Built Environment

Learning & Teaching Showcase 2018

ARCH1161 Architectural Science and Building Environment 1 – Blended Learning Uplift

Philip Oldfield
Course Aims

“The primary aim of this module is to inform and inspire you to design sustainable, comfortable architecture. It is important to consider that ‘building science’ and ‘environmental design’ are not distinct fields separate from studio design. You do not design a building and then later consider ‘how can I make this comfortable?’ Nor is building science only concerned with maths and physics; instead it looks at how scientific principles should inform the design process”
\[ Q_c = \sum U A \Delta T \]

(in the exam – so remember this!)

Where:

- \( Q_c \) = heat loss rate by conduction (measured in W or kW)
- \( U \) = U-value (measured in W/m²K)
- \( A \) = Area of surface (measure in m²)
- \( \Delta T \) = Temperature difference between inside and outside (measured in ºC)
Content

Roof integrated photovoltaic solar panels for heating hot water and powering pool mechanics.

Green roof for passive cooling and added insulation.

Re-organisation of floor plan to orient all primary living spaces to north for solar access and service spaces to south.

Added bulk insulation layers to existing lightweight walls.

Timber bi-fold shutters on tracks to add insulation to north-facing glazing and control light.

Adjustable vertical louvres to control solar gain whilst maintaining views.

Prairie House / Durbach Block Jaggers

Adina University Extension / MGS Architects
Challenges

1. A reliance on an outdated digital platform
Challenges

2. A lack of accountability in group work
Challenges

3. The need to implement more climatic analysis software
What we did

1. Re-built on-line learning resources

Step 2: Determine the Azimuth and Altitude of the sun at the times of day you want the shadows for

This step involves looking at and reading the sunpath diagram. Mark the position of the sun at the times you want to cast shadows for, and read the azimuth and altitude from the sunpath diagram. Then put these numbers into a table.

In this instance, June 21st is the uppermost date curve, and the times can be plotted from the time curves.

An example table can be found on the next screen.
What we did

1. Re-built on-line learning resources

1. First calculate the Resistance and U-Value of the uninsulated wall:

To determine the U-value of a wall we use the formula $U = 1 / \Sigma R$. This means first we have to sum the total resistances (R-values) of all the wall elements, including the inside and outside air resistance.

In this case, this means:

$$R_{\text{outside air}} + R_{\text{brick}} + R_{\text{air gap}} + R_{\text{plasterboard}} + R_{\text{inside air film}} = \Sigma R$$

(enter these values in the spaces below in the order indicated)

$$0.04 \quad + \quad 0.10 \quad + \quad 0.50 \quad + \quad | \quad + \quad | \quad = \quad$$

$$U = 1 / \quad = \quad _{\text{WmK}}$$
What we did

2. Created a Moodle-based team creation and evaluation tool

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Levels</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Does not do a fair share of the team’s work. Delivers sloppy or incomplete work. Misses deadlines. Is late, unprepared, or absent for team meetings. Does not assist teammates. Quite if the work becomes difficult.</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Interacting</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Interacting with Teammates</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Is defensive. Will not accept help or advice from teammates. Complains, makes excuses, or does not interact with teammates. Takes actions that affect teammates without their input. Does not share information. Interrupts, ignores, bosses, or makes fun of teammates.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Commitment</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Keeping the Team on Track</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Is unaware of whether the team is meeting its goals. Does not pay attention to teammates’ progress. Avoids discussing team problems, even when they are obvious.</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
What we did

2. Created a Moodle-based team creation and evaluation tool
What we did

3. Created and integrated support tools for Climate Consultant

3a. Choose download new epw file.

The Energy Plus web site will open automatically.
## What we did

### Other things

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acclimatisation</strong></td>
<td>The process in which an individual organism adjusts to a change in its environment, allowing it to maintain performance across a range of environmental conditions.</td>
<td><em>Acclimatization,</em> Encyclopaedia Britannica, accessed October 14, 2017, <a href="https://www.britannica.com/science/acclimatization">https://www.britannica.com/science/acclimatization</a></td>
</tr>
<tr>
<td><strong>Altitude</strong></td>
<td>The height of the sun in relation to the ground</td>
<td><em>Altitude,</em> Dictionary.com, accessed October 31, <a href="http://www.dictionary.com/browse/altitude">http://www.dictionary.com/browse/altitude</a></td>
</tr>
</tbody>
</table>
What we did

Other things
What we did

Other things

- Construction type: recycled timber
- Consists of renewable energy that can allow the apartments to last up to 200 years.
- Provides solar water heating
- Photovoltaic Panels
- Collects rainwater
- Main facade and roof pods were designed to provide extra shading to the apartments below.
- Double glazed windows are placed to slow down the heat

sunlight to illuminate the heart of the building whilst a vertical sun collector and an automated solar shade were built in to control the amount of sunlight.

2. Renewable Energy

This building uses biofuel to generate energy, which can reduce the use of traditional fossil fuel.

3. Efficient Use of Water.

The low flow fixtures and fittings were applied inside the building to help reduce the potable water requirement.

Another sustainable feature of this feature of this building is the predominant use of glass along the exterior of the building offering the utilization of natural lighting within the building as opposed to artificial.

A very interesting sustainable feature of this building is the drainage system that has been introduced to effectively water all plants with minimal resources. This system relies on the watering of plants located highest on the building. The plants then will absorb the required nutrients, the remaining water is then transferred to the following plants below and so on and so forth in a ladder like motion.
Impact / Results

MyExperience: Overall I was satisfied with the quality of this course

2016 = 5.38
2017 = 5.42
2018 = 5.27

(Due to ‘new’ content and an extra assessment)
Impact / Results

MyExperience: Feedback on digital resources

The digital resources helped me learn = 5.37 (highest of all questions)

“The plethora of resources and support provided by Phil and the tutors. I really appreciated feeling that I could ask questions and get help when I needed. This is by far the most well resourced course that I have completed.”

“The online Moodle resources were very helpful – it extended and added on the knowledge learnt in the lectures and tutorials. It also allowed me to go back to specific resources that were accessed/taught to us during the lectures.”
Impact / Results

Student Performance

Average Mark, 2016 = 70.3
Average Mark, 2017 = 65.1
Average Mark, 2018 = 66.6
Impact / Results

Future Plans

1. Greater weighting of individual contributions to groupwork assessment

2. Implementing more practical on-site measurements (e.g. using thermal cameras)

3. Taking learning through the other environment courses (ARCH1361, ARCH7809, etc)