ABSTRACT

Over the past ten years we have noted the embracing of sustainability as a core precept in both the architectural profession and in schools. Where before energy issues, sustainable materials and development, the energy cycle and lifetime cost of a building was seen as specialist territory, these issues, and the knowledge and practical skills needed to integrate them to any design problem, are now embedded in all architectural practices no matter how small, how remote. This has been due to a whole series of factors - a growing understanding of the impact of development on the environment, UK and EU legislation, crisis in the construction industries, and not least rooting the concept of 'greenness' in the public's imagination.

Thus students entering any design course are likely to have encountered the concepts of energy consciousness, sustainable resources and the global environment particularly from primary school where much project work and creative play will be involved in bringing the subject to life and making it relevant to their own circumstances.

How then are these ideas becoming manifest in the output of students? What are the possible vehicles for fostering and demonstrating good practice in this area? This paper examines the teaching of sustainable design within one school of architecture in the UK. In examining the range of teaching practices in the Mackintosh School of Architecture it explores the experience in recent years in realigning sustainability to a core position within the syllabus, and asks how we support and nurture sustainable design practice within architectural education in the UK.

INTRODUCTION

In 2001 the opportunity arose to consider how best to articulate the technical requirements of our degree with the creative studio-led work which accounted for the greater part of the programme, and to do so in a way that provoked a stronger dialogue between studio and technical staff, and required students to demonstrate their understanding of 'environmental sciences' and structural design, not in the abstract but within their own design solutions. As the studio team we had overall responsibility to define and deliver a programme of studio projects to a cohort of architectural students at a key stage in their education - within their junior honours year and at the threshold of the first year of formal work experience. However we were aware the designing of these studio vehicles might benefit from a more effective consideration of the environmental drivers during their planning and subsequent execution. The process also provoked an examination of our own teaching practice to establish good practice and to discover the barriers students were encountering which hindered a more holistic view of the built form and environmental considerations. This paper describes how studio practice has since developed, set within the context of the ongoing debate on sustainability in architectural education in the UK.

II. THE EXTERNAL CONTEXT

Designing for the environment, being 'green', is taken as read in both student's work and in practice. What was until relatively recently seen as a specialist activity, has now entered the mainstream. The 'Environmental' agenda is now a constant presence within the media and a growing preoccupation in our daily lives. A growing awakening to the precarious environmental balance and fundamental and dramatic shifts in climatic conditions have lead to a demand for architecture that is responsive, responsible and beneficial. Changes in legislation and the general drive to make our buildings more energy efficient, mean that good design in the studio - whether
in a practice or in a school of architecture - now has to embrace sustainable principles and practice. Indeed the ARB (Architects Registration Board - the body responsible for prescribing the qualifications and practical training experience required for entry to the UK Register of Architects) has embedded throughout its criteria describing the key thresholds of experience and knowledge needed by students of architecture, the notions of "humans well-being, the welfare of future generations, consideration of a sustainable environment", (ARB 2002: 5) 1

The Royal Institute of British Architects further amplifies this in its publication 'Tomorrow's Architect', which sets the scene for any student of architecture in the UK and defines not only the levels of expertise and knowledge required to join the profession, but describes the ethos underpinning prevailing attitudes and accepted thinking. "The architect needs to understand the processes of the construction of buildings. The knowledge required is extensive, ranging from the nature and properties of the available materials and established construction techniques to the possibilities raised by new technologies. This knowledge may be gained in a number of ways.... But it must be demonstrated in design project work", (RIBA 2003: 23) 2.

Key to this is the stipulation that students are able to apply their knowledge, to put it into practice strategies, theories and principles during their academic training, in order to appreciate the complex nature of practice itself. In many respects this was nothing new, but merely a restating of a position which been held widely for the past decade. What was new was directness of the statement and the expectations that it held for those studying and teaching today.

Within this context the profession read simultaneously in 'Building Design' magazine of the findings of a report prepared for the government funded Centre for Education in the Built Environment. The article stated, "Architecture schools are failing to teach the importance of sustainability in building design, according to new survey of the UK's 36 architecture schools." The report finds that sustainability is rarely considered in the design curriculum and, when it is the subject is treated as a one-off project or tagged on to an existing brief. Also a majority of schools have 'only one or two lone individuals' who teach students to use sustainable design features such as energy efficiency and materials that cause minimum harm to the environment. It also criticizes the validation bodies for architecture qualifications, the RIBA and ARB, saying that the validation criteria should be rewritten to encourage schools to put sustainability in the mainstream of architectural learning. An RIBA spokesman said "these comments are a shock to us. The RIBA introduced sustainability into the core curriculum of RIBA recognized courses three years ago", (Building Design 2003:7) 3. The only schools the report commended for their approach to sustainability are Cardiff, the Mackintosh in Glasgow, Oxford Brookes, Portsmouth, Sheffield and Westminster (CEBE 2003) 4.

Of the schools mentioned one consistent factor was a strong studio culture, along with a sizable number of staff interested or research active in the field. The lack of representation of engineering-based courses and those located within departments of the built environment was notable. The report used a series of methodologies including formal studies, discussion groups and events to quantify and describe the range of sustainable teaching going on within the educational community. It also goes some way to describe the circumstances that foster a sustainable architectural education.

'Teaching sustainable design demands that we think outside the architectural 'box'. Sustainable design is an interdisciplinary activity that demands a systematic approach to the design process. This approach recognizes that a building is a time-bound process where space is created through materiality, rather than a timeless artifact where materiality encloses space as a product. What happens when the making of space is dictated by the material resources? Ecological design demands that we engage with materiality as a living, evolving entity.’, (CEBE 2003: 19) 5.

III. PRACTICE AT THE MAC
Teaching architecture at the Mackintosh School remains in many ways a ‘traditional’ studio-based system, the studio being the focus of and location for the majority of a student’s education. Over the past two decades there has been a gradual shift to integrate wherever possible elements of theory courses delivered as allied subjects into studio projects, with a view to making more explicit the connections between these subjects and the studio design process.

One area where this has been adopted across undergraduate teaching is in Architectural Technology, where elements of the lecture-based course are embedded and tested through a studio-based output. Often this is achieved through both studio and subject specialist staff being sharing the delivery of lecture courses, and in parallel specialist staff having input into the shaping of studio projects. Cited as one of two case studies by CEBE “The school addresses all aspects of sustainability including social, economic and environmental issues through lectures and studio work. Sustainability is not the central concern of the school but is seen as an essential aspect of architectural design, which should influence all students’ thinking without overriding other aspects of technology and design. The strategy for teaching sustainability is twofold and includes integrating sustainable issues in the studio briefs and closely linking lectures on sustainable design to the studio work so information gained in lectures is applied to studio projects”, (2003:25).

Within certain years, students are tested in their knowledge and their ability to apply this in a studio setting and to a significant level of detail. This is the case in the third year of studies where embedded within the two major studio projects are technical studies each of which demands certain conditions, one environmental and tectonic, the other structural.

IV. EVOLVING THIRD YEAR PRACTICE

Wishing to build on the existing practice in the third year, the main opportunity to explore a student’s ability to provide a sustainable solution to a brief was also the vehicle to explain a coherent environmental strategy. With an interest in devising projects that had quantifiable and testing environmental conditions the studio and architectural science team looked for scenarios where a close narrative thread linked the brief with a sustainable approach. This came from a conviction born of experience that, where particular environmental conditions were merely overlaid, a clear understanding of the holistic benefits a sustainable approach can make are often lost or at least underappreciated. Having initially settled on the generic type of a sophisticated shed – a medium sized building of moderate complexity but one with a responsive envelope that demands a keen understanding of the use of materials. The shed or factory has a further key factor that lends itself to a sustainable solution, that of an efficient and effective use of a limited budget.

"Factories demand a fundamental and unique approach to design. It’s obvious that they have to be cheap: this requires a knowledge of materials and construction techniques. But they also depend on the manipulation of infrastructure, the capability for change, the understanding of different scales and an almost ritualised regulation of the interplay between people, goods, waste and information. In short, factories are the closest phenomena to urban life to be packed into a single

Running in parallel with these aspirational conditions ran a set of environmental imperatives. The building should be passively heated, cooled, ventilated and responsive to the seasonal changes and the workforce. Teamed with the hygiene issues this required an early grasp of certain strategies which harnessed the use of materials, siting and built form.

CEBE echoed it thus "All materiality begins in a specific place. This forces an act of ‘creative realism’ upon the designer who must solve the problem through the resolution of the conditions that are always specific. Even a generic solution must find its ‘place’ through a contextual understanding of the natural forces arising in a specific site", (2003) 7.
V. DEVELOPING APPROPRIATE STUDIO VEHICLES

Developing suitable studio programmes from the basic starting point has involved some lateral thinking. It has also required us to mute certain elements of the design mix, namely the complexity of context so students can concentrate on the dynamic between programme and technology.

An early project, a Cheese Factory, was set within the context of an existing auction market site, becoming both a production space and a sales outlet. Although modest in size its aim was to raise the profile of the product it produced as it presented faces to both town and public. Through its form and use of materials, the building aimed to demonstrate an understanding of low impact, energy efficiency, as well as providing an effective and responsive place to work in. Set in the social context of a series of well-documented food scares, the project required that students examine the arguments and circumstances in which our food is produced. The building offered an opportunity for the interplay between the senses and the rational mind, a sound business decision as well as a manifesto of their belief in a sustainable future.

The Orchid house offered a different set of challenges and conditions to be met in a building of similar size and scale. While hygiene no longer was an issue, the building requires an understanding of ambient light versus sunshine, maximising day length in a northern climate and the ability to harness the sun's potential as a heat source in the winter while guarding against overheating in the summer. An understanding of the needs of a specific collection of orchids defined and focused the argument on biodiversity, as well as highlighting the variable and potentially contradictory needs of differing species.

More recently, with a growing understanding of the key constituent parts that make for an interesting and challenging brief, and of the most effective combination of studio and technical staff input, we have developed a series of more complex building types. In these the aim is not to increase the complexity of the planning or functionality of the building but rather to offer a more loaded environmental context. In some ways this move away from the shed has meant that the buildings required are more one offs rather than easily recognised generic building types. However it has allowed us to explore a more diverse range of situations, and perhaps more importantly required the student to interrogate more thoroughly.

In The Kelvin Archive, a home was proposed for a collection of rare books and manuscripts of the key Glaswegian academic, providing evidence of the emergence of modern science in the 19thC. Embedded within the subject matter was the transition of scientific activity from a philosophical activity to the experimental, empiric science we recognise today. Students were encouraged to demonstrate an understanding of the required environmental conditions while exploring the haptic experience of the building, essentially a synthesis of scientific rationale and building poetics. The paradox of the contradictory environmental conditions required for conservation and research were also considerations.

In 2006 a Reptile House, a geographically displaced environment dedicated to animal required a setting for conservation through observational and breeding programmes. Classified as ectothermic (cold-blooded), reptiles do not generate enough heat to maintain a constant body temperature, necessitating behaviour which exploits environmental conditions for survival. Hence the building must mediate between two different climates, the equatorial rainforest habitat and Glasgow. The principal Vivarium, a 18m high equatorial habitat threw up the twin challenges of high performance envelope with the scale of space. The project also opened up much broader attitudes towards the environment and climate change, providing a critical context for the work.

Our current project has required students to design a Wreck Conservation facility in a small fishing town on the east coast of Scotland. Environmentally the main conservation hall must be able to maintain a stable temperature throughout the year whilst resisting a fluctuating level of humidity associated with the cleaning and conservation of historic boat wrecks. The project has
an added impact on its location in adding to local industry and looking to sustain the viability of a small community facing up to a shrinking fishing industry.

As well as finding ways for studio projects to tie into lecture courses and bring their information to life, we have also considered how we can adapt our studio teaching to support these projects. As key elements within each project, design in detail tutorials are held involving small groups of student discussing their design proposals with a member of the studio team and another from the architectural technology team. This allows us to give clearer, more focused advice, where any contradictions can be ironed out immediately with a variety of differing strategies examined. Over the past five years this has led to an increased confidence within the studio staff to discuss sustainable approaches where before this may have been viewed as specialist territory. It has also led to areas of this knowledge then feeding into their architectural practice beyond the teaching studio.

VI. BEYOND THE STUDIO: CONCLUSIONS

Our aim has been to engender a sense of the holistic nature of a sustainable practice within students, particularly before they enter professional practice for the first time. We hope that this leads to a confidence and curiosity within them, and the ability to question the design and construction norms they encounter and think creatively irrespective of the context they are operating in.

What deters them from pursuing this approach with conviction? At the Mac "The biggest barrier mentioned to increasing the integration of sustainability in the students' work is the lack of inspirational architecture that is sustainable and more importantly the lack of polemic critique and emphasis on the sustainable aspects of inspirational architecture in the architectural press, including constructional detail", (CEBE 2003: 25) 8.

Reflecting on this area of teaching we are also conscious that we need to shift our terminology if not our emphasis on to climate change rather than sustainability alone. We also need to consider the reuse of existing buildings rather than looking at new build alone, particularly when considering that a considerable percentage of work in practice relates to this type of work. Finally we also need to consider projects that students can "reflect on their own lifestyles, transport used and the impact on the environment" (Oxford Brookes 2008) 9. This opens up other potential project types including housing, communal living spaces etc.

Through discussion with our student body, over the next year we aim to gain insights from the experience of students currently in practice as to how they far they were able to apply their knowledge, to further develop the teaching strategy throughout the Mackintosh School, particularly in to Graduate Studies and so embed it across the five years of formal architectural education.

REFERENCES


"Schools "weak on sustainable design". 2003, Building Design, issue 1581, May 2003


last accessed 22/02/08

Routledge: London

Oxford Brookes University, January 2008. Brief summary and Outcomes,  
Designs on the Planet; Studio culture and the challenge of Climate Change  
One day conference,

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