Summary

Students of sustainability, in particular architectural students, are faced with a vast body of published work that forms an important part of their reference library. The idea of the precedent study is, traditionally, central to the education of an architectural student, introducing them to exemplary projects of all types. However, many of the buildings published and purporting to be ‘sustainable’ or ‘green’ lack rigorous and impartial review. In the absence of such credible evidence, how is a student, or for that matter, their instructor, to know that a particular building is an authentic exemplar upon which to base research or teaching.

This paper presents a project and the methodology used by second year architectural students in University College Dublin designed to instil a strong sense of discernment in the student, developing critical and research skills that enable them to differentiate between an authentic sustainable exemplar and one over which there may be doubt.

The project first asked each student to arrive at their own definition of sustainable architecture. This was then tested by applying it to three ‘sustainable’ projects of their own choice. They were then asked to choose the most credible of those three and apply a specifically developed environmental rating system, supplied to them, against which to assess their chosen exemplar. The objective and result of the project was to develop within each student the ability to research authoritative information online, in books and journals and to use this to support and argue for authentic exemplars of sustainable practices in architectural design. The highest rated case studies were then available to the whole class as genuine examples of the highest international standard in sustainable architectural practice.

The best five exemplars of the class were then published in a national sustainable construction magazine, Construct Ireland, along with the methodology developed for the project and used in their assessment.

**Keywords**: Architecture, Education, Sustainability, Precedent

1. Introduction

Over the past two decades the practice of ‘sustainable architecture’ has become accepted and virtually mainstream and the basis upon which many practices now engage with clients. As with any architectural genre, there are good and bad examples. Given the role of precedent in architectural education it becomes paramount that one can be differentiated from the other.

In design studio and in the teaching of the history of architecture, the use of precedent has played a central role since the establishment of Ecole des Beaux-Arts, through the modernist and post-
modernist periods and to today in many schools of architecture [1]. Precedent can also play an important part in the teaching of subjects such as environmental science, technology and any others related to sustainable architecture. They represent part of the past but are equally a part of the present, exemplary and archetypal models and exemplars. To the student they become a potential source of enrichment for ideas. The can be formative influences based on a clear and correct idea of what is good for the environment. The use of precedent in architectural education plays an important part, both in theory and in design, in raising awareness and developing insight, learning from earlier experiences by systematic and explicit analysis [2]. Equally important is that students gain insight into the importance and technique of precedent analysis by self-discovery in working out the exercises, not just by learning ‘how to’. It is no acceptable simply to reproduce a exemplar but rather to understand method, approach and analysis.

In the same way that precedent has been employed to deliver exemplars in the past so it can present to the architectural student a history of architectural response to environmental and ecological challenges. But in doing so more is needed. The student must be equipped with the correct method of analysis in order to understand how to appropriately use such exemplars in informing their own work. Today’s architectural solutions require a broader knowledge than simple technical ones and so precedents chosen are also important, maintaining an awareness of history along side that of ecology and technology, of integrated and wholistic solutions [3]. The student must remain cognisant of the interrelatedness of environmental issues with those of buildability, ascetic, etc.

While these are a part of any such solution many will argue that any architectural solution must embrace a wide range of issues and not be dominated by a single agenda. In a narrow sense, sustainable architecture but there remain many questions about what sustainable architecture is and what role it plays in arriving at solutions to future needs. As greater numbers of so-called sustainable buildings are constructed a problem arises – how to differentiate between those that are actually sustainable and worthy of being considered precedents as opposed to those that are not. Numerous award schemes reward competition entries but even these have a widely varying array or criteria against which projects are judged. As such, award programmes are not immediately comparable. It is fundamentally linked to the question ‘What is sustainable architecture’. As part of an educational process it is also important for a student to be able to deconstruct a project, adopt in an informed way that which has merit and leave the rest.

Publications abound with examples of so called sustainable buildings. But when many are examined more closely it is clear that only a few of the many environmentally related issues are addressed and sometimes not well at all. This project is concerned with developing a critical approach to discerning between real or otherwise sustainable architecture.

2. The Project

This paper presents a project undertaken by architectural students designed to develop those skills of discernment previously inference. The students engaged were in their second year of the University College Dublin (UCD) Architecture programme. It was a joint project involving both the ‘Building Technology’ and ‘The Indoor Environment’ courses and was supported by these lecture-based programmes. The students would have already taken corresponding equivalents in their first year of study. The programme at UCD is a five-year degree, conforming to the European Bologna model and recognised by the Royal Institute of the Architects of Ireland (RIAI) and the Royal Institute of British Architects (RIBA). In 2011, the programme celebrates 100 years of architectural education in Ireland.

Its ultimate aim was to develop the skills required by an architectural student to be discerning and objectively judgmental when considering the merits of sustainable building projects. Furnished with a clearer understanding of what sustainable, ecological or even passive might mean, students are better equipped to apply critical judgement both while in education but also as practicing professionals.

The assigned project was designed to achieve a number of stated objectives. While a number of
definitions of sustainable architecture might be given to a student it was important that, before considering a critical analysis of an actual project, each one took time to explore the range of issues involved. To that extent, students were asked to arrive at their own definition of sustainable architecture and to justify it. The unstated objective was to bring to their attention both the extent of issues involved but also, in many cases, their interrelatedness. It was also considered important that each student worked through and arrived at their own definition and not simply adopt an existing one without question. The project consisted of three stages:

**Stage 1: A Definition of Sustainable Building**
In this stage of the project each student was given the opportunity to develop their own understanding and define what they understand by the term ‘Sustainable Architecture’.

**Stage 2: A Brief Review of Three Example Buildings**
Each student chose three project case studies which were critically reviewed against their own definition of sustainable architecture. In each case they presented background information such as when the building was built, by whom, where, a description of the building and its function and context (e.g. urban, etc.) and a list of features which justified its inclusion among the three.

In choosing their case studies the students were encouraged to look widely across both contemporary and historical projects on the understanding that many recent innovations are actually well ground in both historic and vernacular architecture including passive solar principals and natural ventilation techniques, for example. The object was not to find that single building exemplar that was likely to be the saviour of the planet - it doesn’t yet exist - but one which might inspire innovation and creativity and, importantly, appropriate to its climatic and cultural context.

**Stage 3: A Detailed Review of One Case Study**
The final stage of the project was a detailed study of one of the examples included in Stage 2. For this building the student employed the provided environmental rating system to assess the merits and demerits of the chosen example. All evidence used to support the assertion that it was sustainable had to be appropriately supported through correct referencing to authoritative information sources.

The final submission, approximately 5000 words, consisted of all three stage reports, appropriately illustrated and included a single reference section. Five exemplars of the project were then published in a national sustainable construction magazine, Construct Ireland [ ], along with the methodology developed for the project and the assessment technique used.

3. **Assessment Tools**

The assessment system developed for use in stage three of the project was intentionally kept broad in its consideration of the issues. Students did not have direct access to the buildings considered nor did they have the detail required to carry out a LEED or BREEAM style assessment. Instead, students relied on published material only. Reliance on this material alone also emphasised for the students the often variable nature of such sources and the need for authoritative sources.

The method itself was not dissimilar to many commonly used environmental assessment methods, such as LEED and BREEAM. I was a credit based system, divided into sub-categories reflecting the scale of issues relative to a project. It also included elements from and influenced by the overall approach taken in the Wells regeneration based checklist. This was originally developed by Malcolm Wells in 1969 and published in 1981 in his better-known ‘Gentle Architecture’ [8]. This method has been further developed by the Society of Building Science Educators [9]. It was presented to the students as a list of 20 modified and loosely defined criteria and augmented by a scoring spreadsheet and a more graphical representation of the credits based on the Arup SPeAR method diagram [10].

3.1 **The UCD Sustainable Building Rating System Checklist**
Each criteria was marked on a scale of -100 to +100, after the Wells method, thus recognising and
penalising negative impacts. Criteria were divided into three sub-categories reflecting scales of influence and were as follows:

**A - GLOBAL**
1. A Planetary Exemplar: A bad example for world architecture or a good example for world architecture
2. Harmony: Differentiates man-made and natural or conflates man-made and natural
3. Ecological Footprint: Doesn’t care about its impact or does care about its impact.
4. Life Cycle: Ignores the bigger picture or considers the bigger picture

**B - THE SITE**
5. Air Quality: Pollutes air or cleans air
6. Water Quality: Pollutes water or cleans water
7. Rainwater: Wastes rainwater or stores rainwater
8. Site Condition: Is built on a greenfield site or is built on a brownfield site
9. Waste: Dumps wastes unused or consumes wastes
10. Site Density: Decreases density or increases density
11. Transportation: Requires fuel-powered transportation or requires human-powered transportation
12. Microclimate: Intensifies local weather or moderates local weather
13. Proximity: Is a bad neighbour or is a good neighbour

**C - THE BUILDING**
14. Building Form: Large volume to surface area ratio (sprawling) or small volume to surface area ratio (compact)
15. Natural Light: Excludes natural light or utilises natural light
16. Passive Energy: Uses mechanical heating/cooling or uses passive heating/cooling
17. Energy Performance: Unconcerned with energy performance or monitors and improves energy performance
18. Human Comfort: Produces human discomfort or provides human comfort
19. Indoor Air Quality: Pollutes indoor air or creates pure indoor air
20. Reusability & Recyclability: Very little is reusable/recyclable or a lot is reusable/recyclable

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**UCD Architecture: Sustainable Building Rating System**

Based on the original H&M's Checklist and the SBDC Quebec 2006 Checklist. Copyright UCD Energy Research Group 2010

The Rating System Workbook used to calculate project score is shown below:

<table>
<thead>
<tr>
<th>Project</th>
<th>Degeneration</th>
<th>Regeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit No.</td>
<td>A Planetary Exemplar</td>
<td>A Planetary Exemplar</td>
</tr>
<tr>
<td>1</td>
<td>Air Quality</td>
<td>Water Quality</td>
</tr>
<tr>
<td>2</td>
<td>Rainwater</td>
<td>Site Condition</td>
</tr>
<tr>
<td>3</td>
<td>Waste</td>
<td>Site Density</td>
</tr>
<tr>
<td>4</td>
<td>Transportation</td>
<td>Proximity</td>
</tr>
<tr>
<td>5</td>
<td>Building Form</td>
<td>Natural Light</td>
</tr>
<tr>
<td>6</td>
<td>Passive Energy</td>
<td>Energy Performance</td>
</tr>
<tr>
<td>7</td>
<td>Human Comfort</td>
<td>Indoor Air Quality</td>
</tr>
<tr>
<td>8</td>
<td>Reusability &amp; Recyclability</td>
<td>0</td>
</tr>
</tbody>
</table>

Fig. 1 Rating system workbook used to calculate project score.
4. Results

While the stated objectives of the project were achieved there were some interesting and unexpected results. The general selection of projects did not include, to any great extent, those more obvious and widely disseminated international examples. The students, having undertaken stage one of the project, were more critical of what appeared to be an over-emphasis on a technical approach to issues of sustainability. While the UCD architectural programme does have strong technical and environmental component modules it also has a strong socio-cultural emphasis in both the ‘History & Theory’ and ‘Studio Design’ modules. The result was a welcome and an informed mix of projects exhibiting wider architectural qualities in addition to environmental ones.

Five projects are presented here, reflective of some of the more insightful choices by students. In particular, examples well outside their normal climate and culture attracted their attention. Examples of vernacular architecture are included in part of their first year course and would have had some influence but it was clear that students understood the need to respond appropriately when faced with climatic and socio-cultural differences. The Druk White Lotus School is a widely know exemplar but the Gando School in Burkina Faso is less so. The inclusion to Alto’s Paimio Sanatorium reflects the students’ interest in a particular historical period as well as architectural qualities of light and health while the reference to the Zero Carbon House in Birmingham, of their own culture and contemporary issues of reuse. William McDonough’s Oberlin College is a more contemporary example and well documented. From the examples chosen it was also striking that the scale of many buildings was small to medium, more human in scale. It was clear that international architecture award schemes were widely used by the students in selecting their projects thus emphasising the importance of these being suitably critical in their respective selections and as a source of inspiration to others.

In the final assessment the environmental assessment scores calculated by the students, being
based on published information alone, could not be considered as comprehensive and so were taken as indicative only.

### Table 1: Examples of projects selected by students

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Building function</th>
<th>Location</th>
<th>Architect</th>
<th>Client</th>
<th>Date completed</th>
<th>Awards</th>
<th>Further information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paimio Sanatorium</strong></td>
<td>Sanitorium</td>
<td>Paimio, Finland</td>
<td>Alvar Aalto</td>
<td>Turku University Central Hospital</td>
<td>1933</td>
<td></td>
<td><a href="http://www.nba.fi/tiedostot/c760469d.pdf">http://www.nba.fi/tiedostot/c760469d.pdf</a></td>
</tr>
</tbody>
</table>
5. Discussion, Conclusions and Acknowledgements

The paper should finish with a discussion, final comments and conclusions. Acknowledgements should follow the conclusions if necessary.

6. References