layout was confusing for all but the most dedicated of scholars. By contrast, the renovated Perkins embodies a 21st-century vision of the library as gateway and

commons, a gathering place for learners rather than a warehouse for books.” (Lombardi and Wall, 2006: 2)

Edwards notes the particular technical requirements that library design needs to take into account, in areas such as noise control, lighting, humidity control, cabling and structural loading (2000: ch 7).

The huge changes seen in scientific and technological understandings in recent decades have had, according to one study, relatively little impact on space demands: there seems to have been an increase in productivity per unit of space, as a trend in the direction of smaller, more powerful items of laboratory equipment has allowed more scientific work to be carried out in a given space (Barnett and Temple, 2006: 14). Similar developments were detected in the art and design field, where digital technologies have meant that fewer large items of traditional equipment (printing presses, for example) were needed. As with other learning spaces, flexibility in design is sought in new or remodelled specialist spaces, to allow new scientific or other curriculum approaches to be implemented readily (Bonge, 2002).

One discussion of science teaching spaces (perhaps relevant to other subjects) proposes that their design should *inter alia* support problem-posing and solving; recognise the social character of scientific research, teaching and learning by facilitating interactions between and among students and staff; reflect and foster the blurring of disciplinary boundaries; and acknowledge the role of “serendipity and story-telling” in science by providing space for “exploiting the unplanned and teachable moment, for sharing what is becoming known” (Narum, 2004). As with a good deal of the literature in this field, it is not made clear here what specific changes in the design of science learning spaces would be needed to achieve these benefits.

It is generally recognised in the literature that laboratories, workshops, studios and so on should be seen as spaces with important social dimensions, and that their designs should facilitate social interactions, as well as meeting standard operational requirements. Providing “an island of reflection” in a

central atrium, perhaps, or forming an internal “street” linking related spaces, are possibilities that may support social interactions in new or remodelled buildings (Edwards, 2000: 100). Providing nearby refreshment facilities and semi-private meeting spaces may also increase the likelihood of “serendipity and story-telling” taking place. A move towards larger, open-plan laboratories with shared facilities, rather than separate labs for each research team, with adjoining clustered staff offices, is another proposed way of stimulating this type of interaction (Guterman, 2004).

### **4.2.3 Space as *supporting***

In what has become one of the most widely-quoted aphorisms on the subject, Winston Churchill remarked to the Architectural Association in 1924 that: “We make our buildings, and afterwards they make us” (Crook, 1990). The interplay between the university built environment and its educational purposes is a theme of this study.

Placing the student at the centre of the teaching and learning process in universities, in the UK and elsewhere, is a relatively recent development (Light and Cox, 2001: 33): the extension of this thinking to space issues has not (so far, at least) produced transformational change. In what is perhaps a radical example from America, Wabash College in Indiana, in seeking to respond to the needs of black people in its area, designed a new building which “captures the symbolism and spatial arrangements found in a traditional African village” (Kuh et al., 2005: 105). (Unfortunately, no further details are given of what this means for practical design or learning outcomes; and the College website provides no details.) The literature on teaching and learning, and on the curriculum, in higher education tends either not to deal with issues directly related to space (Biggs, 2003), or to do so only at a highly theoretical level, as when Barnett and Coate (2005: 34) draw attention to Bourdieu’s concept of *habitus* in relation to the curriculum, with its notion of a place, and a form of being, in it. This type of literature does not usually offer pointers as to specific design issues.

### *The need for new design approaches*

Discussions of this student-centred approach have naturally tended to focus on issues of pedagogy, the curriculum and related matters, rather than on the physical environment. Some writers have, however, noted that changed approaches to teaching and learning, including the need to respond to the demands of students from a wider variety of social and educational backgrounds, should carry with them new approaches to design – and that, in particular, teaching and learning should drive design, rather than vice versa (Jamieson et al., 2000; Jamieson, 2003).

Rather little, however, is said about the precise nature of these new spaces demanded by new ideas on teaching and learning. A room, with tables and chairs, and a means of displaying information for all to see, remains the basic teaching space in higher education. In some cases, a simple change in the layout of the chairs and tables in the room is proposed to facilitate a group discussion, rather than the *ex cathedra* layout of a lecturer at the front with ranks of students laid out before her or him – while acknowledging that large-group teaching may in fact demand this “sage on a stage” layout. Preferences of both students and teachers seem to be rather similar: comfortable seating, convenient furniture layouts, temperature control and pleasant outside views feature strongly (Douglas and Gifford, 2001; Scott-Webber, 2004).

Where new building, or remodelling of an existing building, takes place, then greater scope is offered for new concepts to be introduced. This is now seen in new lecture theatre design, where curved spaces can bring the lecturer and audience closer together, and where the use of swivelling seats can allow the lecturer to move from a large-group session, to multiple small-group sessions, and back to a large group. Computer facilities built-in to the furniture can, especially in quantitative subjects, allow students to work on examples given by the lecturer and obtain instant feedback on their work (JISC, 2006). A simple opening-up of separate, awkward spaces can create a more attractive

environment and more useable space. Spaces for learning in non-quantitative fields of study can also be designed more imaginatively, it is argued, involving end-users in design decisions and by taking better account of, for example, wall space and by using lighting more creatively (Dove, 2006). The need here is for designers with various skills – in furniture, lighting, decoration and so on – to be involved with the design process from an early stage.

There are, then, opportunities when new building or remodelling takes place to provide learning spaces that seem likely to improve the experience of learning (and of teaching) by applying intelligent design, probably at minimal extra cost.

In both new and existing learning spaces, attention to micro-design is necessary: “the proxemics associated with seating arrangements in a lounge area...can either promote or inhibit social interaction...physical artifact [sic] messages of support or unsupport can take many forms, signalling a sense of belonging...and a sense of role, worth and value...such messages enhance or detract from students’ ability to cope with college stress” (Strange and Banning, 2001: 31) – and hence their ability to learn. We hope that there will be few cases where there is a need to remove “statuary...that endorse outdated or limited roles for women” (27).

The Scottish Funding Council’s recent study of learning spaces, carried out by the Alexi Marmot Associates architectural practice and the haa design consultancy (SFC, 2006), argued that seven types of learning space could be identified in further and higher education. These space types were for:

- group teaching and learning, where flexible furniture arrangements were needed to accommodate groups of varying sizes, using varying layouts, preferably in square rather than rectangular rooms (the former being more adaptable);
- simulated environments, where practical learning can take place in technological subjects or nursing, say, requiring space for observation as well as for performing the task in hand;

- immersive environments, such as “HIVEs” (highly interactive virtual environments), with advanced ICT, possible in many subjects but more likely to be found in scientific or technological ones;
- peer-to-peer environments, where informal learning can take place, in cyber cafes, for example;
- clusters, where student group work can take place, for example in learning centres;
- individual work, in quiet areas;
- external work – areas outside the building suitable for individual or small group activity.

The SFC study did not consider the lecture theatre as a modern learning space. However, despite the many doubts surrounding the traditional lecture as an effective means of learning (dating back at least to the 1963 Committee on Higher Education, the Robbins report), another study found that it was still popular with staff and, apparently, students, and that new lecture theatres continued to be built (Barnett and Temple, 2006: 12). Nor was traditional laboratory space, as distinct from immersive environments, considered in the SFC study.

We should note, however, that very similar ideas on new learning spaces have been under discussion for several decades: Hickman (1965) welcomed experimentation in the design of teaching rooms, noting the creation of novel horseshoe-shaped lecture theatres, “special visual-aid classrooms” and other innovations. We may speculate on why innovations of these types have been so slow in taking root. An academic attachment to traditional pedagogic practices may be part of the story: “old self-understandings and sets of values live within the new” (Barnett, 2000: 28). A lack of clear evidence as to the learning benefits of these “new” approaches may be another part of the story.

While much of the emphasis in the literature is on new or remodelled buildings, the impact on learning spaces of scheduled and day-to-day maintenance and cleaning should not be overlooked. As a HEFCE study on university building maintenance puts it, “An appropriate and well-maintained

estate is...critical to delivering the institution's core business objectives in a cost-effective way" (HEFCE, 1998: 2). As we have noted (section 4.1), there is evidence that seemingly small matters of premises maintenance affect the sense of community cohesion and thus affect learning: the question is wider than simply the attractive presentation of the campus for marketing or image purposes (Jones, 1994: 122). Maintenance matters: it is not trivial in supporting learning.

### *New learning designs in practice*

The JISC study (2006) creates an image of a set of modern learning spaces. The building reception area has large computer display screens, presenting information on the day's events, perhaps encouraging thoughts in those passing through about new activities. Inside, the learning centre offers both quiet areas and ICT-rich areas where student groups can work on projects, with easy access to the material they need. These areas merge into a cyber-café, perhaps opening on to an outside area with seating, where in fine weather students can work with their laptops or in groups. Seminar rooms and labs or studios are linked to these areas, allowing learning to be a continuing activity, not one confined to a particular space, at a particular time. Many of these changes may often be achieved with relatively limited remodelling of existing spaces. There are close similarities here with current ideas on schools design (DfES, 2002).

A recent study from the US conjures up a similarly appealing picture (Dittoe, 2006). We follow a Dayton University student, Marcy, into her University's newly-created learning space: "Comfortable looking chairs and sofas grouped around coffee tables invited her to sit for a while with her steaming coffee. The small table lamps cast a welcoming glow, more homelike than institutional. 'I'll need to come here to study,' she thought, making a mental note of the tables available to spread out books and the access to wireless." These agreeable surroundings soon begin to have their effect on Marcy: "She then went to the learning space, as she found it a quiet place to organize her day. 'Am I

actually forming good habits?’ she wondered. She smiled. If so, she hoped the latté would neutralize it. Her friends slowly trickled in; by 7:30 a.m. most of her group had arrived. Funny, she mused, the other students, those attending ‘real’ classes in typical classrooms across campus, didn’t seem to arrive early.”

Things get even better: “Two days later Marcy was pondering some of the issues brought up by the debate and other recent discussions. ‘I just don’t get this one point,’ she thought. ‘It’s got to be the foundation for what Dr. Garcia was explaining about the Gnostic philosophy, so I’d better get it...’ Marcy had gotten up and crossed over to the faculty offices a few feet away. Ron Garcia had been talking with one of his colleagues. ‘Pardon me, professor, but could you...?’ Moments later Marcy, Professor Garcia, and Dr. Schramm were sitting in the alcove sofas and drew a crowd. Forty-five minutes later Marcy understood the concept and also had some new horizons opened about the connections between early church history and contemporary philosophy.”

The new learning space certainly seems to have helped Marcy concentrate on her work, though we cannot tell from this vignette whether the major significance was the particular design or simply the fact that smart, new facilities had been provided – that someone in authority was taking an interest. Dr Garcia seems to exhibit saintly patience in being interrupted by a student to go over again what he had already explained, but luckily his diary is (we may infer) sufficiently free to permit an impromptu 45-minute seminar. The primary improvement to student learning, on this account, may be the result of the ready availability of academic staff to undertake additional teaching, rather than (as the vignette clearly wants to suggest) the physical layout and facilities for learning.

A conclusion, then, to draw from this account, and the more UK-related JISC study, may be that changed physical design features on their own may not be enough to achieve improved learning outcomes: a change in the whole pattern of university organisation may be needed to make the new learning spaces work properly. Has Dr Garcia’s office been relocated from his

academic department elsewhere on the campus to the new learning space? If so, what effects has this had on his work? The new learning space may have affected his behaviour patterns as much as Marcy's. While it may be easier for Marcy to find him, but what about his administrative and academic colleagues, as well as other students not using the learning space? Might it be that space design, based on ideas about improved student learning, is driving a wider, possibly unanticipated, set of organisational changes?

In the JISC examples, it seems to be implied that students will take more responsibility for their learning – they will have more choices about where to work, how to work, and with whom to work. It is possible that, while this may suit some students, other might prefer a more structured environment and set of choices.

Further, it is not clear from either study what the implications for space efficiency are for the institutions concerned. The suggestion in the American vignette is that because the space is so attractive, students are there from early morning to late at night; but data about student use on some comparable basis would have been helpful in understanding the costs, as well as the benefits, of this design. The tension between efficiency of space use and other benefits demanding less intensive use of space – flexibility over the organisation of teaching groups and the best use of staff and student time – is a continuing one, constantly being re-worked in changing organisational contexts, and has been the subject of debate for some time (Billing, 1995; Barnett and Temple, 2006). Billing also draws attention to the difficulties in predicting demand for spaces of different sizes in an institution, and the balance between general and specialised spaces, over periods longer than the short term. The provision of flexible spaces may not resolve this problem.

[Dittoe's "Marcy" study appears in *Learning spaces*, edited by Diana Oblinger, a useful recent collection of papers and case studies (mainly from the US) on university space design and planning issues. These are included in the database.]

*Technology and learning*

Technological advances have been presented as ways of improving pedagogy and/or reducing teaching costs for much of the 20<sup>th</sup> century, but actual pedagogic practice has been stubbornly resistant:

“Attempts at institutional reform on the part of special interest groups are now a familiar aspect of the higher education scene in Britain. One early example was the campaign to promote the use of closed-circuit television in undergraduate teaching, which enjoyed prestigious backing in the second half of the 1960s...The educational television lobby succeeded in persuading a number of universities to invest in studio facilities as well as in specialist staff and equipment, but significantly failed to establish the medium as anything more than a marginal embellishment to traditional teaching provision...The same is true of most of the other developments in media and techniques which were clustered loosely under the heading of educational technology...[However,] the introduction of computers as teaching devices...seemed to make good sense. It was sponsored not only by commercial interests but also by a number of enthusiastic academics. Most of the facilities were already available and familiar; the effectiveness of the computer could be readily demonstrated....But even in this instance...it is difficult to say that the outcome has been a major change in pedagogic practice.” (Becher and Kogan, 1992: 127)

However, it would be not be correct to claim that technology and new forms of communication have not had an influence on learning and teaching processes, as certain practices have already been incorporated and become natural parts of the student experience. Now, for example, “we take reading on-screen for granted, and ... in the developed world most reading is probably already electronic” (Kasdorf, 2003: 465). This shift to computers screens, it is possible to claim, is already a shift of knowledge, learning and human engagement. There are a number of studies on the design and operation of

spaces using learning technologies of various kinds (such as Zandvillet and Fraser, 2005).

Similarly, Kress argues that in this “new media age” the screen has replaced the book as the dominant medium of communication. New media make it easy to incorporate multiple communication modes (image, audio, video), and these modes are “governed by distinct logics [which] change not only the deeper meanings of textual forms but also the structures of ideas, of conceptual arrangements, and of the structures of our knowledge” (Kress, 2003: 16). If this is correct, then technology may be seen as changing the conception of learning itself: although the implications for learning spaces appear, again, to be limited. This does, however, lead to ideas of “blended learning”, based on a mixture of modes of learning, and requiring “blended environments” (Milne, 2006), with technology-enabled classrooms.

What implications do these rapidly-changing technologies have for learning spaces? Flexible and adaptable – future-proofed – spaces are needed, as they always have been: Bosworth’s 1913 designs for MIT provided for ample duct space above the ceilings, which is now used for the cabling and other services that Bosworth could not have foreseen (Dober, 1992: 21). The rapid spread of wireless networking has led to further change: one account suggests that “What we’re starting to see is the emergence of spaces that are designed around human rather than technological needs. The spaces are pleasant and have a nice ambience to them, and you can just use your wireless laptop there or whatever you may need to use; but the space is not built around that because it doesn’t have to be. That’s a very interesting and exciting development...you just take a laptop to a space where you like to be” (Mitchell, 2003) – in fact, you can work just as people always have done with books.

It is also clear from the literature that the rapid spread over the last few years of the use of wireless-enabled laptops, using broadband networks, was wholly unanticipated with regard to the educational implications arising from

individual mobility and flexibility in space use. No doubt the next major technological innovation will be similarly unheralded.

The 2005 HEFCE programme of CETLs (Centres of Excellence in Teaching and Learning) has encouraged various initiatives in the design and use of learning spaces. One CETL, called InQbate, is operated by the Universities of Brighton and Sussex:

“The specific focus of InQbate is creativity, how to encourage it, teach it, and use it to transform our teaching and learning. Our vision is encapsulated by a key phrases [sic] found in the subject benchmark for Engineering and Design - core subjects behind the project at both universities - ‘Be creative in the solution of problems and in the development of designs’. Generative activity forms the focus and characteristic of InQbate, with our inherent creative nature augmented by the appropriate use of technology. InQbate offers...an environment within which generative thoughts are welcome. It enables pathways and communication opportunities to enhance the creative process.

“The centrepiece of InQbate will be two Creativity Zones enabling groups of individuals to come together within a high technology environment to communicate their ideas and generate their designs. These activity zones draw their inspiration from operating theatres associated with the explosion in the understanding of surgery, several centuries ago. Observation points will enable other groups of students or guests to see and experience the activity underway...The confluence of state of the art communication technologies and design support software tools will be employed for thought-generation activities.

“[This approach will free] teachers and learners from the constraints of the traditional classroom. New spaces allow new behaviours and dynamics...the availability of a comprehensive range of cutting-edge technologies within a flexible space empowers teachers to construct

compelling learning experiences and tailor these appropriately to changing needs.” (InQbate, 2007).

These are striking claims to make about the effects that space and technologies can have on learning and creativity, and we must wait for an evaluation of InQbate’s work (an initial one is due in late 2007) before any conclusions are possible on the extent to which these claims are justifiable. Clearly, if InQbate can demonstrate significantly improved learning outcomes, let alone improved creativity (however defined), the implications would be considerable. The evaluation will, however, need to be careful to separate improvements resulting from the particular design and features of InQbate, as distinct from reflections of the abilities of the teachers and learners who may be drawn to it, and who will probably not be random samples of the larger populations to which they belong. The fact of it being a special, new facility may further affect how an already unrepresentative sample of users behaves. We discuss this issue further in section 5.

Other currently-approved CETLs raise more modest expectations than InQbate about the anticipated results of their uses of space. Several CETLs aim to offer learning environments similar to those that students are likely to encounter in their working lives. The University of Central Lancashire CETL, the Centre for Employability Through the Humanities (CETH), provides a “realistic work environment” linked to the media and cultural industries (University of Central Lancashire, 2007). This is an attempt to link learning to professional practice in a way that has traditionally happened in clinical, technological and design subjects: it is a simulated environment of the type noted earlier, in the SFC study (2006). It may be that this will become an area of growth in the use of non-scientific/technological space, and careful evaluations of the results of projects such as this will be welcome. A broadly parallel technological example is the Loughborough University Centre for Excellence in Employer-Linked Engineering Education, engCETL (Loughborough University, 2007). This project places emphasis on the particular design of the Centre’s accommodation and equipment, which are intended to enhance innovative thinking in engineering students. Again, it will

be important for the Centre's evaluation to attempt to distinguish benefits that may arise from space design from those arising from a range of organisational and psycho-social factors.

The CETL programme seems to show that increased attention is being paid to space design issues and their links to teaching and learning, although most projects have focused on providing state-of-the-art equipment rather than new configurations of space.

#### **4.2.4 Space as *living***

##### *Residential accommodation*

Residential accommodation can be designed and used so as “to augment, complement and enrich students' academic experience” (Kuh et al., 2005: 99). From the earliest days of the ancient universities, student living accommodation has been seen in Britain as having a role in building a university community, to a greater extent than is usual in Europe (Ramsden, 2003: 15). The planning of the University of York, for example, required that “there should be no rigid demarcation between places where the members of the University work and places where they live and have their homes” (University of York, 1962: 13). Nearly half a century later, discussion continues about the need to break down traditional space demarcations between work and leisure, although now with a technological twist: the creation of cyber-cafes is given as an example of the way these distinctions are eroding. For students today, it is said, “there are no longer huge separations between eating and drinking and working...flexible study/eating/wireless laptop space is getting larger” (Gale, 2006). Possibly York's 1962 plan had in mind a more fundamental convergence than that of “eating and drinking and working”.

There have been a number of American studies examining the academic performance of randomly-assigned room-mates in university residential

accommodation, to see if a “peer factor” exists in this setting that might affect performance. A review of this research concluded that these studies “generally suggest that peer effects do exist. Determining how these effects work is tricky, however...while superior students may foster better performances in some peers, others may find the company of intellectually superior students disconcerting, or intimidating” (Hoover, 2003). However, where peer effects (positive or negative) were found, they were small. More broadly, some American universities have tried to build the experience of living in shared spaces into the educational experience as it is more usually understood, using patterns of communal living to develop bonding between students and thus aiming to support learning (Kuh et al., 2005: 100). At the least, university residential accommodation can play a role in easing the transition for young people from living at home to living at university, perhaps thereby improving student retention; there may also be better conditions for study than are available privately (Edwards, 2000: 133).

Edwards provides an account of various approaches to the design of student residential accommodation (2000: ch 12). There is some evidence that certain residential designs suit some students, in psycho-social terms, better than others (Rodger and Johnson, 2005), which may point to the desirability of making available a range of residential types, on and off campus. The Robbins report reached the same conclusion in 1963 (Committee on Higher Education, 1963: 195).

### *Campus safety*

Students and staff need to feel physically safe in the university if teaching and learning are to be effective and efficient. There is a body of literature on this issue, drawing on work from town planning, design and criminology, which advises on overall campus design issues, individual building design, and issues such as lighting and landscaping: both Strange and Banning (2001), and Edwards (2000), devote chapters to this issue.

As with many other space issues, there may be trade-offs between one objective – increased security – and other desirable objectives, and there may be learning implications in some of these trade-offs: “target hardening”, by deterring outsiders, can reduce “openness and accessibility...and ideas in a rich mix of intellectual pursuit” (Strange and Banning, 2001: 135). On the other hand, human-scale, welcoming environments, constantly alive, are more likely to encourage activities of a sort that deter potential criminals.

### *Sustainability*

Environmental sustainability has become a significant feature in university teaching and research in recent years: around the world, new courses have been developed, or curricula have been redesigned, to address environmental issues, and a large number of university research units have been created in this field. It is also becoming increasingly significant in operational areas: the Association of European Universities “Copernicus-Campus” charter, for example, requires its signatories to “demonstrate real commitment to the principle and practice of environmental protection and sustainable development within the academic milieu” (Association of European Universities, 2007).

More specifically, the Higher Education Funding Council for England undertook a consultation exercise which led to its 2005 policy statement on sustainable development (HEFCE, 2005). This draws attention to, amongst other things, construction methods that minimize environmental impact, and estate management methods aimed at sustainability. Similarly, in the US, guidelines on enhancing indoor environmental quality (IEQ) in a sustainable manner have been developed, which are applicable to learning spaces (National Institute of Building Sciences, 2007). Insofar as sustainability issues will require architects and designers to give greater attention to reducing energy demands in new buildings by providing natural light and ventilation, and minimizing the requirements for mechanical heating and cooling systems, as is proposed in these reports, then impacts on learning spaces are likely to

be entirely beneficial. Sustainable design and operational practices may also provide examples of the campus being a tangible expression of institutional values; this may in turn, we may speculate, contribute to a more cohesive and effective learning community.

## 5 Findings

### 5.1 The campus as a learning space

There is some limited evidence on the role of campus design, as well as the design of individual buildings, in supporting student learning. As learning is a social activity, campus designs are needed that create welcoming, informal spaces for people to meet and talk, and perhaps to work in small groups (Yanni, 2006). The bland, windswept, charmless plazas which are a feature of some 1960s UK universities – “a preoccupation with imagery [which] led to architectural indulgence” (Darley, 1991) – presumably designed with the aim of creating social spaces, are not what is needed. One suggestion is that learning is helped by providing students with possibilities for a “socially-catalytic” “third place”, neither where you live nor work, a place to “hang out”, where new relationships may be explored and existing ones deepened (Strange and Banning, 2001: 146).

We have also noted the need for micro-design (of spaces, furniture, lighting and so on) to take account of learning needs.

These points, and their relationships with learning, need to be studied further. In particular, empirical data are needed to inject some rigour into the speculative and anecdotal writing on this topic; though obtaining such data will pose considerable challenges.

We have also noted that the question goes well beyond purely physical issues: learning is supported in the university by a range of organisational considerations, some of which may be conceptualised as concerning social capital. These structures and processes, linked to various aspects of learning, may help to explain differences in organisational effectiveness.

## 5.2 What makes an effective learning space?

### *Evidence from schools*

There is a long-standing and continuing tradition, in the UK and elsewhere, of applying an education-centred design philosophy to the planning of school buildings (DfES, 2002: 7). This tradition may be traced back to the start of publicly-financed education in Europe in the later 19<sup>th</sup> century. In the UK, this connection between building design and educational theories and methods received special emphasis in the post-1945 national school building programmes, where standardised, innovative school designs were created, for reasons both of cost-effectiveness and to allow new pedagogic methods to be readily applied (Maclure, 1984).

Furthermore, there has been a tradition in school pedagogy of careful observation of the differences that school designs and classroom layouts make to student behaviour and work (Loughlin, 1977), and in particular how these features affect communication among students, and between them and the teacher. Richardson (1967) discusses “ritual and symbolism” in the use and arrangement of classroom furniture, and its impact on learning – for example, how the teacher’s choice of seat in the classroom needs to be made with a range of factors about the pupils and the subject in mind. The function of external spaces at the school has also been studied closely (Armitage, 2005).

This level of detailed observation and reflection on the micro-organisation of teaching spaces is largely absent in the higher education literature. One brief report on this issue in a higher education setting agrees that: “There appears to be very little research about the university classroom landscape and its affect on student behaviour” (Hawthorne, 2002). Another brief account notes the importance of the layout of learning spaces – “the room might...be best seen as a teaching and learning product itself” – but provides no concrete guidance (Brawn, 2006).

Despite this long-standing interest in the connections between school space design and use, and learning, it is still argued that “the positive impact [on learning] of changing the environment of a school has often been overlooked” (Clark, 2002: 2). The limited literature on the topic suggests that this comment may apply even more strongly in higher education. However, Clark, in her study of international research on the connection between the quality of school buildings and learning outcomes, concludes that no reliable connection has in fact been established. Clark reports that some studies from the United States have concluded that small positive correlations exist between the quality of school buildings and standard test scores, after controlling for the socio-economic backgrounds of the school intakes before and after improvements were made to the buildings. These studies are, however, open to various methodological criticisms about the measurement of changes in outcomes, and do not provide a consistent pattern of results. The positive benefits, where they are said to exist, are in any case small. So, from these studies, the issue may perhaps be considered as being unproven, rather than, as Clark suggests, overlooked.

Other schools researchers have argued that, in the early years of formal education, a complex physical environment within schools can be a valuable aid to learning. Such complex environments are said to lead to longer attention spans, to encourage social interactions, and to other developmental benefits in young children (Loughlin, 1977). Clark’s more recent survey of schools research, however, does not point to this as being a significant current issue in the literature. A related speculative view on this point is that (as noted, section 4.2.2) “architecture can generate complexity; it can produce possibilities as well as limit, hinder and decrease the unfolding of events” (Kornberger and Clegg, 2003). No work has been found that makes this point in relation to space design in higher education, or suggests how these ideas might be translated into reality – unless the complexity that visitors find in negotiating many university campus layouts is placed in this category.

One of the most methodologically sophisticated studies of outcomes in schools, already mentioned (Rutter et al., 1979), based on a study conducted

in a group of London secondary schools, concluded that differences in outcomes (measured by scores for attendance, behaviour, examination results and delinquency) between schools could not be explained by such physical factors as the size of the school, the age of the buildings or the space available. In fact, the study found that “overcrowded schools tended to have somewhat *better* outcomes. Of course, we would not wish to suggest that overcrowding was actively an advantage, but certainly spacious buildings did not seem to be any kind of prerequisite for successful outcomes” (101; original emphasis).

However, Rutter and his colleagues did find a “significant association between good pupil behaviour and good maintenance and decoration and care of the building generally. Keeping the school clean, tidy and well painted...seemed to encourage the children to respect their surroundings and behave more appropriately” (1979: 195). That is to say, a cared-for physical environment helped the school to be more effective as a social institution, and hence a more effective educational one. This finding seems similar to that of Yarrow et al (2004) in relation to further education colleges.

### *Some problems with learning space research*

Despite this reasonably extensive body of work, some writers continue to assert that “little is known about the relationship between the [school’s] physical environment and learning” (Flutter, 2006). Flutter’s paper provides an account of various studies in which school students were asked how they would like the physical environment of their schools to be improved, and what they thought of the outcome. The paper argues that these physical changes led to improvements in learning.

A number of points arise from this paper that are of general interest in this area of research. Firstly, it seems from the studies reported by Flutter that the main wish of most respondents, regarding the physical environment, was for their school to achieve a reasonable basic level of maintenance – cleanliness,

decoration, repairing broken windows and so on – which may be thought of as being consistent with Rutter et al's earlier findings. It is not clear if the request by “many students” for “a calmer and quieter environment” is a comment on classroom management, or a call for the relocation of their school to a different area. Either way, space design and use will only be part of the solution. The specific examples given by Flutter of changes made as a result of student involvement, and said to be linked to learning outcomes, come down mainly to colour schemes and floor coverings (and in one case, somewhat bizarrely, hammocks).

The second point is that the author (and it seems the authors of the various studies on which she reports) appears to have overlooked the possible presence of a Hawthorne effect – that is to say, any improvements in learning detected (or even students' beliefs that such improvements had come about) may have come from the mere fact of adult outsiders taking an interest in conditions in the classroom, rather than resulting from the particular changes that were implemented. One of the student respondents surely comes close to acknowledging this in saying: “I like [the redecorated classroom] because it makes it different from other classrooms” (Flutter, 2006). The control given to the students over their environments would also have been a further positive factor. In other words, it was change as such – and perhaps having some control over change – that was important, not the precise nature of the physical changes: not the particular colour scheme selected. The physical changes might simply be symbolic of an enhanced sense of control, of personal autonomy. It could be argued that, providing improved learning was the result, the mechanism hardly matters; except that there may be more effective ways of developing personal autonomy than classroom redecoration.

The third point is that what was being measured were student responses to the changed environment, not learning outcomes. The (generally unstated) assumption is that positive student responses will lead to improved educational outcomes. This vital link was demonstrated statistically by Rutter et al, and a causal mechanism proposed. Although this linkage is clearly plausible generally, it is not demonstrated in the studies reported by Flutter.

*Research in higher and further education*

A similar methodological approach, that of asking users of a new building how it has affected their work, was taken in a study commissioned by CABE, “the Government’s champion for design quality in the built environment” (CABE, 2005). This study asserts that “the existence of well-designed buildings on a campus is a significant factor in the recruitment of staff and of students” (7). In fact, the evidence of the surveys reported, conducted among staff and students about the effects of “iconic” buildings completed between 1996 and 2001 at five UK universities, is more ambiguous about recruitment and retention issues for both staff and students. Although overall a majority of both groups mentioned the new buildings in a positive way (however, in some particular cases only minorities of both staff and students reported any positive feelings at all – this rather damning comment on the architecture in question is not explored further in the CABE study), there was no sense of how powerful an attractant this factor was in comparison with, say, pay and prospects for staff or course-related issues for students. It would surely have been surprising if, overall, there had been a negative response to the provision of expensive new buildings.

The CABE study also investigated the effect of the new buildings on staff and student perceptions of their performance. Overall, some 80% of staff recorded positive impacts, with students at about 50%. The causes of improved student performance were, it is reported, attributed by respondents to three factors: “First, they helped to motivate students in their work. Second, they facilitated inspiration amongst students, and finally they provided key facilities critical to course content” (CABE, 2005: 39). It is hard to know what to make of these findings: how, exactly, did the buildings provide motivation? Motivation for what? How did motivation differ from inspiration? Presumably any standard industrial shed that met purely functional needs could have provided “key facilities”. The CABE study does not cast any light on which particular features

of buildings provided these benefits (was newness itself inspirational, for instance?) – even if the report had made clearer what the benefits were.

A study of the impact on new buildings in the further education sector raises different problems. In this case, in considering the impact of the £750m per year FE capital programme, a positive correlation was found to exist between capital spending and increased student numbers in the colleges benefiting from the spending. The data show that roughly every £10,000 of capital spending produced one extra student, with improved success rates in those colleges whose success rates were previously below average (Frontier Economics, 2007; Lee, 2007). However, the correlation does not necessarily point to a causal connection, as it is plausible that the colleges receiving the new funding were those that were developing new programmes and therefore attracting more students in any case; or where, before the new building, lack of space limited student admissions. This is in effect admitted by the Association of Colleges in commenting on this study, saying “high-achieving colleges end up getting more [capital funding]”, though its spokesman went on to argue that student achievement was improved as “students [are] doing better because they are inspired by their surroundings...new buildings raise expectations and raise hopes. It sends a message to students that this is something different and better.” (Lee, 2007).

It would be wrong to dismiss this claim simply because no data are advanced to support it. It is, for example, consistent with the evidence from Rutter et al, cited earlier, that cleaner, tidier school learning environments lead to improved learning outcomes; this may be a similar case in point. What is not clear is whether it is new buildings *as such* that have made the difference (if one exists), or the cleaner, brighter environment that has resulted: or, indeed, something completely different. This study raises more questions, then, than it claims to answer.

Claims about improved student learning in higher education through better space and facilities design are also put forward in the 2006 SFC report, drawing mainly on a number of studies from the US. Although these studies

have tried to achieve some methodological rigour by using control groups, considerable difficulties remain. For example, the Technology-Enabled Active Learning (TEAL) Project at the Massachusetts Institute of Technology involved “media-rich software for simulation and visualization in freshman physics carried out in a specially redesigned classroom to facilitate group interaction”. The project assessed student learning before and after studying electromagnetism in the new learning environment, as compared with a control group of students taught under normal conditions. The experimental group members were found “to have improved their conceptual understanding of the subject matter to a significantly higher extent than their control group peers” (Dori and Belcher, 2005).

However, this was not a controlled trial in the correct sense of the term, as obviously the experimental group members knew that they were receiving special treatment, and it is improbable that the control group was not aware of this. The mere fact of selection or non-selection could be expected to lead to changed learning behaviour. Furthermore, aside from the technological emphasis and physical changes, different teaching methods were used for the two groups. A range of factors might therefore have led to the improved learning detected: the redesigned classroom could have played some, or no, part in this.

The conclusion from the literature points to the link between space design and learning outcomes being weak at best, and it may often easily be masked by a number of other factors. A high proportion of the literature makes unsupported, or anecdotal, claims about the benefits of new designs or new configurations of existing space. Where they are presented, empirical findings are usually flawed, as they either tend to report changed student attitudes (rather than learning outcomes), or where learning outcomes are reported, they fail to take account of observer effects of various kinds.

The difficulties in designing research meeting ethical standards (and some of the studies examined here seem at first sight to raise ethical problems) that can distinguish between the input to learning from the physical environment

and from other sources are formidable, and do not appear so far to have been seriously addressed. It is possible that a separation of the learning process into neat parcels of different sensory inputs is theoretically, as well as practically, unlikely: if “a curriculum in higher education is...a set of experiences that a student inhabits, experiences that arise out of the student’s interactions with his or her ‘learning environment’” (Barnett and Coate, 2005: 44), then any attempt to trace the influence of one particular thread of experience may well be doomed.

### *Evidence from student surveys in higher education*

Moreover, other work in higher education suggests that students are not over-ly-concerned about the spaces in which they work: “it is clear”, reports one recent study, “that many of the physical aspects of the University services are not important with regards to student satisfaction” (Douglas, Douglas and Barnes, 2006). Other studies (for example, Watson, 2000: 76; Wiers-Jenssen, Stensaker and Groggaard, 2002; MacDonald, 2004) have similarly found that most students place emphasis on the teaching abilities and subject expertise of the staff, tutorial support, library and ICT facilities, and other matters directly related in students’ minds to teaching and learning, rather than on physical facilities. Where respondents comment on the physical environment and its link with learning, it can be unclear what they had in mind. Wiers-Jenssen et al (2002) speculate that particular campus design features may support social interactions and so encourage positive attitudes about the university and hence to learning – a point also made, as we noted, by Strange and Banning (2001). Again, the link in the Wiers-Jenssen et al study between space and learning is indirect – and therefore hard to detect.

Other recent studies suggest that findings showing that students give a low priority to space issues may have quite wide international validity. In a large-scale survey in a US public university, “faculty preparedness” was found to be the key predictor of student satisfaction, and “different perceptions of campus facilities and services have relatively little affect [sic] on the varying

satisfaction of students” (Thomas and Galambos, 2004). A study from universities in Singapore, using a different methodology and attempting to compare students’ expectations with their actual perceptions of their universities once their courses began, found that issues of course content, workload, learning and assessment were greater causes for concern than matters to do with the appearance of the university and its physical facilities (Tan and Kek, 2004).

A large-scale study of English further education colleges, however, while finding that issues about working spaces were of more concern to staff than to students, did reveal student concern about the extent to which college buildings were “clean and welcoming” (Yarrow, Robson and Owen, 2004). This seems to be consistent with Rutter et al’s finding in secondary schools about the importance of good care and maintenance of the buildings (1979: 195).

It seems that it is the academic community which tends to highlight perceived deficiencies in the physical environment in university internal surveys (Bean, 2005): this may be because staff members spend a larger proportion of their lives in these spaces than any given student cohort, and may have higher expectations, based on wider experience, about what is and is not acceptable. To the staff, the buildings are a type of home; to students, they are merely places to come to for limited periods for a specific purpose. The two groups therefore give physical features different levels of importance relative to other organisational issues. (I am indebted to my colleague Karl Wall for this suggestion.)

Although matters connected with physical facilities seem to be ranked lower by students than issues directly related to teaching and learning, this is not necessarily to say that the physical environment does not matter to students. It seems plausible that, if the students surveyed found the physical facilities to be acceptable or better, they would not raise them as concerns. (It is perhaps significant that students in the further education survey cited above did raise concerns about premises issues, albeit not specifically about teaching

spaces.) Had they found them unacceptable, at least in comparison to the teaching and learning activities, they may have taken a different view. We may go further and speculate that where students are broadly satisfied with the teaching and learning process, environmental matters may appear higher up their lists of concerns; but that concerns (justified or not) about teaching and learning may crowd-out environmental issues. As with the findings from schools, then, the link in higher education between the physical environment and learning is a complex one, tied up with many other aspects of being a student and a member of an institutional community. It seems reasonable to conclude that a good standard of basic building care and maintenance is a necessary, but not a sufficient, condition of good learning outcomes.

It should be noted that, frustratingly, a substantial proportion of the literature on student satisfaction surveys deals only with the methodology used and general organisational implications, not mentioning at all the substantive comments made by students (Watson, 2003; Moller, 2006). This may in some cases be because of a reluctance to expose critical comments about institutions to public view.

### **5.3 Flexible space and academic staff resources**

Redesigning learning space on new, flexible principles may not be enough in itself. It is not clear that the implications of flexible space design for the use of academic staff time have been fully considered. As we have noted, Dittoe's (2006) vignette seems to imply that teaching staff are more or less constantly available to provide informal teaching in the re-configured learning space. Given the finding noted above from student satisfaction surveys, this access to teaching staff is likely to have a larger impact on student views reported in any subsequent evaluation of the redesign than the purely physical changes. Yet it will probably be impossible for respondents in such an evaluation, and for the evaluators themselves, to distinguish which of the two causes has led to any improvements in learning that may be detected.

Very little is said in the literature about the effects of managerial policies, generally speaking, on space use (as considered by Barnett and Temple, 2006). Yet pressures from institutional budgeting to improve the efficiency of space use, thus reducing overall space costs, may have important effects on the quantities and qualities of the learning spaces available. Equally, where costly new spaces are provided, there may be pressures (for example) to lengthen the teaching day, or week, or year, to make fuller use of them. Space issues may thus drive learning arrangements in ways not often mentioned in the literature. Managerial decision-making about space use and learning is an under-researched topic in the literature.

#### **5.4 Technology and learning spaces**

Technology has not made large demands on learning space design: indeed, the ubiquity of wireless-enabled laptops and wireless networks means that any university space, inside or outside, can now quite easily be used for ICT-based learning. Although for some spaces (for example, where HIVEs (highly interactive virtual environments) are provided) there will be special demands for display screens, cabling and so on, this will be a small part of total demand; the lack of comment in the literature on such facilities suggests that it is not seen as a particular problem. Again, flexibility in space design, allowing adaptation to new uses at reasonable cost, will be more useful than spaces designed expressly for a technology with a short (and shortening) lifespan.

#### **5.5 Creating a learning community**

Learning in higher education takes place most effectively in a community setting; the need for a coherent physical presence to nurture this community is one explanation of the well-known longevity of universities (Kerr, 1987). There is obviously a great deal more to creating a community than providing a suitable built environment (as we considered in section 4.1), but the

interactions between space, social interactions and learning need to be better understood.

## **5.6 Technical space issues**

Flexibility is a key design consideration for modern learning spaces, breaking down barriers between what were formerly seen as separate domains (group work spaces, the library, the cafeteria and so on). The physical environment needed to support modern approaches to learning, particularly collaborative, project work, is considered in a lengthy American study (Wolff, 2003). As a useful summary of many of the points made earlier in the present study, this paper summarises the design considerations that need to be considered for learning spaces :

- group size – variably-sized spaces for individual and group work
- structural aspects – flexibility of layout; durability of surfaces; access to services
- functional spaces – special requirements of classrooms, laboratories, studios, project spaces
- adjacencies – connections to other people and spaces, internally and externally; access to storage
- psychological and physiological aspects – spaces providing a sense of belonging; private spaces; natural light, heating and cooling
- furnishings – versatile furnishings; variable lighting; display areas.

The design process for learning spaces should involve the intended users of the space (students and staff), and architects and designers with relevant specialist skills. This process should be seen as part of the institution's overall management of teaching and learning, not a separate technical matter.

## 6 Conclusions and recommendations

Understanding the university space is an important element in understanding how universities work – with regard to teaching and learning, but also more broadly. This is a methodologically difficult area, but one that needs more attention.

As one part of this improved understanding, campus and university building design needs to give more consideration to the social underpinnings of learning. Providing welcoming and flexible spaces, including informal meeting spaces, should be seen as part of the support to learning through developing the wider learning landscape. The role that such spaces can play, and the most effective design ingredients for them, needs further study. Clear technical recommendations are needed on the best ways of providing such spaces in different university settings.

It is speculatively suggested that an “architecture of complexity” (but not an architecture of confusion) can encourage new ideas and creativity. No evidence is available to support this claim, but further research should be encouraged, perhaps under future HEFCE CETL programmes. Meanwhile, efforts should be made to conduct evaluations of new learning spaces, in order to provide guidance as to the learning benefits, and the financial and other costs, associated with them.

The apparent connection between day-to-day premises maintenance and learning may need to be drawn to the attention of institutional managements. It seems that small things may make a big difference to learning: grand architectural statements may not be necessary.

We need a better understanding of the role of space in the dynamics of creating more productive higher education communities and its connections with learning and research. This should be the subject of further research. The literature throws almost no light on managerial decision-making about

space issues affecting students or staff: this is a topic where further work would be useful.

Technological change is said to be affecting the nature of learning itself, as well as the ways in which it takes place. The implications for the design of learning spaces seem to be limited, however: flexibility in space design should be the priority. The rapid (and unanticipated) growth over the past few years in the use of wireless-enabled laptops using broadband networks has meant that the need for specialist ICT spaces may be declining. Further technological change will be equally unpredicted. Future-proofing in space design terms can best be achieved by providing comfortable, pleasant spaces that can be readily used in a variety of ways.

The university, space and learning are intimately connected. Untangling them is perhaps impossible, as well as unprofitable. Nevertheless, greater sensitivity to their interactions seems likely to be worthwhile: it seems possible that relatively small improvements may be amply rewarded in learning benefits.

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