



# Active-Learning Tool Kit – Sustainable Development

## Part 6. Instructors experience:

### Workshops and Seminars using the 5-step Methodology

#### The use of the method in a Workshop format

The 5-step methodology, accompanying case studies, templates and the CES EduPack Sustainable Development Edition is now used in workshops and incorporated into teaching at a number of leading Universities including TU Delft, Universitat Politècnica de València, Universitat politecnica de Catalunya, University of Illinois Urbana-Champaign and Cambridge University. This Tool Kit is based on feedback from instructors involve in teaching sustainability concepts to students at both undergraduate and graduate levels and on their experience in using the CES EduPack Sustainable Development Edition.

The format of a standard workshop (Figure 6.1) illustrates one approach. The methodology can be compressed into a 2 hour Workshop or (preferably) expanded to form a week or term-long project based exercise. The approach supports group work and enables group discussion.

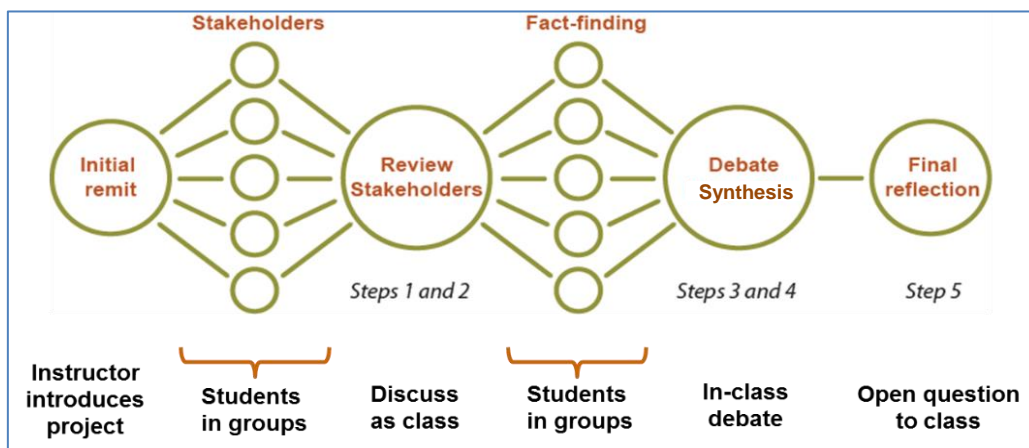
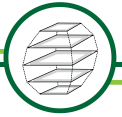


Figure 6.1: example of a workshop process.

#### Experience of the instructors at Granta

We have had experience of using this method in 2, 3 or 5-hour workshops. A typical agenda is reproduced below. The teaching experience is greatly enhanced if participants are given preparatory reading – we ask participants in short Workshops to read the short paper “Assessing proposed Sustainable Developments” that appears as Part 1 of this Tool Kit before they come. Students in week or term-long projects are given a 30 minute introduction to the CES EduPack followed by an introduction to the method with a worked example before they start their project. The use of Templates helps to guide the discussion in groups and manage the time. The 6 Handouts help with initial problems with unfamiliar contexts.



The format that Granta instructors use in a half-day Workshops has the following pattern:

***One week before the workshop***

- Participants are sent the agenda below and a PDF of Part 1 of this Tool Kit to read before they come

***On arrival at the Workshop participants receive a delegates pack containing***

- Agenda for the day
- 2-3 page Handout setting out the case study that will be used as an exercise during the Workshop
- The 6 Handouts (Part 2 of this Tool Kit)
- Templates and Check lists (Part 7 of this Tool Kit)
- Print out of PowerPoint INTRODUCTION to the METHOD (it is contained in Part 8)

***Agenda for the Workshop***

- Introductions and formation of Teams
- Brief introduction to the method we will use
- Introduction to the Project for the Workshop
- *Step 1:* Unpacking the Proposed Sustainable Development
- *Step 2:* Stakeholders
- Planning for Step 3: What facts are needed?  
----- Coffee break -----
- *Step 3:* Fact Finding
- Sharing of facts between teams
- *Step 4:* Synthesis
- *Step 5:* Reflection
- The CES Sustainability Database - Tatiana
- Discussion, Feed-back, Ideas - All
- Current issues of Sustainable Development - All  
----- Workshop closes -----

**Some useful tips**

- It can be useful to think of a specific geographical location in which the proposed sustainable development is to be applied (eg electric buses in London) because it is easier to explore stakeholders on a local rather than a global scale.
- Students need guidance in setting priorities for the fact-finding stage. Before starting this phase it is helpful to list the facts needed to understand the proposal itself and those needed to understand stakeholder concerns, then assign time to explore them systematically. The clearer is the link between stakeholders' needs and the facts-finding stage, the easier the synthesis and the reflection will be.
- It is helpful to prompt students to consider cross-impacts (e.g. reduced emissions, but at higher cost, or an unacceptable reduction in performance); while they are exploring the articulation and the stakeholders.



## Academic Instructors experiences and Granta's response

### Feedback from Bas Flipsen (Industrial Design Engineering at the TU Delft)

#### Teaching approach:

Flipped classroom approach, Peer-to-peer reviews, Method and Questions from the book Materials and Sustainability (Ashby 2015).

#### The name of the course:

Master Teaching for Industrial Design Engineers

#### The number of students and their background:

15 groups \* 5 people = 75 students. Backgrounds: industrial design ~ 80% and other engineering bachelor courses (e.g. mechanical engineering and aeronautics).

#### What is the format/structure of the course?

The course runs for 5 months (from February until June 2016). Every 3-4 weeks there was a workshop, 5 workshops in total 4 hours each with 3 mentors. Every 2 weeks peer-reviews assessment.

Final presentations of 15 groups was on-line with a requirement of 20 slides 6.5 minutes per group and a video-recorded message. The presentation should have included the process and the outcomes.

#### General feedback:

The academic likes this data-driven approach. The Eco Audit Tool is very useful. A Tool Kit would be helpful.

In his view the methodology is best suited for 1<sup>st</sup> and 2<sup>d</sup> year students, who would be guided by the method; at a Master-level students "know" where to look for and employ various methods.

Hard to set-up a prime-objective and differentiate it from an articulation and it will help to reduce "shortcuts" to give a better overview to students.

In the case of this course, the students had received a challenge from a company and found it very difficult to "translate" this into the 5-step framework. One reason is that some companies have not necessarily seen sustainability as a part of their strategy, while students need to keep it as a part of their exercise. Examples of this include: local, rather than an obvious global impact; the students found it hard to think of a "global" impact if the company's operations are on a local/EU-level. Students did not like to have a "negative" impact as a conclusion; they definitely wanted a positive outcome. Also (probably due to companies' focused presentations) they did not want to show the difficulties they had in following the method/data research etc.

The other key challenge was in identification of the focus for fact-finding stage, what is the main issues from materials' perspective (why gold has higher impact than plastics – even a small part in smartphones makes a difference? what are critical materials/rare-earths? Why focus on magnets in electric car/wind turbines example). The solution was in running an Eco Audit to highlight what is the main issue. The need for a process or a criteria/rational on how to choose the focus.

Examples students have used include: helmet (focus on a longer life of the product), knee electronics (reduce the number of operations, enhance the lifestyle – balancing the impact), ice sailing boats (task – introduce all natural materials – challenge only 150 of them).

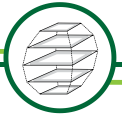
They need support with finding the focus for their work i.e. having an extended example with identification of the problem through analyses in introduction, stakeholders, prime-objective, leading to fact-finding stage focus. They have introduced Eco Audit for analysis of the biggest contributor to the energy/CO2 emissions. (for instance, how to get to the idea that neodymium/lithium are the key materials on the topic of electric cars or wind turbines, why not steel/copper/glass-fibre etc.)

#### Granta's Response:

New hand-outs have been prepared to help to introduce the key concepts to students. The Tool Kit with templates, extensive worked case studies and power point presentations would be of help.

Focus on added value, links. If a "small" product – focus on key part/material, supply-chain etc.

Introduce micro-projects to start the discussion and address the key concepts as a first task.



## **Feedback from Javier Orozco Messana (Department of Mechanical and Materials Engineering at the Polytechnic University of Valencia)**

### **Teaching approach:**

Industrial case studies, Method and Questions from the book *Materials and Sustainability*. (Ashby 2015)

### **The name of the course:**

Technology and Application of Non-Traditional Materials within the Bachelor degree in Building engineering.

### **The number of students and their background:**

Bachelor students in their final year (4<sup>th</sup> year) studying towards a Degree in building engineering.

Group of people between 10 and 20 (from January to June yearly).

### **General feedback:**

The course starts in January and runs until beginning of June (~5+ months).

Use the 5-step method in his course on non-traditional materials in building engineering (e.g. bamboo, hybrid materials, polymers, combinations of materials for new design possibilities), simplifying things where possible, not following rigorously 5-step method. General feedback from the course is positive.

Preselected cases are related to refurbishment of different real buildings. Projects are provided by various stakeholders, including data on all materials quantities for specific applications and relevant software models. The key to the successful outcome is that prepared cases are specific enough and have sufficient details to help students to frame the solution.

The format of the course is first to acquire knowledge on the subject and then to collect data – make interviews/surveys with stakeholders from city council, building companies etc.

The part with data collection starts in April. Students perform materials selection, apply building standards, collect opinions from public and city council. When they start to analyse the impact, they look at energy consumption through available models of buildings and analyse different scenarios by using alternative materials and quantities. They analyse the impact on energy, price, items of importance for refurbishment, opinions and regulations.

At the end they need to present a technical design exploring new possibilities, affecting performance of buildings, evaluate tools and make impact assessment of non-technical steps.

### **What are the main challenges in utilising the method?**

Difficulty in finding the data and perform evaluation looking at a case as a whole.

For the lecturer it is in preparing/finding the case, so students can use it comfortable, having all needed numbers, access to stakeholders and knowing procedures.