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WASTE NOT, WANT NOT: EDUCATION FOR SUSTAINABILITY IN THE CONSTRUCTION INDUSTRY

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ABSTRACT

Not teaching but transforming – an educational process which is easy to espouse but frequently hard to achieve in practice. This case study, set in the building technology environment of a tertiary institution, shows that by immersing students in the practicalities of construction waste management, they can cross a threshold of understanding of the wider principles of sustainability (Timmermans, 2009). By persuading degree students to climb into construction waste bins, analyse the contents and investigate re- or up-cycling for all of the products, they became able to appreciate the role that waste reduction can play at each stage of a product’s life cycle, from sensitive design to careful deconstruction. Using the guidelines provided by Jaques (2013) teams of students are subsequently required to search for examples of recycling and debate the relative advantages and disadvantages critically in an online forum as part of their degree course. This process in turn encouraged transformational thinking, clearly evident in students’ critical analysis and implied that all trades and disciplines, including the construction and infrastructure industry, can transform their perspectives on sustainability. The Construction and Infrastructure industry is New Zealand’s fastest growing sector with employment currently forecast to grow at 2.6% (Daly, 2014). With this growth in the building and construction industry, it is clear that many more students will be entering this trade in the near future. Therefore, this research indicates that educating these future builders on wider principles of sustainability will be a determining factor in the sustainable development of New Zealand. It is imperative that the systemic approach of sustainability is embedded into their curriculum to ensure that there is transformation in values and attitudes of the future New Zealand workforce.

Keywords: Waste management; Product life-cycles; Transformational learning

INTRODUCTION

The United Nations (2002) defines education for sustainability as learning processes that encourage decision making in favour of the long-term future of the environment, economy and equity for all global communities. To achieve this goal of educating global communities, 2005 to 2015 was declared as the Decade of Education for Sustainable Development (Parliamentary Commissioner for the Environment, 2004). During this decade the UN expects countries to embed education for sustainability in all educational levels thus hopefully attaining a sustainable future and therefore providing corresponding opportunities for the present and future generations.

To achieve global sustainability that the UN envisages, it is essential that educators move away from transmissive forms of learning to transformative learning. In the current education system “students are asked to absorb pre-packaged information presented by their teachers, even though research indicates that didactic, teacher-centred education results in reduced cognitive and behavioural outcomes” (Redmen, 2013, p. 1). According to Segalàs, Ferrer-Balas and Mulder (2010) a mixture of different methods in sustainability teaching and learning has a more significant chance of improving students’ eco-literacy. A re-orientation in education is needed that requires a greater focus on experiential learning, active learning and critical thinking. Moore (2005) and Alvarez and Rogers (2006) suggests that pedagogies centred on enquiry based learning, experience and reflection being effective in initiating transformation in students. This is also emphasised by Mezirow (2000), who stated that when learners go through a process of critical reflection, they gain better awareness and understanding on the issues surrounding them. Therefore, educators should endeavour to engage their students in learning styles that encourage greater collaboration and activities involving problem based or enquiry based learning.
Pike, Shannon, Lawrimore, McGee, Taylor and Lamoreaux (2003) explain that campus greening projects promote greater consciousness and awareness in students on sustainability. When working on real projects focused on topics of sustainability, students learn the science behind environmental responsibility. Students in their research were amazed at their ability to reduce the waste stream in actual campus projects that they undertook. Hence, active group projects allows students to see the realities of the current society which translates into a thought provoking exercise which motivates them to think much more about initiatives that can contribute to global sustainability. Evidently, engaging students in group projects, where they can see the harsh realities of everyday activities is the key first step in transforming their values and attitudes towards sustainability.

Exploring these diverse forms of learning is the key to achieving sustainable development in all trades including the construction and infrastructure industry. The Construction and Infrastructure industry has been identified as New Zealand’s most rapidly developing sector as a result of the Christchurch rebuild, Auckland house shortage and leaky buildings. The shortage of skilled workers in the New Zealand construction and infrastructure industry has been challenging for the rebuild. The Building Research Association of New Zealand (BRANZ) also estimates that Auckland’s exponential growth will continue to place pressure on the construction industry (Roberti, 2014). As a result, the construction sector has been identified as the one of the most popular career pathways for 2014 (Daly, 2014). And it is likely that significant changes in the construction and infrastructure industry will entice more students towards this trade in the near future. It is therefore essential that the future students join the profession with a deep awareness of the importance of sustainability already embedded as part of their psyche.

This research, set in the building technology environment of a tertiary institution, shows that by immersing students in the practicalities of construction waste management, they can cross a threshold of understanding of the wider principles of sustainability (Timmermans, 2009).

The guidelines provided by Jaques (2013) emphasises the 5 Rs and also provides examples of the way in which these can be achieved:

- Reduce
- Reuse
- Recycle
- Recover and
- Residual disposal

**METHODOLOGY OF THE CASE**

The case involved students studying an Applied Technology degree at an Auckland based tertiary institute. The degree is a three year programme where students undertake a range of technical and generic courses. As part of the programme second year students take part in a compulsory paper that focuses on global sustainability. The course aims to enable the student to investigate global and local aspects of sustainable technology practices and integrate this knowledge within a local setting. As part of one of their assessments in Semester 1, 2014 students were required to participate in a waste management project. Using the guidelines provided by Jaques (2013) teams of students examined the construction waste bins on site and created an inventory of all the waste they identified. Sixty students participated in the project. After the exercise, the students were then asked to investigate the various categories of waste they identified and investigate options available to re- or up-cycling for all of the products, at each stage of a product’s life cycle, from sensitive design to careful deconstruction.

As the majority of the participants were not building students (and much of the waste was from house building projects) they were additionally asked to consider similar issues related to their own industries. These options then were critically debated amongst previously established teams on an online forum.
At the end of the project students were requested to participate in a questionnaire that was designed to discover to what, if any, extent their understanding of waste management had been transformed by this process.

It was envisaged that this process in turn would encourage transformational thinking. Their critical analysis via the online forum, in conjunction with the results of the questionnaire, is presented below.

DATA ANALYSIS & DISCUSSION

Twenty three students out of the sixty eight enrolled participated in the survey generating a 34% response rate. All students were studying in the Bachelor of Applied Technology (BAT) programme with 52% coming from the Automotive Technology discipline, 35% from Electrotechnology and 3% specializing in Marine Technology. The two Building students taking this course did not respond to the questionnaire but did contribute to the discussion forum.

Table 1: Disciplines of those responding to questionnaire

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive Technology</td>
<td>12 (52%)</td>
</tr>
<tr>
<td>Marine Technology</td>
<td>3 (13%)</td>
</tr>
<tr>
<td>Electrotechnology</td>
<td>8 (35%)</td>
</tr>
<tr>
<td>Building</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

The depth of reflection and critique varied amongst the different groups, and this seemed to depend on the lead set by the early contributors. This meant that while some groups considered a combination of factors including ways to limit the waste being produced initially, as well as researching recycling options for the different materials, other groups took a more superficial approach. Unfortunately, this is one of the disadvantages that working in small online groups is known to create (Panko, 2002).

Out of the students who responded to the questionnaire, approximately half were international, the majority of whom were due to return to their home countries when qualified.

Table 2: Home countries of international participants

The percentages of international students.

Four main themes emerged from the questionnaire evaluation and their responses were examined in parallel with the forum responses made by the different groups after their exposure to the waste. These were:

- Real World Waste
- Waste management in industry
- Money matters
Students’ perceptions of the activity’s value

Real World Waste

A majority of the participants appreciated the waste management project as it gave them an insight into the ‘real waste’ that is generated by most businesses. One student commented that “it helped me see what sort of waste is created in the area we are in and if we don’t see it than we can’t imagine it”. Another student elaborated “it is good to get out of the classroom and see and touch what we are learning about”. Some students were very enthusiastic about this small scale project and suggested visiting waste management sites “that would be more effective with each group looking at the waste material generated from their industry”. Project work of this scale gives student an opportunity to experience first-hand the waste accumulated by society. As suggested by Pike et al. (2003) this experience for students is the first point for transformation of values and attitudes. The realisation that waste is detrimental to the entire triple bottom line became evident when students commented on environmental issues (land-fill and toxins) social aspects (employment and potential health problems) and economic concerns (ineffective use of resources).

One of the international students photographed the waste shown in Image 1, and commented:

“students are mixing all the waste together which is very hazards [sic] because most of the waste are flammable and easy to catch the fire. Moreover the containers are uncovered and not made for collect most of the waste. In addition the safety topics are not covered in this area.”

Sustainable practices featured highly with students in this project. Within their groups students were able to identify issues of waste management that were very simple to handle but easily ignored by industry. Students elaborated on the disappointment they experienced seeing the waste not properly grouped or sorted before they were discarded. Comments such as “waste material sorting method wasn’t appropriate or correctly sorted” and “people did not classify waste material very well” indicates that students started to critically evaluate waste recycling.

Image 1: Construction waste on campus

Additionally, proper planning was considered very important to some students in reducing waste as some identified quantities of waste materials found in the bins that could have been avoided. One student stated that “planning ahead of project saves material wastage” and another commented that “the waste in the bin was still useful”. One student suggested “educating people” as a key to reducing waste.

When asked to reflect on their future employment and their inclination to practice sustainability in industry students gave a number of positive responses. The majority of them were enthusiastic to
participate in proper waste management activities given the opportunity, “I will try to plan out what is required initially before I do something that causes me to make mistakes and create waste” and another student said, “Yes, if I work for a company that doesn’t recycle properly I will bring this issue up with my boss to plan ways to recycle properly”.

**Waste Management in Industry**

All the participants considered waste to be an extremely important issue for their respected industry and were able to relate waste with their own disciplines. One Automotive student stated “we need waste management information for e.g. oil can’t be recycled and can’t throw away in public places”. An Electrotechnology student commented that “as there are many electrical wastes getting into the environment everyday making technology more sustainable is crucial in today’s world.”

The student who took the picture shown in Image 2 noted that:

“We came across a large amount of metal ‘off cuts’ which seems to have come from pipe welding (as per picture) the reduction of this metal waste could have easily been overcome by simply measuring the exact material that is needed and make use of the entire pipe opposed to cutting at random lengths which left us with the ‘off cuts’.

This seemingly simple observation indicates that students are now thinking about the full life-cycle picture of Sustainability and not solely focusing on waste recycling. However, it is not possible to know from our study at this stage whether they had realised this earlier, or not.

![Image 2: Metal waste](image2.jpg)

Nevertheless, the groups varied greatly in their critical analysis of the waste they identified when they discussed issues online. Some groups, as represented by the quote provided above, did consider product life cycles as well as attempting to identify in some detail what could happen to the discarded material. However, others merely listed what was found and talked generally about ‘recycling’.

**Money Matters**

Interestingly, a lot of students were able to associate waste with financial loss. Many suggested that if businesses reduced their waste they could also save financially. One student stated that, “waste
management could save some money” and another stated that, “when I am qualified I will set up waste management so I can save more money in my business.”

Comments of this nature demonstrated that many students had realised that waste management was not an overall expense to industry but was an area where significant financial savings could be returned to companies involved with many different disciplines.

Students’ perceptions of the activities value

Overall students confirmed that the activity had heightened their awareness of waste management although one student made the following insightful comment:

I do not think that the practical exercise was as effective as it could have been. It would have been more effective if each group went to a waste field which their industry and look at the waste material there so [when] we are qualified we will know how to recycle what material concerns our industry.

For the remainder it is clear (see Figure 1) that the activity had value and could have produced a transformation in their attitude.

![Figure 1: Value of the exercise to students](image)

CONCLUSION

By persuading our degree students to climb into construction waste bins, analyse the contents and investigate re- or up-cycling for all of the products, they become able to appreciate the role that waste reduction can play at each stage of a product’s life cycle, from sensitive design to careful deconstruction.

The questions posed at the start of this study were: was the waste investigation project worth doing and would it allow transformational learning to occur? While the students’ responses to the first is an unequivocal ‘Yes’, it is more difficult to guarantee the latter. However, it does appear that it has allowed students to move towards a greater awareness of their engagement with the issue. The authors of this study argue that the transformational process as described by Mezirow (2000) may also occur in an evolutionary or gradual way while still encouraging individuals to develop deeper understanding. It is proposed that the exercise described in this paper is repeated but linked to external visits to recycling plants so that students from all disciplines are enabled to see the relevance in their own areas.

REFERENCES


