RESEARCH

A DEMONSTRATION BUILDING PROJECT: PROMOTING SUSTAINABILITY VALUES

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ABSTRACT

This article explores the relevance of the *demonstration project* as a strategy for inspiring contemporary building practice in a process towards sustainable building and as a tool for influencing environmental values in the community. The Log Cabin Project in Napier, New Zealand, is a demonstration facility for displaying sustainable building and living practices situated on the campus of the Eastern Institute of Technology (EIT). The project is the refurbishment of an existing structure designed to showcase the sustainable use of material resources, energy and water conservation, and wastewater management. The aim was to investigate the effect visiting a demonstration sustainable building might have on people's knowledge of and attitude towards sustainability issues, and more specifically whether the methods for making a building more sustainable displayed in the building affected how people thought about their own living environments. In February 2016, five visitor groups, three of EIT students not previously connected with the project, one of EIT staff, and a local environment group were invited to view the project and surveys were conducted both before and after the visit with 126 participants completing both pre- and post-surveys.

The research found improved scores after the visit in six of the seven survey measures of environmental knowledge, motives, and intentions, especially in the case of student visitor groups. The results also indicated promising increases in environmental values and concerns for environmental quality after the visit. Correlation between gender and sustainable action was not significant, however there was significant correlation between age and actions *intended in the future* where engagement was higher among young participant groups. Moreover, although many visitors had previously engaged with at least one pro-environmental activity before visiting the project (90%), 42% made at least one change as a result of the visit. These findings suggest the project was a catalyst for behaviour change. Discussions are centred on the usefulness of demonstration sustainable buildings as tools for fostering environmental protection practices.

KEYWORDS

demonstration project; sustainable values; refurbishment; behavior change

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1. BACKGROUND

At the beginning of the 21st century the world is witness to unsustainable development characterised by a growing human population, increasing consumption, and unequal distribution of resources (Heinberg, 2010; UN-HABITAT, 2006). In view of this, the built environment has been singled out as a key area of concern for sustainable development from an international perspective (CIB, 1999; SCMT, 2004). Sustainable building practice at the local level entails determining the complex relationships between human activities in buildings, the way the built environment can contribute to human behaviour, and the impact of the built on the natural environment, as well as considering and respecting social, human, and cultural aspects (CIB, 1999; SCMT, 2004).

The use of a demonstration facility as a *good example* in sustainable building has been advocated as an effective tool to bring about change in consumer and community choices, and construction practices (SCMT, 2004; IEA SCH Task 40, 2012). Furthermore, it is a method for innovation, development, and knowledge build-up within the building sector (Rubino et al., 2007). In Europe, considerable efforts have been made to support and promote the use of demonstration projects for sustainable building to develop a culture of environmental performance as a way of verifying improvement, including criteria for recording the achievement of various aspects of sustainability (BRE, 2009; DTI, 1998; SEPA, 2003). On this note, the techniques and methods incorporated within a demonstration building need relevance for the building types found in its locality. Demonstrating sound examples of sustainable building practices and the collection and dissemination of such practices is a positive component of community environmental education (SEPA, 2003; Heiskanen et al., 2015). There are good examples of sustainable buildings in a number of countries that were designed to showcase sustainable building practices and promote pro-environmental behaviour (Dietz et al., 2009; Daly, 2008; Kua & Lee, 2002; Heiskanen et al., 2015).

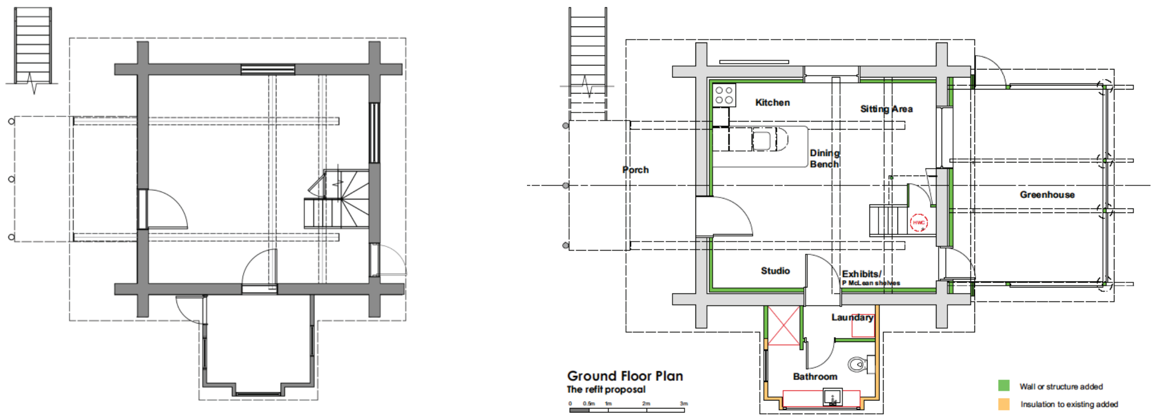
Essentially, this article is a contribution to understanding people's increased knowledge of and concerns for environmental issues related to living in a built environment (Schultz, 2001; Dunlap et al., 2000), and how demonstration building projects can help support further awareness of ecological practices. It looks at *buildings that teach* through displaying environmental

FIGURE 1. Views of the Log Cabin, (a) from the northwest, (b) from the south.

(a) (b)

Source: Alan Neilson photos, 1997.

FIGURE 2. Ground Floor Plan of the Log Cabin, (a) before improvements, (b) after improvements.



(a) (b)

practices and solutions for visitors as prototypes relevant to the locality in order to inform choices, demonstrate practices that are sustainable, and inspire behavioural change through how the building is designed and used.

The building in question is a rescued Log Cabin (LC) at Otatara Hills in Hawke's Bay, New Zealand, on a site that is part of the Eastern Institute of Technology (EIT) (Figure 1). The Otatara Hills site is an example of a place that has strong historic, cultural, and spiritual associations with local Māori[3] (Pishief, 1997). The development of the project included refurbishing a modest LC that was empty and decaying to become a demonstration facility for showcasing sustainable building design and construction technologies, and to be used as an educational tool and focus for the behaviour and values that support sustainability. Formerly, the LC was used as a staff office space and later as a teaching studio space and an artist-in-residence living space but it was in a state of disrepair before this project started. Reusing old buildings rather than demolishing and building new has been recognised as an aspect of sustainable building (Storey, 2017)

The LC is square in plan with an internal footprint measuring 6x6 metres with a small lean-to accessed through a door in the centre of the southern wall and a mezzanine level accessed from a stair against the north wall (Figure 2).

Project design

Because the intentions of the project were to be a catalyst to inspire people's pro-environmental values, the decision was made that the design of the refurbishment would be generated and developed by students at EIT. The Second Year students in the Visual Arts and Design (VAD) programme developed both the brief and final design as part of a Design Studio course. The educational aim was to adopt a reflective teaching method that would enable meaningful learning (Smith et al., 2009). To facilitate working with a group of students who want to influence behaviour through design (Tromp et al., 2011; Wilson et al., 2013), discussion focussed on the need for responsible environmental attitudes to manifest the context of sustainability and ecology through design, coupled with applying *design thinking* in dealing with environmental,

3. Māori are the indigenous Polynesian people of New Zealand.

social and ethical issues in addition to the technical and architectural context (Dorst, 2011). The final design therefore reflected what the students understood by making a sustainable building flowing their research. Out of 19 design students invited to take part in formulating the initial concepts 6 opted to become involved, with the remainder choosing to work on other projects (Bahho & Vale, 2018).

The students established a set of aims for the building refurbishment by comparing guidelines and recommendations from a number of national and international sources in order to find out what characterizes a sustainable building. From this, a design strategy was established for the LC guided by the following parameters; the philosophy of integrating renewable low energy design with low environmental impact of materials; aiming to achieve a Net Zero Energy building; adopting passive solar standards; using recycled building materials and components; waste water treatment; reducing mains water use through conserving rainwater, and achieving healthy indoor air (Bahho & Vale, 2018). The details of what the students incorporated are set out below.

Energy Conservation and Renewable Energy Systems

- The design concept focused on improving the thermal insulation and airtightness of the building as part of the passive solar techniques and evaluating the design using the BRANZ[4] Annual Loss Factor (ALF) tool (Bassett & Stoecklein, 1998) for calculating the energy performance of a New Zealand house.
- A greenhouse was added to the north side of the existing structure so the direct solar gain would contribute to heating the interior living space by way of air convection (EECA, 1994; Gong et al., 2012; Kachadorian, 1997, 138–143). This is an integral part of the building's solar heating system.
- For renewable energy, a solar photovoltaic panel system was required, whereas hot water came from a redundant but existing evacuated tube collector solar hot water system on campus.
- The Required Heat Energy (RHE) for the LC design was calculated as 16.52 kWh/m^2 year, close to the Passive House Institute New Zealand standard of 15 kWh/m^2 year (PHINZ, 2014); this is significant especially considering the LC is a retrofit project. A typical New Zealand house would use 28.95 kWh/m^2 year (Isaacs et al., 2010).
- Natural light was utilised in all parts of the project. To maximize energy savings, power efficient Energy Star®-rated appliances were used and LED lights installed throughout.

Sustainable Building Materials and Techniques

- Timber, as a renewable structural building material with low embodied energy, formed the framing for the new internal lining to the external log walls and the greenhouse. As much recycled timber as possible was used for frames and linings.
- Fibreglass 'batts' were preferred for insulation as they are locally made and use up to 80 percent recycled glass (Pink Batts, 2017).

4. Building Research Association of New Zealand

- For windows, recycled timber was used to repair existing ones and make them suitable for new, double-glazing units to replace the single glass. Recycled single glazed window frames were used for the greenhouse walls.
- The existing kitchen joinery was repaired and refitted.
- Recycled toilet, shower, and washbasin were sourced.

Sewage and Wastewater Treatment

- A sewage and wastewater treatment plant was introduced. The recycled effluent would be used in the greenhouse and excess discharged to a nearby drip-line effluent field.
- Capillary mats were proposed as an effective irrigation method to rationalise the use of treated wastewater in the greenhouse.

Water Conservation

- Roof runoff would be stored in a 10,000-litre rain storage tank and used for drinking, cooking, and washing. As the mean annual rainfall in Napier is not enough, the balance of water needed would come either from savings in use or using the existing mains water connection.

Healthy Indoor Air

- In relation to natural ventilation, the existing window openings fell well within the New Zealand Building Code minimum requirement for achieving healthy indoor air.
- Durable and toxic-free materials and products were chosen for new and refit components.

Project retrofit works

Funds for executing the building works were limited and mostly raised through sponsorship or via the solicited contributions of individuals or groups to the building works. Contributions included labour by students and staff from a number of Trades and Technology Programmes at EIT (Figure 3). This approach prolonged the building period as the work relied heavily on the availability of volunteer helpers and loaned equipment (Bahho et al., 2016).

Research aims

The objective of the part of the project described and discussed in this article was to investigate the effect visiting a demonstration sustainable building might have on people's attitudes to sustainable issues, and whether the methods displayed in the LC for making a building more sustainable affected how people thought about their own living environments. The intention was to achieve an insight into the environmental attitudes of visiting individuals and their reactions to perceived environmental problems, and what they might be prepared to change in their own lives.

2. METHOD

The method used in this article is based on that of a wider study that used instruments from psychology to measure environmental attitudes in those involved in the LC project as designers, builders, sponsors, and visitors (Bahho, 2018). This article reports on the results of surveys held with five groups of visitors to the project once construction work had been completed. All groups of visitors were given a pre- and post-visit survey questionnaire on environmental

FIGURE 3. The Log Cabin after the refurbishment.

attitudes so that conclusions could be drawn about any effect the visit may have had on environmental attitudes.

Participants

At the pre-visit phase, an anonymous three-part questionnaire was given out to 194 participants (93 males, 98 females, and 3 who identified themselves as other), with ages ranging from 17 to 69 years (M = 34.86; SD = 1.246) (Table 1). Later, guided visits to the LC project were organised in groups of various sizes. Each visit was approximately 40 minutes long during which the groups toured the building and were informed about the project in terms of its ecological objectives, initiation, historic links, sustainable characteristics and performance, refit practices, and future prospects. Visitors did not include the students or other individuals involved in the design or the construction of the LC project. Table 1 sets out the sections of the questionnaire to be completed pre- and post-visit.

After the group visits, a second post-visit four-part questionnaire was given or sent electronically to all participants. A total of 126 visitors returned the post-visit questionnaire (49 male, 75 female, and 2 other), with ages from 18 to 68 years (M = 36.63; SD = 1.230). The EIT Trades group of 15 participants did not return it because the timing of the survey was too close to the end of their academic programme. Only 10 of the 23 members of the pre-visit Environment Centre group completed the second questionnaire (Table 2).

TABLE 1. Survey sections.

	Section 1: EC[1]	Section 2: AC[2]	Section3: NEP[3]	Section 4: SA[4]
Pre-visit questionnaire	✓	✓	✓	
Post-visit questionnaire	✓	✓	✓	✓

[1]Environmental Concerns measure (based on Schultz, 2001), [2]Awareness of Consequences measure (based on Joireman et al., 2001), [3]New Environmental Paradigm scale (based on Dunlap et al., 2000), [4]Sustainable Action questions

Surveys

In addition to demographic information (gender, age, and ethnicity), the pre-visit questionnaire was aimed at finding participants' level of environmental knowledge before the visit to the LC. The post-visit survey was aimed at assessing whether the LC project visit coincided with an increase in environmental awareness or a change in attitude towards sustainability.

Section 1: Environmental Concerns (EC). Attitudes to environmental concerns were assessed using a 12-item scale measuring three categories of concerns regarding environmental problems caused by human behaviour. The categories were egoistic concerns (me, my lifestyle, my health, my future), altruistic concerns (people in my community, all people, children, my children), and biospheric concerns (plants, animals, marine life, birds) (Schultz, 2001). ECs were indicated on a 7-point Likert scale (1 = not important to 7 = supremely important).

Section 2: Awareness of Adverse Consequences (AC). AC beliefs are causally related to value orientation where individuals make choices they believe are consistent with their value orientation biases (Joireman et al., 2001). AC beliefs were examined using a 13 statement scale measuring three facets of the Environmental Survey Scale (selected from the five facets in Joireman et al., 2001). These are perceived egoistic consequences (4 items), perceived social consequences (5 items), and perceived biospheric consequences (4 items). All statements were rated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree).

TABLE 2. Participant visitor groups.

	Visitor groups	Pre-visit (N)	Post-visit (N)
Group 1	EIT Staff	29	24
Group 2	EIT Students	54	31
Group 3	VAD Students	73	61
Group 4	Environment Centre	23	10
Group 5	EIT Trades	15	0
Total		194	126

Section 3: New Environmental Paradigm (NEP). The set of 15-items are designed to measure the overall relationship between humans and the environment, with three items for each of five hypothesized facets of an ecological worldview. These are the reality of limits to growth, antianthropocentrism, the fragility of nature's balance, rejection of exemptionalism, and the possibility of an eco-crisis (Dunlap et al., 2000). This has been the most widely used measure to investigate environmental concerns (Dunlap et al., 2000; Dunlap & Jones, 2002). The eight odd-numbered items were worded so that agreement indicates a pro-ecological view, and the seven even-numbered ones so disagreement goes with a pro-ecological worldview. All statements were rated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree).

Section 4: Sustainable Actions. A set of 23 action statements at the post-visit phase aimed at discovering what sustainable actions the participants had done or intended to do, and changes made as a result of their visit to the LC project, based on the Utah House survey model (Dietz et al., 2009). Actions were listed, an example being "Install additional insulation in home." Alongside each statement were three columns where participants needed to choose whether the action was done *before* the visit to the LC project, *because of what they have learnt* at the LC project, or was one they intended to do *in the future*.

Procedure

As mentioned above, prior to the LC visit participants were asked to fill in a pre-visit questionnaire. The student participants were given this in a classroom setting, while those for the EIT staff were delivered personally. For the Environment Centre group, questionnaires were completed on site before the presentation of the project's purpose and features and the tour of the building. Some 3–6 months after the intervention, a post-visit survey was conducted. Questionnaires were handed to the student participants in a classroom setting, while the remainder were personally or electronically delivered.

Data Analysis

All data analyses were performed usingthe Statistical Package for the Social Sciences (SPSS), except as noted. Survey data were entered by hand into an SPSS file. The focus led to a parsimonious approach to the data, as the main goal was to explore change after the intervention. SPSS Syntax was created for running the main steps, which were later divided into sections for reporting. A (*p*-value) of <0.05 for all statistical tests performed was considered significant.

Reliabilities

Cronbach's alpha coefficients were used to assess the internal consistency of data. As a reliability coefficient, alpha is expressed as a number between 0 and 1. According to Nunnally's (1978) rule of thumb, instruments used in basic research should have Cronbach's alpha coefficients of 0.70 or higher. However, Clark and Watson (1995, p.315) noted, "…it is not uncommon for contemporary researchers to characterise reliabilities in the 0.60s and 0.70s as good or adequate." For a sample of a 100 or larger, Cronbach alpha coefficients greater than 0.40 are acceptable for research purposes (Mueller, 1986) (Table 3).

To assess whether a visitor's knowledge of each item in sections 1–3 of the questionnaire had increased, a paired t-test was used to compare the stated level of knowledge before and after the visit (Blaikie, 2003, p.183; Creswell, 2014, p.165). This included comparisons according to gender, age, and ethnicity. Analysis of variance (ANOVA) was performed on knowledge

TABLE 3. Cronbach's alpha scores for seven survey measures from three sources, pre and post-visit.

Measure	Pre-visit (T1)			Post-visit (T2)		
	N	Cronbach Alpha	No of items	N	Cronbach Alpha	No of items
EC egoistic	196	0.917	4	126	0.916	4
EC altruistic	191	0.864	4	119	0.886	4
EC biospheric	200	0.898	4	126	0.904	4
AC egoistic	190	0.579	4	121	0.570	4
AC social	195	0.632	5	121	0.724	5
AC biospheric	198	0.552	4	125	0.602	4
NEP	185	0.759	15	120	0.808	15

ratings for three of the visitor groups of VAD students, EIT students, and EIT staff, to look for significant differences. For Section 4 of the post-visit survey, percentage participant responses to targeted sustainable actions and future intentions were calculated using SPSS. As mentioned above, the Environment Centre and EIT Trades groups, registered only 10 and zero post-visit responses respectively, so they were not considered in the comparisons.

3. ANALYSIS

Of the 194 participants who completed the pre-visit questionnaire, 126 filled in the post-visit survey, a response rate of 65% (Table 3).

Demographics

Survey participants were 48.0% male, 50.5% female, and 1.5% other. They were predominantly NZ Europeans (65.9%) followed by Māori (21.1%). A review indicated 44.8% of visitors were aged 17–25, which is expected given the student contingent.

Descriptive Analysis

Descriptive analysis involves the Means, Standard Deviations, and Alpha values of the seven measures; the three Environmental Concerns (EC) measures, the three Awareness of Consequences (AC) measures, and the NEP scale. Tables 4 compares the Means and Standard Deviations for the pre-visit group results with those from similar studies by Schultz (2001) and Milfont et al., (2006). The comparison shows that the visitor group Mean values towards the three EC measures (egoistic, altruistic, and biospheric) are slightly higher than those of Schultz and Milfont et al. The results for ACs were compared with those of a study by Joiremean et al (2001) (Table 5) and the visitor group responses were also higher, particularly those about concerns for others and the community. Lastly, the results for the selected NEP items were compared with those from a study by Amburgey & Thoman (2012) (Table 6). This comparison again showed the visitor groups knowledge of environmental issues was notably higher except in the case of NEP item 6.

TABLE 4. Environmental Concerns: comparisons of Means, Standard Deviation, and Reliability for Schultz (2001), Milfont et al. (2006), and LC pre-visit surveys.

	Schultz[1] N = 1010		Milfont et al[2] N = 658		LC Visitors N = 196		Cronbach Alpha reliability value		
	M[3]	SD[4]	M	SD	M	SD	Schultz	Milfont et al	LC Visitors
EC: Egoistic Concerns	5.47	1.51	5.36	1.29	5.58	1.44	0.71	0.90	0.91
EC: Altruistic concerns	5.78	1.49	5.77	1.14	5.98	1.37	0.64	0.88	0.85
EC: Biospheric concerns	5.33	1.38	5.44	1.05	6.22	1.07	0.86	0.89	0.89

[1]Selected results from (Schultz, 2001, p. 329), [2]Selected results from (Milfont et al., 2006, p. 753), [3]M = Mean, [4]SD = Standard Deviation.

TABLE 5. Awareness of Consequences: comparisons of Means, Standard Deviation, and Reliability for Joireman et al. (2001) and LC Visitors pre-visit surveys.

	Joireman et al. N = 191		LC Visitors N = 196		Cronbach Alpha reliability value	
	M[1]	SD[2]	M	SD	Joireman et al.	LC Visitors
AC: Egoistic consequences	5.48	0.95	5.82	1.34	0.67	0.57
AC: Social consequences	5.53	0.93	6.10	1.25	0.76	0.63
AC: Biospheric consequences	5.22	0.97	5.53	1.54	0.65	0.55

[1]M = Mean. [2]SD = Standard Deviation.

Correlations

Simple correlations were computed between all seven measures, pre and post-visit and evaluated using two-tailed tests. All relationships were reported in a correlation matrix. General inspection of the correlations revealed the NEP measure (Section 3 of the questionnaire) was strongly associated with the rest of the measures ($p < .01$ in all correlations), indicating that its variables are closely associated, albeit to a varying extent, with the outcome variables of both Environmental Concerns (EC) and Awareness of Consequences (AC) measures. The post-test NEP measure was particularly correlated with the three AC post-test measures: Egoistic Consequences ($r = .28$, $p < .01$), Social Consequences ($r = .57$, $p < .01$), and Biospheric Consequences ($r = .59$, $p < .01$). Consistent with the biospheric considerations, biospheric concerns were, as expected, strongly correlated with biospheric consequences ($r = .24$, $p < .01$). Further inspection revealed that, as anticipated, egoistic concerns were strongly associated with altruistic and biospheric concerns ($r = .68$, $p < .01$ and $r = .45$, $p < .01$ respectively).

TABLE 6. Comparison of NEP scale in Amburgey & Thoman (2012) and LC Visitors pre-visit surveys.

New Ecological Paradigm (NEP) items and item numbers M		Amburgey and Thoman[1] N = 328		LC Visitors N = 185		Amburgey and Thoman	LC Visitors
			SD	M	SD	$M_{POMP\ score}$[2]	$M_{POMP\ score}$
NEP 1	Limits [3]	3.13	1.28	4.97	1.56	53.25	66.17
NEP 2R	Anti-Anthro	3.14	1.11	4.86	1.61	53.5	64.33
NEP 3	Balance	3.62	1.08	5.18	1.57	65.5	69.67
NEP 4R	Anti-Exempt	3.22	1.02	4.17	1.62	55.5	52.83
NEP 5	Eco-Crisis	3.91	1.07	5.84	1.30	72.75	80.67
NEP 6R	Limits	3.09	1.21	2.88	1.66	52.25	31.33
NEP 7	Anti-Anthro	4.05	1.11	6.28	1.12	76.25	88.00
NEP 8R	Balance	3.74	1.08	5.32	1.59	68.5	72.00
NEP 9	Anti-Exempt	4.33	0.81	5.75	1.29	83.25	79.17
NEP 10R	Eco-Crisis	3.44	1.17	5.18	1.61	61	69.67
NEP 11	Limits	2.48	1.23	5.12	1.58	37	68.67
NEP 12R	Anti-Anthro	3.02	1.45	5.44	1.75	50.5	74.00
NEP 13	Balance	3.02	1.45	5.36	1.50	50.5	72.67
NEP 14R	Anti-Exempt	3.62	1.12	4.44	1.69	65.5	57.33
NEP 15	Eco-Crisis	3.57	1.16	5.70	1.40	64.25	78.33

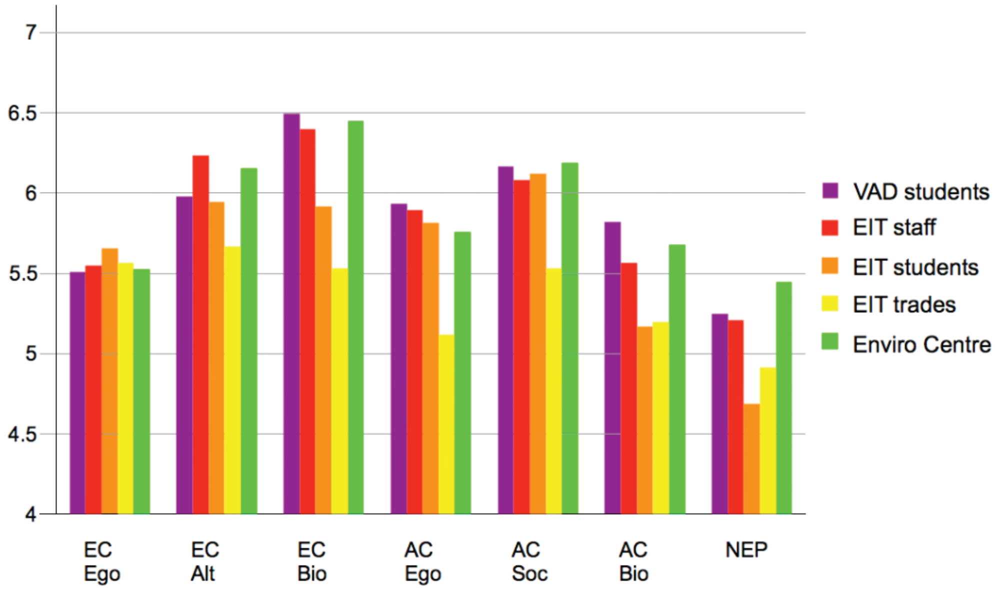
(1) Amburgey & Thoman (2012, p.239) used a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree), while LC Visitors used a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). Mean values were therefore converted to the percentage of maximum possible score (POMP)[2] for comparison (Cohen et al., 1999; Fischer & Milfont, 2010). (3)Limits = Ecological limits, Anti-anthro = Human domination, Balance = Balance of nature, Anti-exempt = Human exemption, and Eco-crisis = Ecological catastrophe.

Comparison with pre-visit survey results

All five groups who visited the LC project recorded their responses to the seven measures at the pre-visit stage. The means were adjusted for each variable using Estimated Marginal Means (in SPSS) in order to allow comparison of the means of unequal sample sizes (as in ANOVA).

Comparing the Mean (M) for the participant groups pre-visit against the seven measures, itemised with the associated Standard Error (SE) (Figure 4), revealed that in relation to egoistic measures of both EC and AC, EIT Students had the highest average means in ECs ($M = 5.65$, SE = 0.19) and VAD students the highest in AC ($M = 5.93$, SE = 0.10), while at the lower end of the EC measure the four groups were close, with VAD students the lowest by a small margin ($M = 5.51$, SE = 0.16) and EIT Trades having the lowest AC measure ($M = 5.11$, SE = 0.23).

FIGURE 4. Estimated marginal means responses to each of the five groups at the pre-visit stage in relation to the seven measures: the three ECs, the three ACs, and NEP.



For altruistic and social measures of EC and AC, EIT Staff and the Environment Centre had the highest average means (*M* = 6.23, SE = 0.20 and *M* = 6.17, SE = 0.16 respectively), and EIT Trades the lowest in both measures (*M* = 5.56, SE = 0.29 and *M* = 5.53, SE = 0.20 respectively). For biospheric measures of both EC and AC, VAD students attained the highest averages in both measures (*M* = 6.46, SE = 0.10 and *M* = 5.81, SE = 0.11 respectively) with EIT Trades having the lowest in EC measure (*M* = 5.53, SE = 0.23) and EIT students the lowest in AC measure (*M* = 5.17, SE = 0.13). Finally, in relation to the NEP scale, the Environment Centre group achieved the highest average mean (*M* = 5.44, SE = 0.14) and EIT students the lowest (*M* = 4.68, SE = 0.09).

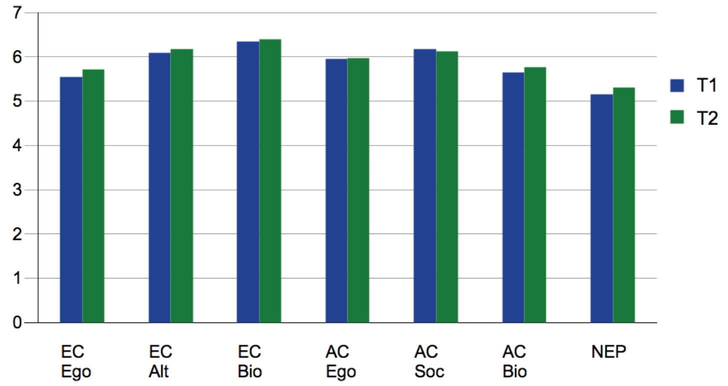
In order to find out the highest means, and hence the most pro-environment visitor group, means of the seven measures for each of the five groups were averaged. The Environment Centre group, not unexpectedly, had the highest average mean of (*AM* = 5.87) followed very closely by VAD students (*AM* = 5.86), while the EIT trades group had the lowest average (*AM* = 5.35). Although the Environment Centre group were not the highest in all comparisons, they were close to the top in most measures. The results also showed that the VAD student group, a mixture of visual arts and design students, had a similar knowledge of and passion towards sustainability issues and the environment.

4. RESULTS AND DISCUSSION

Paired-sample t-test

A paired sample t-test was used to analyse and compare the mean difference for responses to the seven measures before and after the visit (Statistics Solutions, n.d.). Comparisons (*t*-test) of these responses indicated a marginal increase in knowledge in all the measures except the AC Social Consequences category (Figure 5). In general, it seems participants already had a

FIGURE 5. *t*-test paired sample statistics. Mean responses to the seven measures.



N = 126. EC = Environmental concerns (Schultz, 2001), AC = Awareness of the Consequences (Joireman et al, 2001), and NEP = New Environmental Paradigm (Dunlap et al., 2000).

reasonably high level of knowledge about a variety of sustainability topics, which is evident in the relatively high pre-visit mean scores.

Although the AC Social Consequences category (altruistic consequences) was lower in T2 compared to T1, the drop was not significant. Some of the increases were also very small (for example AC Egoistic). Overall, comparing the means and standard deviations of the seven measures before and after the intervention reveals the means in T2 were statistically higher than those in T1, except in the AC Social Consequences category, thus endorsing the finding above. The standard deviation values in T1 and T2 were statistically similar (Table 7).

Ranking of T1 scores was similar to T2 (Table 8). There were positive correlations in all paired samples, indicating that higher scores in T1 were associated with higher scores in T2. This was important for the paired-sample t-test because large and positive correlations (above 0.00) imply less standard error in testing the hypothesis that individuals' environmental values increased in T2 compared to T1. Statistically significant 2-tailed value would have a demarcation less than 0.05.

There was noticeable change in some measures between T1 and T2, particularly in EC egoistic and NEP scale, but not in all measures.

Split-plot Analysis of Variance (ANOVA)

Split-plot ANOVA mixed design analysis was used to test the differences between groups before and after their visit to the LC project (T1 and T2). The analysis looked at comparisons across groups, particularly those with high sample size to compare change over time. For this part of the analysis the EIT Trades group were excluded as they did not do the post-visit survey, together with the Environment Centre group as only 10 participants completed it. The three groups in the split-plot analysis were VAD Students, EIT Students, and EIT Staff (Table 2).

From the main t-test comparison (Tables 9 and 10), only one statistically significant difference between the pre and post surveys was found, this being the NEP scale ($p < .05$). In addition, there was a marginally significant change in the egoistic concerns measure ($p = .076$), which includes the egoistic measure in ECs as well as ACs. So the split-plot ANOVAs only concern these two measures.

TABLE 7. Before and after Mean and Standard deviation values in the seven measures. N = 126.

Measures	Time	Mean	SD
EC egoistic	T1	5.54	1.46
	T2	5.73	1.34
EC altruistic	T1	6.09	1.10
	T2	6.17	1.02
EC biospheric	T1	6.34	0.88
	T2	6.40	0.82
AC egoistic	T1	5.95	0.86
	T2	5.98	0.87
AC social	T1	6.18	0.75
	T2	6.12	0.86
AC biospheric	T1	5.65	1.03
	T2	5.77	1.02
NEP	T1	5.16	0.71
	T2	5.31	0.74

TABLE 8. Paired sample correlations analysis, T1 and T2. N = 126.

	Measure pairs	Paired-samples Correlation	Standard Error	Paired differences		Sig. (2-tailed)
				Mean	SD	
Pair 1	T2-EC egoistic & T1-EC egoistic	0.679	0.064	0.180	1.126	0.076
Pair 2	T2-EC altruistic & T1-EC altruistic	0.596	0.084	0.085	1.010	0.347
Pair 3	T2-EC biospheric & T1-EC biospheric	0.634	0.071	0.066	0.734	0.317
Pair 4	T2-AC egoistic & T1-AC egoistic	0.354	0.089	0.032	0.989	0.713
Pair 5	T2-AC social & T1-AC social	0.522	0.078	−0.065	0.797	0.363
Pair 6	T2-AC biospheric & T1-AC biospheric	0.561	0.071	0.120	0.962	0.163
Pair 7	T2-NEP & T1-NEP	0.708	0.056	0.149	0.560	0.004

TABLE 9. Descriptive Statistics of NEP scale measures.

	Groups	Mean	SD	N
T1_NEP	EIT staff	5.24	0.68	24
	EIT students	4.67	0.59	31
	VAD students	5.29	0.63	61
	Total	5.12	0.68	116
T2_NEP	EIT staff	5.28	0.73	24
	EIT students	4.88	0.67	31
	VAD students	5.41	0.68	61
	Total	5.24	0.72	116

NEP Scale. Descriptive statistics of the 116 participants (three groups) across T1 and T2 are shown in Table 9. In T1, both EIT staff and VAD students had rather high mean scores of (M = 5.24 and M = 5.29 respectively), although at T2, the EIT staff mean had risen marginally to (M = 5.28) and that of the VAD students a bit more (M = 5.41). For EIT students, the mean score at T1 was (M = 4.67) and this rose to (M = 4.88) at T2.

The noticeable improvement in T2 in both VAD and EIT students (compared to EIT staff) could be attributed to the students' relative youth, and their values changing in response to what they have been told.

Figure 6 supports the observations from Table 9 with the plot profiles of T1 and T2 showing the largest rise occurred in the EIT student group followed by the VAD students, while rise in the EIT staff group was marginal.

FIGURE 6. Plot profile, NEP scale measure between T1 and T2.

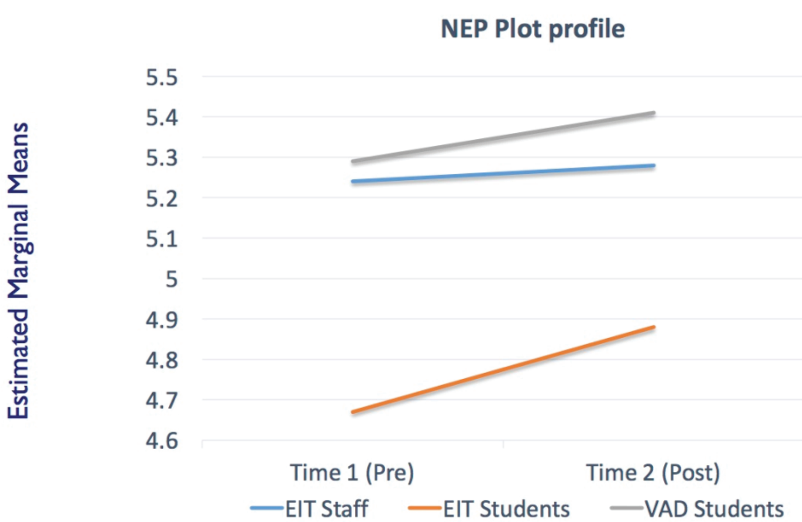


TABLE 10. Descriptive Statistics of egoistic measures.

	Groups	Mean	SD	N
T1_egoistic	EIT staff	5.40	1.42	24
	EIT students	5.82	1.11	31
	VAD students	5.46	1.59	61
	Total	5.55	1.44	116
T2_egoistic	EIT staff	5.18	1.68	24
	EIT students	6.23	0.66	31
	VAD students	5.73	1.29	61
	Total	5.75	1.30	116

It was clear that the two student groups, mostly young people, were affected by their visit to the LC project. Hence, in terms of attempting to educate the community about pro-environmental practices and change people's values, directing attention to the young could be profitable.

Egoistic measures. Descriptive statistics of the 116 participants for Egoistic measures across T1 and T2 are given in Table 10. The EIT students had a high mean score ($M = 5.82$) in T1, which rose to ($M = 6.23$) in T2. The other two groups of VAD students and EIT staff had means scores of $M = 5.46$ and $M = 5.40$ respectively at T1, but at T2 the former had risen to $M = 5.73$ while the EIT staff mean dropped to $M = 5.18$.

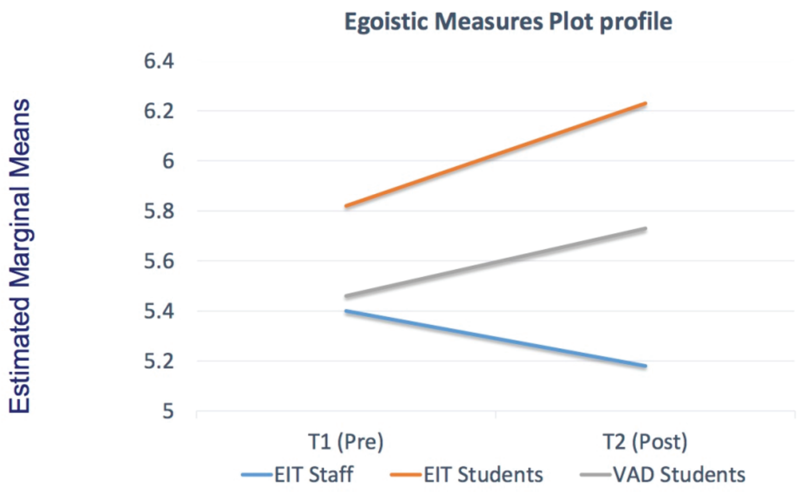
Figure 7 supports the observations from Table 10 showing plot profiles of the three groups at T1 and T2. The largest rise occurred in the EIT and VAD student groups, while the egoistic position of the EIT staff dropped at T2.

The rise in T2 for the students could be attributed to the fact that being young they would be concerned about the future. Interestingly, despite the high means at T1 of the VAD students, they still improved their scores at T2. This is in line with other research conducted on young people's environmental attitudes where it was found this age group possesses overwhelming feelings of environmental concerns, combined with feelings of frustration, sarcasm, and a perceived inability to act (Connell et al., 1999). On another note, many young people left out the question related to their concern about children because they did not see it as relevant, not having children. This is problematic and could have influenced the results.

Sustainable actions data

The group visits to the LC project took place between February and August 2016. The focus was on describing the environmental practices, including overall sustainability, passive design techniques, renewable energy use and energy efficiency, water conservation, waste management, recycling and re-use, as well as sustainable landscaping. The post-visit questionnaire repeated the pre-visit one with the addition of section 4, which was designed to find out what the visitors have done or intend *to do after* their visit to the LC project. It included 23 *sustainable actions* and visitors were asked whether they had done this before the visit, as a result of it, or would do in the future. The results were entered and labelled in SPSS according to the *number* of

FIGURE 7. Plot profile, egoistic measure (ECs and ACs) between T1 and T2.



listed *actions* they had performed in a five-point scale (1 = 0 actions; 2 = 1–5 actions, 3 = 6–10 actions, 4 = 11–15 actions, 5 = 16+ actions).

Cronbach's alpha coefficient for assessing the internal consistency of data was calculated to be (α = 0.86), considerably higher than the recommended (α = 0.70).

A total of 126 participants returned the post-visit survey (including the 10 participants from the Environment Centre), out of which 90.4% reported doing at least one of the listed actions before visiting the LC project. The most common pre-visit actions were to turn off room lights while not in use (49.0%), use second-hand furniture at home (41.5%), grow veggies or fruit at home (35.0%), install energy saving lights (34.0%), and install recycled or reused materials or items, and produce compost from kitchen waste (both 29.5%), (Table 11).

In comparison, the number of sustainable actions that participants had done *before* visiting the LC was not significantly correlated (p = 0.411) with the actions done *as a result of* the visit (r = –0.074). This may be partially attributed to the fact that a large proportion of respondents were students with limited finance to invest in sustainable technologies, or because a significant number of them did not own their homes. Another reason could be that the period between the pre-visit and post-visit surveys (3–6 months) was short for taking major sustainable actions such as installing PV panels. However, the number of sustainable actions that participants had done *before* visiting the LC was significantly correlated with *future* intended actions ($p < 0.05$). Although this relationship was not strong (r = –0.214), it was significant, indicating a link between how environmentally motivated the participants were and the number of actions they intend to implement in the future.

Engagement in specified sustainable activities *before* the visit by gender and age is explained in Table 11. However, the correlation (p = 0.07) between gender and sustainable action was not significant (r = –0.162). According to the *number of listed actions* on the determined five-point scale, the mean for males (M = 2.91, SD = 1.10) was slightly higher than females (M = 2.69, SD = 0.86), indicating that males were slightly more likely to be engaging in the listed activities before the visit than females. This was not in line with findings of other studies where females were found to be more likely to engage in pro-environmental behaviour (Meinhold & Malkus,

TABLE 11. Percentage of participants performing target actions, and their future intention. N = 126.

Sustainable actions	Done *before* my visit to the LC (%)	Done *because of what I learnt* at the LC (%)	I intend to do this action *in the future* (%)
Install additional insulation in home	23.5	2.5	27.5
Upgrade windows to double glazing	10.0	1.5	35.0
Utilise natural light indoors better	21.5	9.5	22.0
Install energy saving lights	34.0	7.0	16.5
Turn off room lights while not in use	49.0	1.5	8.5
Switch power company to one that uses renewable resources	11.0	3.0	30.0
Purchase higher energy star appliances	23.0	3.0	27.0
Install solar panels for electricity	2.5	1.5	41.0
Install solar hot water heating	4.5	2.0	37.0
Use water saving washing machine	22.5	0.5	28.0
Install water efficient toilet and/or shower head	13.0	1.0	28.5
Reduce time taken in daily shower	25.5	7.5	14.0
Collect and store roof run-off water	6.0	3.5	31.0
Install water efficient irrigation system	7.0	3.0	29.0
Recycle grey water	2.0	4.5	31.5
Install black water management system	1.0	3.0	27.0
Change landscape plants to native	17.0	7.5	24.5
Produce compost from kitchen waste	29.5	4.5	17.0
Grow veggies or fruit at home	35.0	4.0	18.0
Install recycled or reused materials or items	29.5	4.5	14.0
Use second-hand furniture at home	41.5	2.5	10.0
Use low or no VOC paint	7.0	1.0	27.0
Use formaldehyde-free materials for kitchen work surfaces	11.0	3.0	21.5

2005; Schultz, 2001; Swami et al., 2010; Hunter et al., 2004). With regard to age, there was significant correlation ($p = 0.00$) between age and sustainable action ($r = 0.367$) supported by the data analysis showing that engaging in sustainable activities was higher for age groups 55–65 and 65+ (M = 3.64, SD = 0.92; and M = 3.63, SD = 1.40 respectively) compared to age groups 17–25, 25–40, and 40–55 (M = 2.50, SD = 0.76; M = 2.50, SD = 0.88; and M = 2.82, SD = 0.95 respectively). This indicated that middle-aged participants were significantly more likely to be engaging in sustainable activities than other age groups *before* the LC project visit.

Post-visit sustainable actions

Referring to Table 11, a considerable number of participants (N = 126) reported implementing at least one action *as a result of* their visit to the LC project (42.1%). The most common actions were to improve their use of natural light indoors (9.5%), reduce time taken in the daily shower (7.5%), change landscape plants to natives (7.5%), and install energy saving lights (7.0%). Not surprisingly, actions requiring high cost such as installing solar panels for electricity, or installing solar hot water, were not noted *as a result of* the visit (nor *before*), yet these two actions were the highest rated for something participants intend to do in the *future*, with responses of 41.0% and 37.0% respectively. With regard to recycling grey water and installation of black water management systems, both high cost actions, 4.5% and 3% respectively installed them *as a result of* the visit compared to 2.0% and 1.0% respectively *before* the visit. However, intentions to carry out these actions in the *future* were 31.5% and 27.0% respectively. This showed that visitors were aware of the actions they needed to take to make their living environments more sustainable.

Engagement in specified sustainable activities post-visit by gender and age is shown in Table 12, indicating that correlations with actions *as a result of* the visit ($p = 0.61$, $r = -0.045$) or *intended* actions in the future ($p = 0.17$, $r = 0.120$) were not significant. While the mean value for a sustainable action *as a result of* the visit was similar for males and females (M = 1.51, SD = 0.71 and M = 1.49, SD = 0.59 respectively), for *intended* actions in the future the means for male participants were than those of females (M = 3.00, SD = 1.26 and M = 3.14, SD = 1.15 respectively). This result is in line with studies by Meinhold & Malkus (2005), Schultz (2001), and Hunter et al. (2004). For age, a significant ($p = 0.000$) and strong correlation was found between future *intended* actions and age ($r = -0.317$), while correlation between age and actions *as a result of* the visit were not significant ($p = 0.250$) and weak ($r = -0.103$). The results also showed that the mean values of actions *as a result* of the visit were low across age groups, but for future *intended* actions the means were relatively higher in age groups 17–25 and 25–40 (M = 3.36, SD = 1.24 and M = 3.58, SD = 1.21 respectively) compared to age groups 55–65 and 65+ (M = 2.36, SD = 0.80 and M = 2.13, SD = 0.83 respectively).

TABLE 12. Means and Standard Deviation of pre and post LC visit surveys. Means scale relates to the *number of actions* performed on a five-point scale (1 = unsatisfactory, 2 = satisfactory, 3 = good, 4 = very good, 5 = excellent).

		Gender		Age				
Male N = 47		**Female** N = 77	**17–25** N = 50	**25–40** N = 24	**40–55** N = 33	**55–65** N = 11	**65+** N = 8	
Activities done *before* the visit	Mean	2.91	2.69	2.50	2.50	2.82	3.64	3.63
	SD	1.10	0.86	0.76	0.88	0.95	0.92	1.40
Activities done *as a result of* the visit	Mean	1.51	1.49	1.52	1.50	1.55	1.55	1.00
	SD	0.71	0.59	0.64	0.65	0.66	0.68	0.00
Activities *intended* in the future	Mean	3.00	3.14	3.36	3.58	2.91	2.36	2.13
	SD	1.26	1.15	1.24	1.21	1.10	0.80	0.83

5. CONCLUSIONS

This research was focused on raising people's awareness of environmental issues and getting them to realise the effects of the stress placed on the global environment. This was communicated through exposure to an existing domestic scale structure that had been converted as a demonstration building to show possible ways of living and building sustainably. For visitors, surveys comparing results before and after visit showed improved scores in six of the seven survey measures (Figure 5), with improvements in NEP scale and EC egoistic measure most noticeable, especially in the case of VAD and EIT student groups (Figures 6 and 7). This could be because being younger, students are more concerned about the effect of a degrading environment on their lifestyle, health, and future.

Through comparing the pre and post-visitor surveys, it seems there are indications of change in values as a result of visiting the LC project. However, because of the many possible influences on intent to act it is not possible to state that such intentions are absolutely to do with the project. However, since all types of visitors have demonstrated similar signals of intention the LC project appears to have inspired some thoughts towards environmental actions (see Table 11), given 42.1% of those who returned the post-visit survey reported implementing at least one low-cost sustainable action *as a result of* the visit, despite the short turn around in the post-visit responses of 3–6 months. On the other hand, 96% of those who returned that survey reported they *intend to do in the future* at least one sustainable action, including high cost investments such as installing solar panels for electricity, or a solar hot water system. Results also showed the mean values for actions people *intend to do in the future* were higher in age groups 17–25 and 25–40 highlighting the intentions of younger individuals towards sustainable action leading to pro-environmental behaviour (Hines et al., 1986/87). This suggests seeing the technology working in a building increases people's belief in the technology as they see it as something they could do. Hungerford and Volk (1990) concluded issue awareness does *not* lead to behaviour change in the environmental dimension, claiming the focus needs to be on individuals developing a sense of ownership and empowerment so that they are prompted to become environmentally responsible and active citizens. The hope is a demonstration building will confirm the old proverb "seeing is believing."

In relation to gender, quantitative evidence from this study suggested actions *as a result of* the visit were rather similar for males and females, although female participants were more likely than males to partake in sustainable activities *in the future*, a finding supported by other studies.

Perhaps the most important lesson from this study is that seeing a working sustainable building can both reinforce attitudes to sustainability and promote people to take sustainable actions at home.

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REFERENCES

Amburgey, L. W., Thoman, D. B. (2012). Dimensionality of the new ecological paradigm: Issues of factor structure and measurement. *Environment and Behavior, 44*(2), 235–256.

Bahho, M., Vale, B., & Milfont, T. (2016, July). *Buildings that teach: a strategy for sustainable design*. Paper presented at the 6th International Conference on Harmonisation between Architecture and Nature: Eco-Architecture 2016. Alicante, Spain (pp.143–154). Southampton, UK: Wessex Institute of Technology & Alicante, Spain: University of Alicante.

Bahho, M., & Vale, B. (2018). Buildings that teach: Developing sustainable building design criteria. Article accepted in *The International Journal of Sustainability in Economic, Social and Cultural Context, 13*(4), 21–39. Retrieved from: https://doi.org/10.18848/2325-1115/CGP/v13i04/21-39

Bahho, M. (2018). *A demonstration sustainable building: a tool for investigating environmental values*. PhD thesis. Wellington: University of Victoria in Wellington.

Bassett, M. & Stoecklein, A. (1998). *A new thermal design guide for New Zealand houses*. Paper presented at the IPENZ Conference, Auckland, New Zealand. Retrieved from: https://www.branz.co.nz/cms_show_download.php?id=f0397fd3e8741535f102469142d5d53fbb34f40c.

Blaikie, N. (2003). *Analyzing quantitative data*. London: Sage Publications.

BRE (2009). Building Research Establishment, *Demonstrations of sustainability: The Rethinking Construction dimensions and how they have addressed sustainable construction ideas.* Rethinking Construction Ltd: London. Retrieved from: http://constructingexcellence.org.uk/wp-content/uploads/2015/03/demonstrations_of_sustainability.pdf

CIB (1999). International Council for Research and Innovation in Building and Construction, *Agenda 21 on Sustainable Construction*. CIB Report Publication 237: Rotterdam.

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*, 309–319.

Cohen, P., Cohen, J., Aiken, L. S., & West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivariate Behavioral Research, 34*, 315–346.

Connell, S., Fien, J., Lee, J., Sykes, H., & Yencken, D. (1999). If it doesn't directly affect you, you don't think about it: a qualitative study of young people's environmental attitudes in two Australian cities. *Environmental Education Research, 5* (1), 95–113.

Creswell, J.W. (2014). *Research design: Qualitative, quantitative, and mixed method approaches* (4th ed.). Los Angeles: Sage Publications.

Daly, P. (2008, October). *Crossing thresholds: A zero energy demonstration house in Ireland*. Paper presented at the 25th Conference on Passive and Low Energy Architecture, Dublin.

Dietz, M. E., Mulford, J. & Case, K. (2009). The Utah house: An effective educational tool and catalyst for behaviour change. *Building and Environment 44*,1707–1713.

Dorst, K. (2011). The core of design thinking and its application. *Design Studies, 32*, 521–532.

DTI (1998). Department of Trade and Industry, *Rethinking construction: The report of the construction Task Force*. London: DTI.

Dunlap, R. E., & Jones, R. E. (2002). Environmental concern: Conceptual and measurement issues. In R. E. Dunlap & W. Michelson (Eds.), *Handbook of environmental sociology* (pp. 482–524). Westport, CT: Greenwood Press.

Dunlap, R. E., Van Leire, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP Scale. *Journal of Social Issues, 56*(2), 425–442.

EECA (1994). Energy Efficiency and Conservation Authority, *Design for the sun: Reference manual* (Vol. 2). New Zealand: Energy-Wise.

Fischer, R., & Milfont, T. L. (2010). Standardization in psychological research. *International Journal of Psychological Research, 3*, 89–97.

Gong, X., Akashi, Y., & Sumiyoshi, D. (2012). Optimization of passive design measures for residential buildings in different Chinese areas. *Building and Environment, 58*, 46–57.

Heinberg, R. (2010). What is sustainability? In R. Heinberg & D. Lerch (Eds.), *The post carbon reader: Managing the 21st century's sustainability crisis* (pp.13–24). Healdsburg, CA: Watershed Media.

Heiskanen, E., Nissilä, H., & Lovio, R. (2015). Demonstration buildings as protected spaces for clean energy solutions: the case of solar building integration in Finland. *Journal of Cleaner Production, 109*, 347–356.

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1986/87). Analysis and synthesis of research on responsible environmental behaviour: A meta-analysis. *Journal of Environmental Education, 18*, 1–8.

Hungerford, H. R., & Volk, T. L. (1990). *Changing learner behaviour through environmental education. Journal of Environmental Education, 21*(3), 257–270.

Hunter, L.M., Hatch, A., & Johnson, A. (2004). Cross national gender variation in environmental behaviors. *Social Sciences Quarterly, 85*(3), 677–694.

IEA (2012). International Energy Agency, Solar Heating and Cooling Programme (SHC) Task 40/ ECBCS Annex 52. *Towards net-zero energy solar buildings*. Retrieved from: http://www.iea-shc.org/task40/index.html.

Isaacs, N., Saville-Smith, K., Camilleri, M. & Burrough, L. (2010). Energy in New Zealand houses: Comfort, physics and consumption. *Building Research and Information, 38*(5), 470–480.

Joireman, J., Lasane, T., Bennett, J., Richards, D., Solaimani, S. (2001). Integrating social value orientation and the consideration of future consequences within the extended norm activation model of pro-environmental behaviour. *British Journal of Social Psychology, 40*, 133–155.

Kachadorian, J. (1997). *The passive solar house*. Vermont: Chelsea Green Publishing Company.

Kua H.W., & Lee, S.E. (2002). Demonstration intelligent building: A methodology for the promotion of total sustainability in the built environment. *Building and Environment 37*, 231–240.

Meinhold, J. L., and Malkus, A. J. (2005). Adolescent environmental behaviors: Can knowledge, attitude, and self-efficacy make a difference? *Environment and Behavior, 37*(4), 511–532.

Milfont, T. L., Duckitt, J., & Cameron, L. D. (2006). A cross-cultural study of environmental motive concerns and their implications for pro-environmental behaviour. *Environment and Behavior, 38*, 745–767.

Mueller, D. J. (1986). *Measuring social attitudes: A handbook for researchers and practitioners*. NY: Teachers College Press.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

PHINZ (2014). Passive House Institute of New Zealand, the Passive House standard. *PHINZ*. Retrieved from: http://www.phinz.org.nz/passive-house-standard.

Pink Batts. (2011). *Facts 2011*. Retrieved from: http://www.pinkbatts.co.nz/why-pink-batts/facts/

Pishief, E. (1997). *Assessment of heritage significance: Otatara Pa historic reserve*. New Zealand: Department of Conservation. Retrieved from: http://www.doc.govt.nz/Documents/conservation/historic/by-region/echb/otatara-pa-assessment-of-heritage-significance.pdf.

Rubino, B., Edén, M., & Femenias, P. (2007). Towards a sustainable building approach: arenas of enactment, models of diffusion and the meaning of demonstration projects for change. In *CIB World Building Congress, Construction for Development, Cape Town, South Africa*. Retrieved from: https://research.chalmers.se/publication/61542

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology, 21*, 327–339.

SCMT (2004). Working Group Sustainable Construction Methods & Techniques, *Draft Final Report 3/11/2003*—Contract Number: B43050/2003/352567/SER/B4.

SEPA (2003). Swedish Environmental Protection Agency, *The Power of Example: an evaluation of how examples of best practices, good examples and success stories are used in the work for sustainability*. Report 5283, ISBN 91-620-5283-7. Naturvårdsverket: Bromma, Sweden. Retrieved from: http://www.naturvardsverket.se/Documents/publikationer/620-5283-7.pdf?pid=2932. Accessed 8 February 2017.

Smith, D., Hedley P., & Molloy, M. (2009). Design learning: A reflective model. *Design Studies, 30*, 13–37.

Statistics Solutions. (n.d.). *Statistics solutions: Paired sample t-test*. Retrieved from: http://www.statisticssolutions.com/manova-analysis-paired-sample-t-test/.

Storey, J. (2017). Lambie House: deconstruction and eco-refurbishment. In E. Petrovic´, B. Vale, & M. Pedersen Zari (Eds), *Materials for a healthy, ecological and sustainable built environment: principles for evaluation* (pp.321–327). Duxford, UK: Woodhead Publishing.

Swami, V., Chamorro-Premuzic, T., Sneglar, R., & Furnham, A. (2010). Egoistic, altruistic, and biospheric environmental concerns: A path analytic investigation of their determinants. *Scandinavian Journal of Psychology, 51*, 139–145.

Tromp, N., Hekkert, P., & Verbeek P-P. (2011). Design for socially responsible behaviour: A classification of influence based on intended user experience. *Design Issues, 27*(3), 3–20.

UN-HABITAT (2006). *State of the world's cities 2006/07: The millennium development goals and urban sustainability*. London: Earthscan.

Wilson, G.T., Lilley, D., & Bhamra, T.A. (2013). Design feedback interventions for household energy consumption reduction. In *16th Conference of the European Roundtable on Sustainable Consumption and Production (ERSCP) & 7th Conference of the Environmental Management for Sustainable Universities (EMSU) (ERSCP-EMSU 2013), Istanbul, Turkey*. Retrieved from: https://dspace.lboro.ac.uk/dspace-jspui/handle/2134/12522.