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Author/Contributor:

Hough, Richard

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Practice-Based Design Education: The Arup Design School Programme

Richard Hough

Principal, Arup, and Professor of Multi-Disciplinary Design, University of NSW

ABSTRACT

Some design firms develop their own internal educational programmes to strengthen employee skills in areas relevant to the firm's plans and aspirations. International multi-disciplinary design firm Arup has developed a programme of 'design schools' for younger staff, intended to strengthen the firm's design culture. The schools are very broad in concept and execution, and based loosely on the traditional university 'studio' method of design teaching. This paper describes the programme, reviews available evidence regarding need and value, and considers possibilities for further study to develop the programme.

INTRODUCTION

Arup is a large global design firm employing around 8000 staff across 80 offices in 40 countries, with an intake of 500 or so new graduates every year. Consulting services range across all aspects of the built environment, from small buildings to major infrastructure projects; from specialised technical advice to large-scale urban planning (www.arup.com).

The firm has an unusual corporate structure. It is not privately owned, cannot be traded and has no shareholders. It is held in trust on behalf of its employees, so is free to reinvest profits in things like R&D, internal education and skill growth, intranets, and support to relevant social causes.

One such internal investment is in 'design schools'. While their value has become an article of faith within the firm in the 8 years the schools have been running, this paper reviews the available evidence regarding their need and effectiveness, their relation to university-based studio-style teaching, and ways in which they might be studied in more detail to make them more relevant and useful.

I. ORIGINS

Arup's programme of design schools started in 1999. The schools were initially UK-based and known as the 'design summer schools', but by 2004 they had spread to all 4 regions

of the global Arup Group. 20 schools have been conducted to date:

Europe Region

1999 London; 2000 London; 2001 London; 2001 Edinburgh; 2002 Sheffield; 2003 Manchester; 2003 Bristol; 2005 Warsaw; 2005 Newcastle; 2006 Birmingham; 2006 Milan.

Americas Region

2003 Marshall, Ca (near San Francisco); 2004 Marshall; 2005 Marshall; 2006 Marshall

East Asia Region

2003 Shatin (near Hong Kong); 2004 Shatin; 2006 Shatin

Australasia Region

2004 Katoomba (near Sydney); 2006 Dandenongs (near Melbourne)

The schools were instigated by the main Board. Responsibility for building up the programme was then passed to the global DTX (Design and Technical Executive). DTX acts as a catalyst for strengthening the design culture within the firm, for coordinating the firm's global R&D investments, and for sponsoring projects within the parallel "Foresight and Innovation Group", such as the 'drivers of change' programme, which in turn feeds into the design schools.

There are also Design and Technical Groups at regional level, which represent the offices and business sectors within the region, and organise the regional design schools. Since 2003, there have been cross-region representatives at each school.

II. FORMAT

Schools are typically held over a 3-day period:

Thursday afternoon / evening: Arrival; introductory 'ice breaking' exercise; dinner, with presentation by motivational speaker.

Friday: Morning and afternoon design exercises; dinner, with further guest presentations.

Saturday: All day design exercise; return home Saturday evening.

The schedule is intended to strike a balance between 'firm time' and 'personal time'. Venues are typically resort-style locations on the outskirts of major cities. Accommodation involves a large meeting space with worktables and benches, and breakout spaces for smaller groups. Delegates number 30 to 35, supported by 4-6 more senior staff, including some with teaching and facilitation experience. Delegates are typically nominated by line group leaders, and chosen from promising younger staff who have been with Arup for 3-5 years or so.

A practice has emerged in Europe Region, though not taken up elsewhere, of adopting a theme for each school, which then informs the choice of design exercises and presentations. The names of themes adopted so far have included 'Environment'; 'Flight'; 'Fashion'; 'Sport'; 'More for Less'; 'Entertainment'; 'Journeys of the Future'; 'Expecting the Unexpected'; 'Elegance'.

Invited presenters have also ranged widely, and have included the female world speed record holder for paragliding; the head of Jaguar automotive design; a world-famous chef; high-profile architects, product designers and fashion designers. One of the design exercises is often built around the interests of the key presenter, with their close involvement in the development and execution of the exercise. Key Arup designers also feature in presentations and exercises, but external presenters offer a novel perspective, and provide a faster transition out of the delegates' comfort zones, which is one of the intentions of the exercises.

Sometimes there has been evidence of a 'cultural influence' in the style and content of the exercises, depending on the region conducting the school. The European Region schools have been described by cross-regional participants as likely to delve more into the philosophical underpinnings of design and to give more space for theoretical discussion. Initial Americas Region schools were said to emphasise commercial opportunities and constraints in design outcomes. The East Asian and Australian schools have been described by some delegates as 'more pragmatic'. Such feedback, though anecdotal and subjective, provides useful perspective, and has influenced the style of subsequent schools. Last year's Australian school for example introduced segments examining design theories per se, and exercises on communicating design ideas. This ability to obtain global feedback and make adjustments, is of course one of the privileges of a large multi-cultural and multi-disciplinary catchment.

To increase the return on investment in the schools, delegates are expected to promulgate the experience in various ways,

including the holding of 'lunchtime presentations' in their own offices. These have sometimes blossomed into a series of lunchtime workshops that revisit the design exercises themselves, reusing the same material. Some delegate groups have generated intranet websites to upload material, to keep in touch with one another, and to draw others into ongoing discussions. No site has survived indefinitely. Personal relationships continue and evolve, but it seems to require another school to regenerate the process.

III. CASE STUDY: 2nd AUSTRALIAN DESIGN SCHOOL

The agenda for the 2006 Australian design school was as follows:

Arrival: 3PM Thursday

'Ice-breaker': Verbal exchange of bio's and 'personal examples of good design'.

Presentation: Design in practice. Tristram Carfrae, Arup Fellow.

Pre-work for Friday AM exercise: Locate and photograph a suitable site in the resort grounds.

Pre-dinner exercise: Deconstructing design: Competition to recognise and appraise obscure design products.

Dinner presentation and discussion: The role of design in the office of the Victorian Government Architect. John Denton, DCM and Government Architect.

Friday AM

Presentation: Design theories and parametrics. Mark Burry, Federation Fellow, RMIT University Spatial Information and Architecture Laboratory.

Design exercise: A personal reading room. Facilitator: Mark Burry.

Jury, feedback, discussion.

Friday PM

Presentation: Communicating design ideas. Richard Hough, Arup Australasia Design and Technical Leader.

Design exercise: Costume design for extreme sports maintenance. Also catwalk, demonstration, and presentation to client. Facilitator: Andrew Wisdom, Principal, Arup.

Friday evening

Presentation: Design with wine. Matt Carter, Bulong Estate, Yarra Valley.

Dinner presentation: Global warming and the Antarctic. Rob Gell, Gellignite PL, sustainability consultants.

Saturday AM

Design exercise: Introduction to Antarctic Base exercise, commence exercise.

Saturday PM

Presentation: Product design, prefabrication. David Adderton, Adderton Design.

Design exercise continued: Completion of Antarctic Base exercise, and presentations.

Jury and feedback.

Summing up, more feedback and discussion, questionnaire, departure.

IV. CASE STUDY: ANTARCTIC BASE DESIGN EXERCISE

The ‘all-day’ exercise chosen for Saturday had several useful learning features. It was set in an exotic environment and so required delegates to adopt unconventional constraints and opportunities; it required close integration between specialists from numerous disciplines, including structural engineering, mechanical, electrical, and hydraulic engineering; façade, geotechnical, transportation, and water engineering; environmental physics and energy modelling; architecture, project management; civil and environmental engineering. All of these disciplines were represented in the school, and several within each design team of 4-5 delegates.

The unusual seasonal working arrangements for Antarctic bases generated discussion about human needs and behaviours. The accelerating loss of ice shelves raised questions about safety, risk, and the purpose and value of the human presence. Time did not allow fundamental challenges to the brief however, and team discussions moved on, sometimes too quickly, to ‘engineering’ solutions to the physical challenges of the harsh environment. Groups typically ‘brainstormed’ the challenges and potential technical solutions, listing them on flipcharts and assigning tasks to individuals to develop each one further. The groups then reassembled to try to integrate the part-solutions devised by individuals. In some groups, this dynamic led to a dominant character setting an early ‘organising principle’ for the base, into which other solutions were fitted. In other groups such an organising principle was reached by consensus.

In all cases, there was a mixture of individual and team working, culminating due to pressure of time in a concerted and sometimes hectic consultation toward the end, out of which came the final presentation material, with rapid production of graphics and physical models.

V. SURVEYS AND RESEARCH INTO THE SCHOOLS

A. Assessing the need.

The importance of design in engineering education and practice is well enough established (Adams 2003:275, Higgins 1989:169, Little 2001:309, Sheppard 1996), and has long been taken as self-evident within Arup. The setting up of the UK schools, and the choices regarding format and content, were largely informal and intuitive. By and large that still remains the case. The main aims of the schools are no more specific than to encourage reflection on the design process, to provide an experience of the whole process rather than just isolated segments of it as in a consulting environment, and to network with peers from other disciplines.

There have however been intermittent attempts to analyse aspects of the programme more formally, and two in particular are worth reporting. The first was a series of questionnaire-based surveys between 1999 and 2003 to help define the nature of design tasks carried out by younger staff within Arup, and the methods and tools used. The surveys were designed and executed by David Gann, Head of Innovation and Entrepreneurship, Imperial College, London, and reporting was internal to Arup (Gann 2001). They provided insights that helped inform the style and content of exercises in subsequent design schools. Results from similar more recent surveys have generally been consistent with the early findings.

Gann’s population was relatively inexperienced engineers from within the Building Engineering groups in the firm’s UK offices, typical of the candidates invited to the early design schools. Some of the survey outcomes are listed below.

(a) Time spent on design activities, and type of project (%’s rounded).

Activity

Briefing and feedback	16%
‘Sketch’ stage of design	18%
Working drawings (assumed to incorporate ‘detailed design’)	47%
Site phase activities	19%

Size of project

‘Large’	49%
‘Medium’	26%
‘Small’	25%

Type of project

‘One-off’	74%
‘Repeat’	26%

(b) Design problem solving techniques (ranked by importance according to respondent)

Mean weighting ex 5

Face-to face conversation within Arup	4.4
Sketching	4.2
Use of analytical tools	3.7
Working with others in the project team	3.5
‘Electronic scouting’ (intranet, internet)	3.1
Trying new designs in CAD	2.5

(c) Media for design (ranked by importance according to respondents)

Designing on paper	4.2
Designing on computer	4.0
Designing by physical models	1.6

(d) *Extent of collaboration between respondent and other actors*

Architects	4.3
Clients	3.4
Other consultants	3.4
Contractors	3.3
Suppliers (materials, components)	3.1
End-users	2.1

Regarding (a), the large portion of time spent resolving detailed design during creation of working drawings is not surprising given the relative inexperience of the designers. This is traditionally the 'learning ground' for acquiring higher-level design skills. The intent of the schools of course is to encourage and accelerate the strengthening of more broadly-grounded design skills, given they represent greater potential for value-adding on projects, hence a more significant role for individuals and for the firm itself. Detailed design is increasingly provided by rule-based software, and is also increasingly carried out by contractors. Both these trends are drivers for the growth of broader design skills in consulting firms, though within the constraint that feedback to designers from detailing and execution remains an essential part of design education.

Regarding (b), it is no surprise that information-rich 'face-to-face' communication tops the list. It is of course the dominant mode at the design schools. Despite their importance, interpersonal communication skills remain a challenge for many would-be design engineers however, and 'communication' modules have been included in some recent schools. IT communication methods continue to gain importance in practice, and Arup is active globally in research projects into collaborative virtual environments. Just as for design team collaboration in practice, so the design schools may come to have a virtual aspect before long.

Since its initial use, Gann's questionnaire has not been applied with enough consistency to identify how the results in (c) have changed in recent years. Observation suggests the first two modes will by now have been reversed, viewed across all phases of design. Again, Arup is involved in several large research projects to understand and capitalise on this trend in practice, including a Commonwealth supported project 'Delivering Digital Architecture in Australia', with RMIT's SIAL. Given the emphasis on multi-disciplinary design skills, the schools are likely to continue using the convenience and speed of paper sketching and physical model building for the present however.

Given the roles of the questionnaire respondents, the dominance of architects as collaborators in (d) is not surprising. Architects also feature as popular guests and facilitators at the schools. The low ranking of 'end-users' is also not surprising, for the same reason. It points to an important opportunity for learning however. In response, schools often now include presentations and participation by 'end-users' who may be clients as well, but who are not engineers.

As for the original 'template' surveys by Gann, questionnaires used at recent schools invite general comments on 'ways to improve the quality of design carried out in the firm', and 'ways to improve the effectiveness of the design schools'. Regarding the former, Gann's compilation of significant comments includes:

- more thinking time at concept stage for younger engineers
- award to teams involved / public mention
- more presentations of finished projects, to build on ideas
- more cross-office activities
- more brainstorming at concept stage
- set up spaces to allow modelling
- more inspiring workspaces
- more money to be spent on projects useful for learning skills
- more attendance at design schools
- faster computers
- promotion

Regarding comments on the schools themselves, feedback on the main aims mentioned above suggests they are generally well met. Feedback also indicates that the studio-style environment is well received, and some offices have gone as far as to establish informal multi-disciplinary 'design crit' sessions on a regular basis. Amongst the concerns expressed, the difficulty of achieving a transition from the open-ended brainstorming environment of the school, back to the more constrained office environment, is a common theme. The firm's global and regional Design and Technical Executives grapple with this challenge, and continue to devise new ways of addressing it, with mixed success. Another complaint is the absence of a comprehensive 'design theory' for guidance in practice. On this point, schools now often feature a presentation or even a whole exercise on at least one theory of design, if only to highlight the complexities.

B. Assessing Outcomes and Value

Despite the significant internal investment, the design school programme has been subject to little quantification in terms of outcomes and value. More scrutiny is applied to other internal 'design and technical' investments, like R&D projects, intranet-based skills networks, funding of technical experts and so on. Belief in the value of the schools is strong and pervasive, but implicit. 'Self-assessment' via delegate questionnaires as noted above, is the main value indicator. There is also an expectation of some 'embedment' back in the delegates' offices via post-school activities, which are usually monitored, though not quantified.

Observations have been made by some external parties, notably Whyte (2004), who compares Arup's design schools with university-based design studios, and highlights the following differences.

University-based design studio	Practice-based design studio
1. Ongoing training alongside theoretical education, long projects lasting weeks or months.	1. Intensive 'time out' from practical apprenticeship; short projects in one weekend (compressed time frames).
2. Focus on individual skills, competitive, formal marks.	2. Work in multi-disciplinary teams, collaborative, no formal assessment.
3. Focus on process of design development: use of precedents; critique of work in progress by peers, instructors, visitors.	3. Focus on idea generation: brainstorming; negotiation of group solutions; critique of work by mentoring design school assistants and peers; group presentations.

Table 1. Comparison of university based and practice based design studio models.

Whyte adds that;

“Within the university, the design studio is a major component of degree courses such as architecture, fashion, graphical and industrial design. The practice-based design school is in many ways quite different The intention (of the Arup design schools) is to improve young engineers’ understanding of the design process, and to promote rapid team-building skills. Expert engineering designers use a form of creativity or design expertise, which Hough calls intuition (Hough 1996:18), to select potential solutions for analysis. This is gained through practical design experience. Hence in a leading inter-disciplinary engineering and design firm such as Arup, there is an incentive to develop organizational abilities to exploit diverse knowledge sets in design.”

There are also of course a multitude of lecture / seminar / workshop programmes available to Arup engineers both internally and externally, that can provide more formal and ongoing training and skill growth, in the context of continuing professional development. These could be considered analogous to the lecture series run in parallel with studio or project work in university engineering courses.

VI. CONCLUSION

What can university educators learn from such a practice-based design school model ? Whyte (2004) makes some relevant comments:

“Should university-based design studios develop collaborative design skills ? Should educators see the development of a community of peers as important to the design studio experience ? When is it appropriate to introduce studio-based work ? The shift of focus from the individual to the group may have important lessons for design education within the academy”.

The favourable experience of the Arup design schools supports the case for more studio style design teaching in university engineering courses, provided the students have enough grounding to bring specific learning and skills to the projects. Depending on the format, a studio environment can also offer simultaneous development of collaborative and team-working skills, consistent with the team-working expectations of design practices.

Conversely, how might practice-based studio methods like Arup’s design schools benefit from the insights and skills of university-based design teachers and researchers ? Opportunities raised in the paper include the need for better understanding of the value and effectiveness of different types of design exercises and facilitation methods, of ways to better embed the rarified school experience in the subsequent cut and thrust of office routine, and of the best balance to strike between the study of design theory and learning from ‘hands on’ design exercises.

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