

Keynote address

Sustainable Retrofitting: A Case study in Research Led Teaching (RLT)

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Introduction

The research work reported here describes a project concerning the proposed renovation and retrofitting of a bioclimatic tower in Malaysia through a three day colloquium and charette exercise with students and practitioners. Following the completion of this project it was found that many of the characteristics of both the activities and the knowledge outcomes during and from this exercise are consistent with what could be called a research-led teaching approach (RTL). The paper first defines research led teaching and then describes aspects of the approach used in the project, which have similarities with RTL. Conclusions from this analysis suggest that conventional research processes and methodologies can frame important questions for practice, however often these cannot be resolved easily through conventional methods of architectural science research. RTL, which takes questions from the conventional research process and explores these through design, offers a model for future architectural research.

Research-led teaching?

In recent years there has been increasing interest in integrating the research activities carried out in universities and the teaching activities.

Angela Brew argues that 'research-led teaching lies at the intersection of a number of approaches to teaching. It may involve the use of any number of these dimensions simultaneously.' Importantly she argues that a starting point for RTL is the way we define, frame and carry out "research." More importantly we need to be clear about the nature of the 'discipline and subject content,' and how we view the 'practice of teaching.' The next step she recommends is to articulate this into a pedagogic framework; she defines a number of models of how we might define RTL, the first two are framed around activities carried out in research and the second concerns the attainment of knowledge either through the analysis and creative process of thought and our minds or collection of facts which are independent of minds.

1. Research as 'external' activities, i.e. presenting conference papers, posters, teamwork and networking; the RTL would support these activities.
2. Research in terms of 'internal' activities such as analysis of data, conceptual advances of ideas; RTL will take the form of classes in methodology and data interpretation.
3. Research as gaining 'knowledge' in objective terms as external facts independent of minds. The RTL

process here would emphasize the gathering facts.

4. Research as in gaining 'knowledge' in constructivist terms (being as much "made" by knowing agents as "discovered"). RTL will emphasize communication and the social and environmental conditions under which knowledge can occur. (Brew 2003)

Hence the first step in the define how we see our research and then from this we can analyse the RTL approach uses in the Sustainable Retrofitting project a priori though a reflection of the activities and outcomes from the project.

Our view of research

Research comprised a number of themes related to reducing the environmental impacts of buildings such as mitigating the effects of climate change through three types of retrofitting, bioclimatic, ecological and technical. Retrofitting is defined as the replacement improved and more efficient of building technical and non technical systems through physical obsolescence. Increasing a driver for obsolescence had from the green imperative.

In recent decades, we have become more aware of increasing damage to the environment and a widening global gap between the rich and the poor. There is a growing realisation that the way we develop is not sustainable.

We need to find a way to improve our quality of life while living within our environmental limits and ensuring a fair society. This is sustainable development.'

<http://www.defra.gov.uk/sustainable/index.htm>

So for example climate change effects on temperature are happening in tropical climates such as Malaysia with increased temperature on average. Hence the mitigation and adaptation response called for provided design opportunities in practice but also there is a need for further action of international policies and standards, economic and social change.

Many bioclimatic and ecologically designed building provide a way of mitigation and adaptation strategies to address the needs of climate change. Work on large commercial buildings has seen innovation in the application of green technologies which increase the number of heat sinks in buildings which avoids the problem of using air conditioning to pump heat to the exterior. The Mewah-Oils Headquarters, Port Klang (Westport), Selangor, West Malaysia has a large area of landscape in side the building which is used for passive cooling. The Guthrie Pavilion Shah Alam, Selangor, Malaysia uses a large mega structure parasol roof to increase airflow and shade to the building beneath. The NARA UMNO, Pulau Pinang modifies the form of the building to improve access to the prevailing se breeze. Finally organics heat sinks are used in the DIGI Technology Operation Centre, Malaysia in the form of green walls.

The main research question that came from this view of research concerned how to retrofit these green technologies to an existing building.

Research led teaching approach

This research question formed the basis for the RLT. Using the design charette as vehicle a three day research colloquium, site visit and charette was organized. A 20 year old bioclimatic tower which was undergoing renovation was used at the trial

building for retrofitting. The main principles of Eco design were used as the basis for the design brief.

- Eco infrastructure-
 - green- natural systems
 - blue- water systems
 - red- human systems
 - grey- engineering physical systems
- Biointegration –Biotic (living) and abiotic (non living) integration
- Ecomemesis- ecosystems mimicking and translation
- Eco design as Restoring Impaired Environments- biodiversity regeneration
- Ecodesign as self- monitoring – life cycle measurement (Yeang, 2012)

The results from the work show that using Ecomemesis it is possible to re-conceptualise the existing building with a new vision. In this case it was possible to use the rain forest a metaphor and reshape the form and spatial organisation of the building accordingly. Furthermore this improved the potential Biodiversity regeneration. A number of principles for Biodiversity regeneration were adopted.

- All species and habitats should be conserved, maintaining ‘natural’ evolution.
- Eco systems conservation
- The natural stock of ecological resources- soil, ground and surface water, land biomass, water biomass has regeneration limits.
- Interconnectedness
- Improvements in one area of a country should not be at the expense of others.
- Aversion of risk

- Precautionary principles, unknown thresholds to incremental change which could have significant systematic consequences
- Scale of impact
- Human minimisation of energy and material flows into ecosystems (Zarsky 1990).

It was found for this to be successful it was necessary to appropriate areas of the city that were in a natural state such as wild life reserves and natural parks. Recommendations were made to change the zoning of selected areas to improve the connections between the existing areas of nature and the building. In this way species regeneration is possible by building larger habitat areas in the city. Bio integration at the site level resulted in the increase in the Green ratio ie the ration of bioti to abioti, in this case the existing ration was about 8 per cent and through zning of the building this is increased to about 40 per cent of the site and building area. Finally, new Eco infrastructure was recommended support the Eco design retrofitting

Conclusions

The outcomes from RLT approach are consistent with the vision of Sustainable Retrofitting in Commercial buildings.

‘Despite recent improvements in energy efficiency being made in new build it is important that the existing commercial building sector also take action to meet emission reduction targets. The objectives and challenges of such action will reduce the risk of the sector becoming obsolete due to high-energy use and poor environmental performance. (Hyde et al 2012)’

Through Eco-design and renovation for climate change, Bioclimatic retrofitting, and the use of technological and behavioural change it is possible to reduce the energy intensity of large mega watt commercial buildings

Research led teaching in architecture as demonstrated in the case study provides a view of research as practice. That research questions can be examined through design in many cases can be both a creative and speculative process which has wider implications than conventional research. The RLT provides research involving internal and external aspects of the discipline in this case it touches on issues of urban design, planning and ecology. In research terms it seems highly consistent with knowledge generation involving a constructivist view where the charette forms the social and environmental conditions for the knowledge creation. However in this case the practice approach of using design principles assists in guiding and focusing the research domain.

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