Designs on the Planet
A workshop series on architectural education and the challenges of climate change

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ABSTRACT: The design of human settlements is a key factor for addressing carbon emissions, finite resource availability, ecological deterioration and climate change. The role of architectural education in promoting the principles and practices which address these issues is significant. New pedagogic paradigms are required to produce graduates endowed with holistic competences including environmental knowledge related to sustainable design. These competencies are set to become a compulsory part of professional architectural education in the UK , although the successful incorporation of technical principles within creative design still faces a number of pedagogic barriers. To address these challenges, the Designs on the Planet workshop series was set up as a national forum. Its primary aim was to contribute to the development of environmental responsibility as a creative factor in the practice and pedagogy of architecture. The workshops were attended by academics, educators, practitioners and representatives of professional bodies. This paper reviews the year-long process of DoP, presenting the conclusions of the workshops, exploring the results of the application of the pedagogic principles within participating universities and discussing new teaching methodologies and curricular structures which could facilitate overcoming the divide between sustainability- related building sciences and architectural design in higher education and professional practice.
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INTRODUCTION

In 2007, the UK government declared that all new housing and schools should be 'zero carbon' by 2016 [1] and all buildings are expected to be 'zero carbon' by 2019. Students entering architecture programmes in 2009 need to have all the skills necessary to meet these requirements by the time they graduate. The two questions facing the design community are: how can we enable architectural educators and students to respond appropriately to the challenge of climate change and what are the new pedagogic paradigms that are required to facilitate this?

The last UK review of architectural education in relation to sustainable design teaching revealed a major split between studio teaching and academic lecturing in technology [2]. At the same time, Guy and Moore have identified that there are many plural approaches to sustainable design in architecture [3], making it difficult to formulate any changes unless these are directly responsive to the modes and cultures of teaching involved. They have called for 'symposia and other dialogical spaces' that can address matters pragmatically. This paper identifies key barriers and opportunities within the UK architectural education system in relation to meeting the climate change challenge and draws parallels with similar endeavours in other international contexts. It does so in the context of a pragmatic initiative called 'Designs on the Planet' (DoP), which iteratively explored new approaches through three sequential national workshops.

DoP BACKGROUND

To address these new pedagogic challenges and facilitate discussion and exchanges between academics, educators, designers and representatives from professional bodies in the UK, the Designs on the Planet (DoP) workshop series was set up as a forum by Oxford Brookes University, the University of Nottingham and Cardiff University. Its primary aim was to contribute to the development of environmental responsibility as a creative factor in the practice and pedagogy of architecture. Both Graham [4] and Orr [5] have identified taking ethical responsibility for design as a pre-requisite to improving environmental design. The workshop series was sponsored by CEBE (Centre for Education in the Built Environment) and supported by the RIBA (Royal Institute of British Architects), as well as by industrial sponsors. The workshops attracted representatives from the majority of Schools of Architecture in the UK (34 out of 41), and

included internationally renowned academics, educators, practitioners and representatives of professional bodies.
Each workshop commenced with keynote speakers followed by a series of parallel brainstorming groups examining different aspects of architectural education in practice and a plenary session that distilled the findings of the workshops into summary recommendations which were circulated to attendants and, then, forwarded to SCHOSA (Standing Conference of Heads of Schools of Architecture, UK), and RIBA.

DoP1 – OXFORD BROOKES UNIVERSITY

The first DoP workshop, held at Oxford Brookes in January 2008, set out the challenge of addressing climate change within a studio culture. It attempted to initially define the territory that needed to be covered, including setting criteria for assessment, establishing benchmarks in the studio, identifying best practice and tools, and, finally, the role of 'imagination' and 'evidence' in the studio.

The president of the RIBA gave a key-note speech introducing a new 'carbon briefing' [6] for UK architects and challenging educators to pick up the baton. Other speakers demonstrated new approaches and tools in both practice and education, including a 'zero carbon' comprehensive design project for final year students that insisted on urban projects being planned for zero carbon at both the macro and micro scale at the same time. New tools in the workshop included using 'post-its' and a 'dialogue board', where the 'post-its' were placed as an open source of questions and comments from participants in response to issues raised by the initial speakers, which threaded through the workshops into the plenary.

Both the assessment and benchmarking workshops concluded that students and Schools of Architecture should be encouraged to set their own benchmarks and assessment criteria, rather than trying to follow any kind of national curriculum. This is very much in line with Guy and Moore's thoughts on adopting a plurality of approaches to address sustainable design [3], while at the same time encouraging students to adopt a position of accountability. The 'best practice and tools' workshop allowed staff from different schools to individually showcase their one 'best tool' for the benefit of others. This proved remarkably fertile ground and staff were eager to ensure the exercise was repeated regularly at a national level. The fourth workshop concluded that imaginative projects could be evidence-based but that studio design tutors were not skilled enough to address the climate change issues yet, and that a national CPD (Continuing Professional Development) programme was urgently needed to enable tutors to do so. At the same time, it was agreed that both staff and students needed to be able to envision buildings in a future that will be radically different from the present in terms of environmental conditions.

The plenary session revealed the depth of concern and commitment among staff, when virtually every single participant agreed they would return for the next national workshop. The plenary agreed that the action points identified by the four workshops should be taken forward to the Standing Conference of Heads of Schools of Architecture (SCHOSA) to endorse. As a result, for the first time this body committed itself to asking all Schools in the UK to review their teaching in relation to climate change and report back to SCHOSA after a year – a major policy shift in architectural education had taken place. At the same time, the RIBA agreed to assist in the development of a CPD programme for tutors related to its own professional 'carbon briefing' programme.

DoP2 – UNIVERSITY OF NOTTINGHAM

The second DOP workshop was held at the School of the Built Environment, University of Nottingham, in September 2008. The workshop focused on the development of design briefs at undergraduate and postgraduate level, integrating principles of sustainability and climate change. The event was attended by more than 60 academics as well as by practitioners and representatives from industry. The DoP2 workshop featured key-note presentations given by internationally renowned professionals and two parallel brainstorming sessions (one in the morning and one in the afternoon), whose results were presented and discussed within plenary sessions. The sub-themes which oriented the discussion in the morning parallel four workshop groups focused respectively on: definition of a framework for the writing of design briefs; integrating teaching methodologies; criteria for assessment and marking of technical and creative work; and, barriers and challenges for integration. The outcomes of the morning brainstorming session resulted in a series of identified educational practices related to these various areas.

The first workshop group emphasised the need to define a clear direction in the definition of academic programmes and design briefs, establishing the educational targets to be achieved at different stages of the curriculum. It was agreed that academic curricula should be flexible enough to accommodate different teaching practices, yet maintain a prescriptive component to guarantee the achievement of established pedagogical objectives. In the definition of briefs, contextual issues should be given primary importance and also consider interventions in existing buildings/urban contexts rather than just new build. Design tutors need to be fully aware of the challenges of climate change and incorporate this awareness within their pedagogical attitude. It is also important to encourage students to emphasise reflection and critical self-evaluation of their work in order for them to take full ownership of the challenges of sustainability and increase their enthusiasm for environmental design.

The second workshop group highlighted that integrated teaching methodologies require a thorough pedagogical process, whereas fundamental environmental contents are delivered in a technically-sound, but yet inspired way, in order to facilitate their embracement in design. To do so, rules of thumbs and principles to be applied at the early stages of development can often be as important as calculations, although a clear balance between design and verification methods has to be clearly agreed to facilitate a fair assessment and moderation of outcomes.

The third workshop group revealed that some technical content of environmental design (e.g. noise, thermal, ventilation aspects, etc.) are hard to teach in an inspired way, particularly in terms of integration with design. Clarity and transparency in the definition of qualitative and quantitative criteria/benchmarks are needed to ensure a clear set of marking standards for students, part/time tutors and visiting critics, and also consistent assessment processes across different studio units. It was suggested that the design approach should start with the experience (e.g. a small experimental building), and then proceed with quantitative measurements and more precise calculations. One possible pedagogical approach in this direction could include a 'bite-sized' project at the start of the course, and then the achievement of full environmental integration later on (e.g. in year 3 or 4). Contextual exempla and real case studies should always be provided to increase evidence-based learning.

The fourth workshop group agreed that the main challenge is represented by the actual complexity of the design process, at every level of education. Making degrees multi-disciplinary is an essential objective; this should be based on stronger links amongst staff. Finally, in terms of opportunities, there is a need to change students' expectations, developing an appreciation for issues of sustainability and climate change and their value within the design.

In the afternoon, DoP2 participants were asked to join specific year-based 'charette' groups - covering every level of architectural education - in order to design a written brief. It was established that design briefs in the first year should integrate sustainability and climate change in a poetical and cultural way, focusing on people and environment to create/encourage passion and enquiry. The acquired intuitive skills should then be refined through better understanding of the quantitative aspects that influence the success of a design, towards a full holistic exploration in year 2 and, specifically, in year 3, where tutoring and student-developed briefs should aim towards a balance between guidance and freedom. At postgraduate level, one of the main challenges for the successful integration of issues of sustainability and climate change is constituted by the different experiences, skills and knowledge that students bring to the course. Briefs at postgraduate level must be informed by research and be able to deliver "in-depth" knowledge/skills, particularly in terms of performance tools with international awareness.

DoP3 – CARDIFF UNIVERSITY

The third and conclusive event of the 'Designs on the Planet' series was organised in January 2009 by the Welsh School of Architecture and UK Centre for Education in the Built Environment (CEBE) in Cardiff, with a focus on delivering sustainability through comprehensive design projects at postgraduate level, and in particular on the exploration of creative ways in which climate change issues can be comprehensively incorporated into the architectural discourse. The theme of this event was derived from the common concern at the previous two events that design integrity could be lost as a result of implementing requirements for low carbon strategies within design proposals. Postgraduate, RIBA Part II or Diploma courses were chosen as a focus for this event because projects at this level require the student to consider a range of complex, diverse and often contradictory issues in this manner. Furthermore, by gaining a better understanding of how sustainable thinking can be integrated into Part II courses, it might be possible to then work backwards to determine requirements for students in earlier stages of the course.

The method of working at the third event was through a series of Master classes focussed on the development of design programmes that could be given to students. Brainstorming groups were established to look at urban scale projects, mixed-use and residential projects, public buildings, and projects where students were able to generate their own briefs. Each group was given an existing brief for a design project (nominated by one of the participating Schools of Architecture) and, over the period of a day, the group was asked to develop that brief to enable a fuller integration of sustainable principles. An 'expert' in sustainable design was asked to lead each group in order to provide advice and guidance on how programmes might best be developed.

During the first workshop session of the day, participants were asked to deconstruct the original brief, trying to highlight the principal aims and objectives in terms of student learning. They were asked to reflect upon the extent to which these aims and objectives encouraged students to incorporate a low-carbon agenda in their proposals, and to augment these learning outcomes, where necessary. Participants were asked whether specific carbon targets should be included in the objectives, for instance by suggesting that all students should produce designs that meet a particular low-carbon standard. At this early stage, there is actually often a need for the prioritisation of objectives, and tough decisions are needed to make programmes manageable.

Generally, it was felt that objectives setting mandatory targets (for instance 'zero carbon') were not

always helpful, as quite often this would lead to students adopting a superficial approach, rather than thinking strategically. What was seen as being important was for students to be able to demonstrate a capability in sustainable thinking and understanding the implications of their design decisions. In order for this to be possible, students need to develop a series of intuitive 'rules of thumb' that they could use when designing at an early stage, as had been already suggested at the previous DoP workshop in Nottingham. A related objective suggested that students needed to be able to engage in a meaningful dialogue with experts in sustainability from the early stages of development of their design brief.

Rather than setting specific targets that all students should achieve, it was felt that it was important for students at this stage to be able to define the benchmarks towards which they would work. Students would however need to justify how they had set the level of their benchmark to prevent the adoption of inappropriate standards. This would require students to consider espoused carbon targets, but also to recognise the ethical implications of setting a benchmark too low.

The second workshop session focussed on the delivery of the programme, asking how students would be able to meet the relevant objectives. One particular concern here was that it is common for the delivery of a programme to be delegated to a part-time, visiting tutor, who may not be familiar with the principles of sustainability. Part of the development of programmes is to ensure that these tutors are sufficiently briefed and managed. Furthermore, where students were asked to generate their own design briefs (as it is common in many schools of architecture in UK), there may be a need to incorporate some degree of tuition with students on formulating their own sustainability goals.

It became apparent that many of the participants at this final workshop felt uncomfortable about teaching at the cutting edge of sustainable design (highlighting again the requirement for design tutor CPD identified earlier), and that financial resources were not always available to bring in suitably qualified experts who could balance design integrity with low carbon approaches. The concept of team teaching was seen as important, with design teachers needing to work closely with 'technology specialists' from the very outset, including the initial design of the programme brief. Design tutorials where both design and technology tutor were present was seen as particularly helpful, although it was recognised that design tutors should at least be able to give strategic advice to students at the conceptual stage of projects. Asking students to use environmental prediction software at an early stage of design was seen as a useful tool, provided that students were able to understand the implications of the results achieved.

The final workshop session looked at how design projects might be assessed in terms of their sustainability outcomes. Questions were raised as to what minimum standard students would need to meet in order to pass or indeed be awarded distinction. Could students demonstrate a capability in sustainable thinking without actually achieving a high standard of low carbon design in their buildings? How might this capability be evidenced? If students failed to reach the standards they had set themselves, could they still pass? Can distinctions be awarded to students who have failed to achieve a high level of carbon reduction in their schemes?

One suggested solution would be to ask students to keep a reflective 'carbon diary' as part of their project work, highlighting any decisions they made, and the implications of those decisions on the carbon usage of their building. Reflections should be evidence-based at key stages of the building's development. The intention of this was to record the students design processes, and to ensure genuine consideration was given to sustainable thinking.

A number of key barriers and concerns were highlighted during the workshop, particularly relevant to the UK context. Lack of resources, particularly in terms of staff expertise and available curriculum time, was recognised, although it did appear that this was less of a problem in some schools than others. Some schools may need to think carefully about how they prioritise their resources. The need for students to develop intuitive 'rules of thumb' was mentioned frequently and was considered by many participants to be more important than using predictive software. There does however appear to be a general lack of simple, agreed guidance on explicit 'rules of thumb' principles and standards for sustainability that could be used in this respect

OUTCOMES FROM DoP WITHIN ORGANISING UNIVERSITIES

Two of the national workshops have provided impetus for the organising universities to review their own technology teaching as part of the SCHOSA requirement. The outcomes of the final workshop have yet to be seen.

At Oxford Brookes University a major technical review has led to the Department of Architecture adopting the aim to be 'carbon neutral' in both its teaching and organisational management and agreeing to pilot a 'carbon neutral project' in its professionally–validated postgraduate architecture programme. The Department of Architecture has also adopted a framework of agreed Sustainable Design Precepts which will guide the future development of design and technology modules.

In Nottingham, as a result of the DoP events, the established framework for the design briefs has been introduced in studio modules at all levels (undergraduate and postgraduate), whilst new integrated assessment and marking criteria have been implemented by design and technical staff to reduce the assessment load on tutors and students, yet still highlighting specialist components

within the design effort. At the same time, DoP has provided the opportunity to 'fine tune' and restructure part of the curriculum (e.g. the creation of the 'Environmental Design and Tectonics' modules at year 2 and 3, merging previously detached environmental and construction teaching and integrating its assessment in studio) in order to further support a comprehensive 'design studio space' where design, structural, construction and environmental issues are introduced, investigated and actively implemented at once.

At Cardiff University, all postgraduate students undertaking their final design projects are set a target of ensuring that their buildings are carbon neutral.

INTERNATIONAL PRACTICE

The efforts of DoP to undertake a national review and catalyse the development of architectural studio teaching strategies in relation to climate change issues has been echoed in other countries where individual and national initiatives are covering similar issues.

In New Zealand, a year long carbon neutral initiative has been adopted by the Faculty of Architecture and Design at the University of Wellington, whereby all its carbon emissions have been offset by carbon credits related to wind farms and other forms of renewable energy generation. At the same time, the Faculty has embarked on a series of projects to promote sustainable design teaching in its curriculum and monitor its actual emissions with the aim of reducing these, year on year [7].

In the USA, the Educators Practitioners Network are working with the Society of Building Science Educators (SBSE), the American Institute of Architects (AIA) Committee on the Environment, and the AIA Sustainability Discussion Group (SDiG) to produce a Carbon Neutral Design (CND) Resource for educators and practitioners [8]. The CND Resource will provide practical design guidelines and strategies to assist in design and planning processes for carbon neutral design, including case studies that document successful built projects and an annotated bibliography of CND tools and software. A CND studio conference has also been proposed as an intensive three-day workshop focused on the development of consensus based guidelines, strategies, tools, and resource lists for carbon neutral design; in many ways, this mirrors and expands on the DoP process. Participants will include educators from the CND Educators' Network, who are currently teaching architectural design studios with carbon neutrality as a theme, and practitioners nominated by AIA and/or SBSE, who are designing low carbon residential and commercial projects. The outcomes of the conference will be used to develop further online, web-based resources [9].

BARRIERS AND OPPORTUNITIES FOR INTRODUCING CLIMATE CHANGE AGENDA

Despite the various international initiatives taking place in architectural education to address climate change issues, the three 'Designs on the Planet' workshops suggest that there are real barriers which are preventing design tutors immediately implementing carbon neutral projects in the studio. These include a continuing lack of really good design tools, 'rules of thumb' principles and agreed standards set against fear factors, conflicting value systems, ignorance and the pace of change.

Although proponents of sustainable design claim that the design tools already exist, a recent survey of modelling software [10] has candidly highlighted the faults of various programmes which are either too complicated to use or too simple in their analysis. Fortunately, software companies are beginning to wake up to these limitations by harnessing simple design sketch-up tools such as Ecotect, to more powerful modelling programmes such as IES, giving the best of both worlds. There is also a genuine fear factor in the studio - acknowledged during DoP workshops - that evidence-based approaches will reduce design freedom. Perhaps here we need to draw on the recommendation to use 'the power of limits' [11] [12] to show that design constraints usually generate more creative solutions. The need to generate designs that reduce CO_2 emissions is in itself a constraint that has the potential to lead to the generation of novel solutions. Furthermore, Lawson argues that the process of architectural design requires the architect to maintain (and resolve) a number of parallel lines of thought [11]. He likens this to a juggler keeping a number of balls in the air at the same time (p. 151). Sustainable design could be compared to another ball to be kept in the air.

The fear factor is also allied to a value system prevalent in UK studio culture, which still tends to privilege visio-spatial over evidence-based design solutions to a programme [13]. This is gradually changing, however, as legislation increasingly requires practitioners to provide more evidence of building design performance. Studio tutors readily acknowledge a level of ignorance in the face of very rapidly changing technology and climate scenarios, and, although this is a barrier, it is surmountable through a training programme for teachers such as 'Agent of Change' in the USA [14].

There are further opportunities for overcoming these barriers through linking CPD-Continuous Professional Development programmes for architectural educators directly to changing legislation and professional requirements. Other ways forward for DoP lie in benchmarking studio projects against leading edge practice, using buildings with proven performance credentials via post-occupancy evaluation to help establish sound methodologies.

CONCLUSION

'Designs on the Planet' has not resulted in a specific blueprint for Schools of Architecture to take forward in terms of addressing climate change. It has, however, fundamentally altered the landscape of architectural teaching in the UK through collective dialogue spurring both the leading professional body for architects (RIBA) and the Heads of Schools of Architecture to take up the baton of 'greening' architectural education. The focus on climate change has been important insofar as it has made certain issues related to sustainable development and sustainable design more tangible. This has in turn has helped Schools of Architecture attempting to grapple with all facets of sustainability in their teaching to contextualise and focus the debate.

The deliberate focus on the studio teaching was necessary to expose the continuing fault-line in teaching that creates both barriers and opportunities – the need to address reality through imagination and evidence at the same time but always through specific and varying contexts [3]. It is clear that government policy is not the best leader for architectural education as it is always one step behind the leading edge thinking that Schools wish to emulate. At the same time, there is a real need for evidence-based design approaches in education in order to improve building performance and lower their carbon emissions. The culture of design tutoring is changing - intuitive, tacit systems of knowledge are now being assisted by ever increasing sophistication in technology tools that can model physical responses more accurately.

The challenge now is to ensure that design and technology tutors can keep up with their students, who have embraced these approaches as part of the new media culture. Perhaps, the greatest challenge of all is to ensure that architectural education continues to receive the highest quality of feedback from practice in relation to sustainable design, while continually informing itself through self-instigated pedagogical research in this area. The national 'Designs on the Planet' series of workshops has provided one small step towards meeting this challenge and the next in the series is now being planned.

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REFERENCES

1. DCLG (2007). *Building a Greener Future: policy statement*. London: Crown.
2. Fowles, B., Cocoran, M., Erdel-Jan, L., Iball, H., Roaf ,S., Stevenson, F.(2002). *CEBE SIG Report - Sustainable Design in Architecture*. Centre for Education in the Built Environment, CardiffUniversity,pp.1-55,[Online],Available: http://www.cebe.ltsn.ac.uk. [20th January 2009]
3. Guy, S. Moore, S.A. (2007). Sustainable Architecture and the Pluralist Imagination. *Journal of Architectural Education*, 60(4): 15-23.
4. Graham, P. (2002). *Building Ecology: First Principles for a Sustainable Built Environment*. Wiley Blackwell.
5. Orr, D. W. (2002). *The Nature of Design: Ecology, Culture and Human Intention*. New York: Oxford University Press.
6. RIBA (2008),*Carbon Literacy Briefing,* RIBA, London
7. Carbon Neutral School of Architecture, [Online], Available: http://www.victoria.ac.nz/architecture/news/docs/Carbon NeutralSchoolofArchitectureArticle.pdf – [20th January 2009]
8. Boake, T.M. et al. (2008). *Carbon Neutral Design Project*. [Online},Available:http://www.sparksdesigns.co.uk/workingfiles/bluezulu/oxfordconference/presentations/pdfs/01_3_2.pdf - [20th January 2009]
9. Wasley, J. (2007). *The SBSE Wingspan Conference on the Carbon Neutral Design Studio*, [Online], Available: . http://www4.uwm.edu/cds/PDF/researchInitiatives/WasleyWingspreadCarbonNeutralStudio.pdf [20th January 2009].
10. Simulating debate! A review of simulation software projects (2008) *Green Building,* 18 (3): 44-48.
11. Lawson, B. (2006). *How designers think: The design process demystified*. London: Architectural Press.
12. Stokes, P. (2006). *Creativity from Constraints: The psychology of breakthrough*. New York: Springer.
13. Cuff, D. (1991) *Architecture: The story of practice*. Cambridge: MIT.
14. Kwok, A., Grondzik, W., Haglund, B. (2005). Agents of Change Project: Making Sense of Success. *Proceedings of 30th National Passive Solar Conference - Solar 2005*. Orlando, Florida, August 7-12, 2005.