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Contemporary Research Topics

This issue of Scope: Contemporary Research Topics (Learning and Teaching) takes the theme of "Sustainable Practice". It aims to engage discussion on contemporary research in the field of sustainable practice (including resilience, sustainability science etc). It is concerned with views and critical debates surrounding issues of practice, theory, history and their relationships as manifested through the experiences of researchers and practitioners in sustainable practice. The focus of this issue is the integration of the United Nations Sustainable Development Goals.

Formats include: editorials; articles; perspectives; essays; artist and designer pages; logs and travel reports; reports on and reviews of exhibitions, projects, residencies and publications; and moving, interactive works (to be negotiated with the editors for the online version, with stills to appear in the hardcopy version). Other suggested formats will also be considered; and special topics comprising submissions by various contributors may be tendered to the editors. All material will be published both in hardcopy and online. High standards of writing, proofreading and adherence to consistency through the APA (6th Edition) referencing style are expected. For more information, please refer prior issues for examples. A short biography of no more than 50 words; as well as title; details concerning institutional position and affiliation (where relevant); and contact information (postal, email and telephone number) should be provided on a cover sheet, with all such information withheld from the body of the submission. Low resolution images with full captions should be inserted into texts to indicate where they would be preferred; while high resolution images should be sent separately.

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Contemporary Research Topics

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Editorial

Sam Mann

In writing an editorial such as this one, the task is fourfold - to describe a theme that binds the contributions in a way that makes the whole greater than the sum of the parts; to highlight particular features of contributions; to look to the future, to espouse on challenges raised by the papers therein; and lastly, to thank all the people who contributed time and expertise to make it happen

First. The theme. This is where it gets tricky. The call for papers for this issue included the notion of "integrating the Sustainable Development Goals". And indeed, all the papers in this issue align with at least one of the SDGs and all of the SDGs are included. For some this link is clear, for others it is a bit more tenuous. Some, such as Marianna Cherrington's description of the role of Environmental Social and Governance Sustainability clearly fits in Goal 8 but it also has links to others. Perhaps because transport doesn't have a goal of its own, Kawtar Tani's study of Transportation habits of students can be seen to contribute to efficiency of energy use (Goal 7), transport infrastructure (Goal 9). Urban systems (Goal 11), responsible consumption (goal 12), education (Goal 4), and possibly addressing poverty (Goal 1). Perhaps more genuinely contributing to a wide range of goals, Ana Terri's conversation with Claire Goode about Ana's experiences in volunteering in Vanuatu. Ana's various projects contributed to reducing poverty (Goal 1), help subsistence farmers with education (Goal 2 and 4), developing capabilities (Goal 4), reducing inequalities (Goal 10), social justice (Goal 16), Life on Land (Goal 15) and is a clear partnership approach to achieving the goals (Goal 17).

But the SDGs are not supposed to be a checklist, a scorecard to pick a winner by who touches the most goals. Rather the brief analysis above highlights for us the diversity of areas covered by the papers in this issue. From Mary Butler's social innovation for wellbeing through vision, to Tori Clearwater's description of art providing the vision by which people can "see". Hey, there's a theme - "vision", but we're grasping at straws, probably plastic which would become part of Tori's wall. But while we should celebrate the diversity of the papers, it seems to be cheating to describe the fact that we can't see a theme is the theme.

So what else could we describe as the theme for the issue? There is a definite cluster around education. Hamish Smith and his colleagues' description of frustration - "everyone had the same frustration but for the lack of model for doing something...nothing was being done". This led to an eWaste repurposing scheme which is not just in an educational institution, it is treated as an opportunity for education. The solution is not treated merely as a materials flow, but as a solution integrated with learning (this has interesting echoes of Finn Boyle's development of a learning system integrated with composting described in our previous issue). Mazin Bahho's paper aims to educate students about what sustainable living practices are through engaging them in a reflective practice inquiry of designing a demonstration project for sustainable building. In designing the repurposing of a log cabin as a demonstration of sustainable building, students move from a transactional interaction of designing a thing, to realising the capability of design to reveal new understandings of ecological and sustainability issues. Similar transformations can be seen in Emma Anderton and her nursing student colleagues' (with Jan Ross) work in eScooters. What started out as a simple brief to work with a community group became an insightful project about motivations.

Overlapping with this cluster around education, are papers with a creative emphasis. Meg Brasell-Jones and Pam McKinlay describe the role of the oceans and argue that "for water quality to change, we have to change what we do on land". Like Tori Clearwater, they take the stance that art has an important role in challenging and inspiring people into action - reaching new audiences to inspire the public.

Clearwater describes the "attempt to create a space where people bring their own knowledge and prior experiences to the work as they recognise materials that exist in their daily lives. Through this realisation, I hope the work will get people thinking and start a conversation".

Both describe the artists' visual response rather than aesthetically pleasing versions of data. Clearwater describes "the use of materials and products to create 'beautiful' works that become abject as the message and product become apparent".

Otago Polytechnic's "Our People Make a Better World" describes all the papers. The cynic might argue that you would be hard pushed to find a paper in a sustainability journal that didn't meet this but we like it so that's what it is.

So that's the first editorial task - a theme. And task two- the highlights seem to have come along for the ride already.

So, third task, what can we learn from all this? What does this collection of papers tell us about sustainability? Only one takes a pillars approach. All describe a thriving approach to sustainability (rather than a reduction approach). Only two begin with a threat and then only briefly before focussing on positive action. Only one has an undertone of pessimism. None take an explicitly regenerative approach except perhaps Ana Terry's work in Vanuatu where she advises us to slow down and to build relationships. We would like to see more systems approaches - more joined up thinking. Mary Butler's social innovation for vision comes close in this respect.

Last and most heartfelt. We would like to thank our contributors, reviewers, editorial board, research office, and colleagues. Without your efforts towards making a difference the world would be in a poorer place.

Finally, to paraphrase from Tori Clearwater's paper we hope that you are interested in this collection of papers, we now invite you to read them, as they reveal their meaning or you discover the meaning of your own.

TRANSPORTATION HABITS OF STUDENTS AT UCOL: HOW GREEN ARE OUR STUDENTS?

Dr Kawtar Tani

ABSTRACT

The aim of this study was to explore the transportation habits of students, and assess how 'green' are students from the Universal College of Learning. Data about students' modes of travel to a tertiary education provider in New Zealand were collected in 2018 from 227 enrolled students. Green modes of travel included walking and cycling, while the non-green method was driving. Data collected also included distance from the student's home to the institution, age, gender, ethnicity, and enrolment type. Results showed that the majority of students used a non-green method of travel, international students were more likely to choose a green mode of transport, and females were more likely to drive than were males. There was a significant difference between the working status of participants, and their mode of transportation, where non-green participants were more likely to be working, while green participants were more likely to be not working. Implications and limitations of this study are presented.

Keywords: Green transport, Carbon footprint, Student commute, Sustainability, Tertiary education.

INTRODUCTION

The New Zealand government is committed to moving towards low emissions and climate-resilient economy by 2050. This, according to the Zero Carbon Bill Discussion Document (New Zealand Ministry for the Environment, 2018), will deliver health and environmental benefits. The air we breathe will be cleaner, and more people catching buses and trains more often will reduce traffic congestion in our cities.

According to the New Zealand Ministry for the Environment (2018), New Zealand's gross emissions have increased 19.6 per cent since 1990, and carbon dioxide from road transportation has contributed the most to this increase. To understand the transportation-related carbon footprint of Universal College of Learning (UCOL), transportation habits of students will be explored using an existing sub-set of data collected for a previous study that is currently in press.

A number of tertiary institutions measure their carbon footprint to help monitor their impact on the environment. For example, the University of Cambridge in the United Kingdom have introduced the Cambridge Green Challenge that aims to reduce carbon emissions, part of this is related to managing "the demand for travel and promote sustainable travel within the University" (University of Cambridge, 2018). Similarly, Victoria University of Wellington in New Zealand calculate their carbon footprint yearly, and claim that their emissions per student are among the lowest in the world (Victoria University of Wellington, 2018).

The purpose of the present study was to explore the transportation habits of students in order to assess how green are students at of UCOL.

METHOD

Participants

The sample consisted of 227 students (109 males and 107 females) at a tertiary education provider in New Zealand. Of these students, 34 were international students and 182 were domestic students. The mean age of students was 26.97 years (SD = 8.21). Participants identified as European (104), Asian (54), Māori (44), Pasifika (4), and other ethnicity (8). Eleven participants did not report their student ID and/or name, so their gender, ethnicity and enrolment status could not be obtained from the student database.

Materials

Data were collected using a questionnaire that was given to students at the beginning of selected classes. The selected courses aimed at different student groups, thereby making it possible to address many students from different levels and disciplines. Completing the questionnaire took approximately five minutes.

To ensure students' anonymity, identifiable data (for example names, contact details) were only accessible to the author. Approval to conduct the study was obtained through the research ethics committee at the institution in which the research was conducted.

Procedure

Data were collected using a questionnaire administered by lecturers across UCOL during lecture and tutorial sessions during the last two weeks of semester 2, 2017. All questionnaires were accompanied by an information and consent cover letter, in which the aim of the study was explained, as well as that participation in the study was voluntary and that participants' anonymity was guaranteed. Students were asked to indicate whether they agree or disagree to participate in the study by ticking the appropriate option on the information and consent cover letter. 227 questionnaires were returned completed (response rate of 93%).

Participants were questioned about their working status (Yes / No), mode of transport to the institution (Drive / Walk / Bus / Cycle / Other), distance from institution (in minutes). Students were also asked to provide their student numbers and/or names, and this allowed the collection of the age of the student (in years), gender (Male/Female), ethnicity (European / NZ Māori / Asian / Pasifika / Other), and enrolment type (Domestic / International), from the institution's student database.

Data were analysed using SPSS version 22, all statistical tests were two-tailed, and alpha was set at 0.05.

RESULTS

Participants' mean age was 26.97 years (SD = 8.21), which did not differ significantly by gender. One hundred and eighty-two participants were domestic students and 34 were international. The ethnicity of participants was given as 104 New Zealand European, 44 New Zealand Māori, 54 Asian, four Pasifika, and eight other. The mean time of travel to UCOL was 23.47 minutes (SD = 20.65). Eleven participants did not report their student ID and/or name, so their age and ethnicity could not be obtained from the student database.

Participants' mode of transport to UCOL was as follows: driving to UCOL (n = 132), walking to UCOL (n =60), taking the bus (n =28), and cycling (n =3). Four participants selected 'other' modes of transport, which were not specified. When the categories were collapsed into 'green' (walking, taking the bus, and cycling), as opposed to non-green mode of travel (driving), there was a statistically significant difference in the proportions of green versus non-green, X^2 = 7.54, p < .05; more students used a non-green method of travel (n = 132) than used a green method (n = 91).

There was no evidence of a statistically significant difference in the number of students who worked ($n =$123) or who did not work ($n =$ 103), $X^2 =$ 1.77, $p =$ .183, and no difference in participant gender with female $n =$ 107, and male $n =$ 109 (one participant did not state their gender).

One hundred and three participants were not employed and 123 participants were employed (one participant did not declare their employment status). To investigate the demographics of those who used green or non-green methods of transport, the relationship between working (yes vs. no) and mode of transport (green vs. non-green) was explored. There was a significant difference between the working status of participants, and their mode of transportation, whereby participants who used a non-green mode of transport were more likely to be working ($OR =$ 1.54), while green participants were more likely to be not working ($OR =$ 86), $X^2 =$ 4.20, $p =$ .04. There was no evidence of a statistically significant difference in the ratios of males versus females and working versus not working, nor between working and enrolment type (domestic vs. international) and mode of travel.

Using a median split on age (up to 25 years = 'young', more than 25years = 'older'), there was no evidence of a difference in mode of transport, enrolment type, work status, or time to travel to UCOL.

A Chi-square test of independence was also used to explore the relationship between gender and mode of transport. There was a statistically significant difference in the gender ratio of students who chose a green mode of transport; females were more likely to drive ($OR =$ 2.39) than were males ($OR =$ 1.04), $X^2 =$ 8.52, $p =$ .004.

There was a statistically significant difference in the time taken to travel to UCOL between males (20.65, $SD =$ 16.03) and females (26.48, $SD =$ 24.72), t(206) = 2.026, $p =$ .04. There was no evidence of a statistically significant difference in the time taken to travel to the institution, by mode of transport.

The relationship between enrolment (domestic vs. international) and mode of transport was statistically significant. International students were more likely to choose a green mode of transport ($OR =$ 2.09) than were domestic students ($OR =$ 0.52), $X^2 =$ 13.48, $p <$ .0002.

DISCUSSION

This study explored the transportation habits of UCOL students, with the aim to assess how green students are. Results showed that significantly more students used a non-green method of travel (n = 132) than used a green method. This creates an opportunity for the institution to introduce measures to decrease its carbon footprint, such as carpooling opportunities for students and staff, free public transport, and charging stations as used in a number of tertiary education institutions.

There was a significant difference between the working status of participants, and their mode of transportation, where non-green participants were more likely to be working (OR = 1.54), while green participants were more likely to be not working. It can be argued that those who are not working may not have a greater need for personal transportation in comparison to those who are working, because the latter have the additional requirement to commute to work. Moreover, it can be argued that those who are working are likely to use a motor vehicle because they can afford to have their own transport.

A personal means of transportation can provide flexibility around their commuting needs. However, such personal means of transport need not be a motor vehicle that uses high carbon emissions, but it could be a green method that contributes to the reduction of carbon footprints of the institution. For working students, this can only possible if additional support and alternative green options are provided, and supported by the institution.

Being able to afford personal means of transport could also be one of the reasons behind our result showing that international students were more likely to choose a green mode of transport than were domestic students. With

the high course fees associated with international enrolments, international students are more inclined to keep their living expenses low, and make use of the cheaper modes of transport such as walking, cycling, or using the free buses to commute to the institution.

According to the study results, females were more likely to drive than were males, and there was no evidence of a statistically significant different in the gender ratios and working status. One of the reasons behind the difference between female and male participants may be due to the attitudes towards the environment. It would be interesting to investigate the opinions and attitudes of females and males towards being green.

A potential limitation to the findings reported in this study, that future research can address, is that in this study, driving did not include driving electric cars which is a green mode of transport. This is because to the knowledge of the researcher, only two electric cars were used in the campus where the study was conducted, and these belonged to staff members of the institution. Another potential limitation is that driving could include carpooling. Future studies could differentiate between these as many would argue that carpooling is a greener mode of transport.

CONCLUSION

In this study, driving was the main mode of transport of students to UCOL. With the increase in student population, faculty, and staff, efforts could be made to curb the transportation-related carbon footprint of UCOL. By understanding the transportation habits of students, strategies can be put in place by the institution to help achieve the goals of the Climate Change Response (Zero Carbon) Amendment Bill (New Zealand Parliament, 2019) that was introduced on 8 May 2019. The institution could encourage the use of low or zero emission vehicles by introducing a charging station for electric vehicles. Alternatively, the implementation of a carpooling application for students and staff could encourage shared transport which will help towards reducing carbon emissions in the city. All of which would contribute to the aims of the proposed Zero Carbon legislation and help keep New Zealand green.

Dr Kawtar Tani is a senior lecturer in business and ICT at Universal college of Learning.

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HOW CAN CONTEMPORARY ART CONVEY COMPLEX SCIENTIFIC IDEAS AND INFORMATION?

Tori Clearwater

Humans have been a driving force behind climate change and extinctions for hundreds of years. Since the first steps out of Africa, man has been wreaking havoc upon the environment. As technology advanced in the Industrial Revolution, populations boomed, and consumption and demand went up. As a result we have been pillaging the natural world with little thought of the future. Our throwaway society, with its convenience products, is raising its head from the waters of our oceans and spilling onto our shores, as global warming, pollution, species extinction and ocean acidification begin to show in every corner of the world. The alarming facts that illuminate what is happening now and what is to come are generally presented in scientific reports and the media in numerical form, which can alienate the individual. The numbers are so large that it seems impossible for one to make a difference. I hope to challenge this idea and bring statistics to individuals using art, specifically sculpture, so they may reach an understanding and realisation may be reached.

In this article, I will explain some of the many ways contemporary art addresses the problems associated with the human practices of consumption, disposal and pollution. I will examine how artists have interpreted, incorporated and represented statistics in their art. Theoretical frameworks applied in this essay include those of representation (specifically, depiction of mass and numbers), phenomenology, and the abject.

To contextualise the artworks, I will first analyse the science behind them, focusing on the largest environment on earth: the one beneath the waves. I will explore how artists work through information in order to convey it visually to a wide audience. Artists working with conservation and pollution in their practices include Chris Jordan, Aurora Robson, Daniel Webb, Tan Zi Xi, and Tara Donovan. Each use their work to convey statistical data and facts about pollution and consumption; they create immersive spaces and intricate sculptural work that is both abject and beautiful. Some of these artists only use one of these conventions to produce work whilst others cross over and touch on more than one strategy. I am analysing them in these frameworks to understand better what is effective in their artworks, to identify and use these ideas in my own practice.

Plastic affects our environment and wildlife in many different ways; research now suggests that entanglement and ingestion are only the tip of a much larger problem (Parker & Olson, 2018). The impacts of plastic on our environment are complex and difficult to convey. I want to explore how artworks can bridge this vast informational gap.

It is challenging to try to control the interpretation of an artwork, as every viewer will see each work differently and come to their own conclusions. However, I believe it is possible, as an artist, to help people to 'see'. Jane Norman argues that "Communication with an artist must be through his work. It must be direct, not diluted by verbal translation" (Norman, 1970, p. 191). This means that in order to educate, the work must first attract attention and

interest, especially when conveying ideas to the general public who often do not have the confidence or education to interpret artworks.

PART ONE: THE FACTS

Nature has been knitting polymers since the beginning of life. Every living organism contains these molecular chains (Freinkel, 2011). Humans selectively used some of these naturally occurring plastics, including ivory, turtle shells and cow horns, but these became scarce as the market expanded. In response, John Wesley Hyatt, in 1869, made a plastic called celluloid created from a natural polymer: the cellulose in cotton. Although not a synthetic plastic, this was a breakthrough; developed to make consumer items like billiard balls, combs, buttons and piano keys. In one of Hyatt's pamphlets it is stated that "As petroleum came to the relief of the whale," so "has celluloid given the elephant, the tortoise, and the coral insect a respite in their native haunts; and it will no longer be necessary to ransack the earth in pursuit of substances which are constantly growing scarcer."

Figure 1. Cutlery whale. Image copyright Riach (2018).

Synthetic plastic is a recent invention that has only been commonly found in our society for the last 70 years (Knight, 2014). Plastics' vast variety of uses, and cost effective production have enabled this product to become commonplace in almost every home, country and habitat on earth. The first synthetic plastic, derived from fossil fuels, was Bakelite, invented in 1907 by Leo Baekeland. The plastics industry was driven by the two World Wars to create a range of useful, durable materials. After the Second World War, the industry turned to the market and manufactured products like Tupperware®, available to the consumer in 1948. Plastic is now used to make almost

everything from packaging to clothing and carpets.

Plastic has infiltrated much of our lives, but it is now apparent that plastics are not the solution previously thought. The blind use of plastic has had disastrous consequences on the environment. Questions are now arising about how something sold as disposable can be made of a product that is all but indestructible (Leeson & Ruxton, 2016). Yet many people still do not see the consequences of this material, thinking that once the material has left their direct sight it goes away. There is no such 'away'.

Plastics leach chemicals immediately after production, do not biodegrade, but photodegrade and once broken into small 'micro-plastics' gather other chemicals, especially in the ocean (Katsnelson, 2015). Ingested by wildlife, the toxins are released and stored in tissue, and enter the food chain, (Katsnelson, 2015) resulting in bioaccumulation and bio-magnification. This contamination causes many health problems including cancers, immune system deficiencies and child developmental issues (Leeson & Ruxton, 2016). Society's huge appetite for plastic is poisoning us. Animals at the top of the food chain are experiencing severe consequences of this chemical build up, with mothers potentially killing their young by feeding them poisoned milk from their own poisoned bodies (Attenborough, 2018).

Hideshige Takada, a geochemist at Tokyo University of Agriculture and Technology in Japan, discovered organic pollutants, such as polychlorinated biphenyl (PCSs) and dichlorodiphenyltrichloroethane (DDT), at one million times more their normal concentrations in plastic debris than naturally in seawater (Katsnelson, 2015). Plastics cause injuries to seabirds and other sea animals by damaging and blocking their internal organs "but in recent years plastic and 'micro-plastics' chemical hazards have emerged as a major issue" (Otake, 2016, p. 1). Takada and his team studied the short-tailed shearwater's ingestion of micro-plastic: high concentrations of the flame-retardant poly-brominated diphenyl ethers (PDBEs) were shown in the bird's adipose tissue (tissue that stores fat) (Katsnelson, 2015). Ecologist Mark Browne "says this was a game changer because up until this point everyone thought that these particles would just be ingested and pass out the other side" (Katsnelson, 2015, p. 551).

Researchers first reported finding small pieces of plastic in the ocean 40 years ago but it was not until 2014 that Richard Thompson, a marine biologist at the University of Plymouth, showed evidence of a truly microscopic plastic which he categorised as 'micro-plastic' (Katsnelson, 2015). The most common micro-plastics in the ocean are microfibres, thousands of which are released after every wash of synthetic clothing (Scheer).

Matt Savoca, an ecologist from the University of California Davis, has researched the smell of ocean plastics. He discovered that floating particles grow algae that produce dimethyl sulfide (DMS) when eaten by krill; this smells like food to tube nosed seabirds (such as the albatross) in the great expanse of the ocean (Savoca, 2016). When Chris Wilcox, Erik Van Sebille, and Britta Denise Hardesty, University of California, performed a spatial risk analysis they found that about 90 percent of seabirds were ingesting plastic today which is expected to rise to 99 percent by 2050 (Wilcox, Van Sebille, & Hardesty, 2015).

'The Anthropocene' is a concept that helps us to reflect on how humans have influenced their environment so much so that we have left, and will continue to leave, a permanent mark on the planet which is recorded in the strata or planet's surface (Moore, 2000). The term was first used by Eugene Stoermer but formalised and popularised by Paul Crutzen in 2000 to describe a new geological era. Part of the Anthropocene is the sixth extinction which plays a large role in my practice. I am interested in our manipulation of, and interaction with, the environment.

Plastics are something every living being encounters every day, designed to be used once and thrown away, yet ironically designed to last centuries as they are non-biodegradable. I would like to start a conversation about what remains; what will survive, and what legacy we will leave. Currently there are 41,415 species on the International Union for Conservation of Nature (IUCN) Red List, and 16,306 of them are endangered species threatened with extinction. In the last 500 years, human activity has forced over 800 species into extinction (Kasnoff, 2018), including the Panamanian golden frog, great auk, yangtze river dolphin, Tasmanian tiger, dodo, passenger pigeon and western black rhinoceros, to name only a few (International Union for Conservation of Nature , 2018).

History tells us what happens when things change too fast. There have been five mass extinctions before, and we are now on the cusp of another, caused by us (Kolbert, 2014). I am interested in our relationship with our environment and the question of what has led humanity to believe we are separate and better than nature. Our constant desire for a solution to environmental crisis, despite the lack of real action on the part of individuals and societies, is what drives my work. I aim to educate others and ask hard questions about what current habits are leading us toward: cataclysmic events in which the world will survive, but evidence of our existence may only remain in the materials we leave behind. We will all live for a 1000 years in the plastic cup and disposable spoon we threw away.

My art practise centres on the global issue of plastic pollution, in relation to the state of our environment and climate change. I use plastic as a symbol of our creativity, development and technical advancement, as well as the society we have created, one that demands and thrives on convenience, our 'throwaway' society.

PART TWO: ARTISTS' RESPONSE

How numbers, mass and consumption are portrayed

Numbers and statistics can be used to create a visual impact of mass and consumption, helping the viewer to understand how much a number truly represents. We might believe we understand statistics presented to us in daily life, but what we really comprehend of large numbers is 'big'; the difference between thousands, millions and billions becomes abstract and incomprehensible (Dvorsky, 2016), such that the implications of the numbers are lost. Some artists are tackling this problem by using visual strategies to represent the numbers.

David Buckland, an artist, film director and writer, says "We intend to communicate through artworks an understanding of the changing climate on a human scale" (Miles, 2010, p. 20). Buckland's project *Cape Farewell* (2003) brought together artists and scientists to see climate change in action, in the hope that art will be inspired by the experience and provide a more compelling visual interpretation of graphs, diagrams and incomprehensible numbers.

Buckland's aim is to translate information in a way that bridges the barrier of raw statistics to one of understanding. Chris Jordan, Aurora Robson and Daniel Webb have similarly translated data and statistical numbers into art. Timothy Morton in the *Ecological Thought* states that "studying art is important, because art sometimes gives voice to what is unspeakable elsewhere, either temporarily - one day we will find the words - or intrinsically - words are impossible" (Morton, 2010, p. 115). I believe art can help people's understanding of greater problems, by addressing them in a way that people can visualise, and giving people something more tangible than numbers and statistics.

Photographer Chris Jordan's *Running the Numbers II: Portraits of global mass culture* (2009 - current) is a series of photographic works depicting statistics about consumption and pollution. The images range from wildlife photos to historic artworks, each created with a different pollutant material. Hundreds of thousands of different plastics and materials construct images that do not resemble the unique material; they become a spectrum of colours and patterns. These works depict the amount of something within a specific time and from a specific place. "Numbers our brain just doesn't have the ability to comprehend, we cannot make meaning out of these enormous statistics, so that's what I'm trying to do with my work, take these statistics... and translate them into a more universal, visual language" (Jordan, 2017). One work from this series, *Whale* (2011, Figure 1.), is based on a photograph by Bryant Austin, which depicts 50,000 plastic bags, equal to the estimated number of pieces of floating plastic in every square mile of the world's oceans (Jordan, 2018). Jordan's images resemble paintings or prints. It is not until the image is zoomed in on that we can see the medium that was invisible upon first inspection. Through this realisation, the viewer becomes aware of how much these numbers truly represent.

Sculptor Aurora Robson's work, *What Goes Around, Comes Around* (2008, Figure 2.), is a 9,000-bottle installation commissioned by the Bank of America. The work is made of interwoven plastics, collected from the bins of the

business. "It is intended to illustrate connectivity and the reciprocal nature of matter and energy, while raising awareness about human impacts on the environment and our discreet power as consumers" (Robson, 2007). The work resembles molecules and atoms, showing the changing energy and manipulation of matter that occurs all around us. Robson has chosen to portray our impact on the environment by manipulating a material we rely on, plastic. The plastic waste from the site encourages the employee/viewer to see that their one bottle adds up when combined with others. Collectively, the individual objects no longer have singular meaning but a more powerful one. This is conveyed to the consumer: one might not make a difference but together changes can take form.

Daniel Webb's work, *Everyday Plastic* (2018 Figure 3.), is a collection of all of the artist's waste over a year. The work is 13 metres wide by four metres tall and contains 4,490 pieces of plastic; 60 percent is food packaging, 93 percent is single-use plastic, eight items are biodegradable and just 56 items made from recyclable materials. The process of making this work was itself educational for the artist (Barton, 2018). The work captures a snapshot in the artist's life and truly shows the scale of consumption in a household, bringing to light what we do not see and putting it in perspective. It has the potential to attract people who recognise materials consumed in their daily lives. The work is a signature or mark of an individual, and viewers may respond by thinking about how their own 'signature' might look.

Each of these artists explores numbers, mass, and consumption in different ways. Jordan's large photographs illustrate incomprehensible statistics, Robson uses social connections to make people aware of a problem, and Webb depicts an ordinary year in his life, to show an individual's consumerism.

One of my works depicts me struggling to hold up a bag of found ocean plastics (Figure 4.), this work is responding to data compiled from shearwaters, where one 90-day-old chick was found dead with a gut full of plastic, accounting for 15 percent of the bird's body mass (Leeson & Ruxton, 2016). The bag of plastics weighs 8.25 kg which is how much plastic would be in my stomach if I was this sea bird.

I have used raw statistics and combined it with the human body to show how much plastic was really inside that chick. The mass appears much larger when it is held in reference to a body especially as people can 'enter' the photograph and place themselves in the image, which in turn reveals the 'crushing' situation.

The use of immersive art environments and spaces to produce phenomenological responses

Immersive art spaces that result in a phenomenological experience can convey messages as the work, the mind and body become interwoven (Bishop, 2005). Each person's prior experiences will determine how they look at and interpret the work and their physical response. Impacts vary with each person but, as discussed previously, the physical, visual depiction of numbers can become something that helps people reconsider their life choices. The physical experience of being immersed in an environment can produce a different effect than that of a photo; ideas and issues become tangible and real. Buckland says "personal responses are more engaging than government reports or scientific data, and that imaginative narratives are needed to humanize a remote form of nature … artists can successfully tackle this subject, making points succinctly and powerfully" (Miles, 2010, p. 21). Tan Zi Xi, Aurora Robson and Tara Donovan have produced art works that create phenomenological, immersive spaces.

Tan Zi Xi's installation work, *Plastic Ocean* (2016. Figure 5.), is composed of 20,000 plastic items suspended above and around the gallery space, encasing and immersing the viewer, creating an altered perspective. The installation brings the viewer into a position where they can experience the ocean's condition.

In 2008, Zi Xi created *'An Effort Most Futile,'* a series of illustrations that communicated her concerns about the environment. *Plastic Ocean* was inspired by this, as a way for her to "create a physical manifestation of the Pacific Garbage Patch" (Zi Xi, 2016). She wanted to communicate with people in a more physical way, to convey this enormous problem. The plastic items are freely suspended, so as the viewer walks through the space they create a ripple of movement. The objects rustle in contact with the body and sway to mark their passage; and in this way

the body becomes part of the work. *Plastic Ocean* is on such a large scale that the space is transformed, becoming beautiful and sublime, while also conveying a very clear message. The viewer becomes a small figure within the mass. A phenomenological reading is encouraged as the items are recognisable; each container or bottle is a product that we encounter every day, and we can see our life reflected in these everyday consumer items. This work is a reminder of the permanence of our impact on the oceans. We are a fragile small species in the face of this vast problem, and yet, as a collective, we are the cause (Zi Xi, 2016).

Robson works with materials associated with consumption and pollution. She collects plastics from the environment and suspends them, creating immersive spaces that encourage a phenomenological response, as the viewer walks within the confines of the sculpture or has to arch back to see it hanging overhead.

The *Great Indoors* (2008. Figure 6.) at Rice University in Houston was a portal or tunnel that visitors could walk through (Gomez, 2009). Loosely based on the human body, ribs form the structure leading to a centre in which there is what the artist describes as the 'heart.' "What happens when a heart forms in a human being is one cell suddenly pulses and then the next time it decides to pulse all the surrounding cells pulse with it" (Weiss, 2014). Robson believes this idea is crucial in creating works that have a life of their own, in that they start conversations and create awareness. Similarly, Rebecca Solnit talks of an artwork that remains "alive, to engage in a conversation that will not ever end but will instead keep feeding the imagination" (Solnit, 2014). The work is made in the community with volunteers who all have a similar outlook on plastic, so connections form between people, initiating conversations that can grow. Robson wants to give people 'a pulse' that can start a movement. "This is a global problem and art is a global language" (Weiss, 2014).

Tara Donovan takes objects we overlook in our daily lives and transforms them into large installations. She disguises the material, often presenting it on such a scale that the form is initially hidden; the careful arrangement becomes an unidentified mass. *Haze* (2003, Figure. 7.) contains nearly two million drinking straws, stacked pointing outward against a wall to create a surface of subtle swells and hollows (Frankel, 2003). Presenting very small consumer items, such as plastic cups, straws and toothpicks, *en masse* changes how we view them, as they take on a resemblance to natural phenomena and become 'landscapes' in the gallery. Donovan's immersive spaces respond to the physical qualities of materials to get a response from the audience. "I want people to bring their own associations to it, to feel what they feel, experience what they experience from their life" (Nyholm & Wagner, 2015). Her works react with light; see-through or shiny material changes with the body's movements.

The artists that I discussed above create immersive spaces to encourage phenomenological responses. The works are large scale and use a wide range of materials and techniques to play with the body's interaction within a space. The viewer is sometimes fully immersed and becomes part of the work, the work is expanded through community engagement, or small items of our ordinary lives get transformed in a way that we could not imagine. Each of these strategies is an attempt to communicate with the viewer in a more personal way by intimately engaging their mind and body. They are able to interact with the work on a level other than that of a two-dimensional depiction; it must be experienced in real time, in real life, as it requires all the senses, and the viewer's presence, to be fully appreciated and understood.

My work is an attempt to create a space where people bring their own knowledge and prior experiences to the work as they recognise materials that exist in their daily lives. Through this realisation, I hope the work will get people thinking and start a conversation.

Figure 2. Author and plastic wall. Image by O'Brien (2019).

Figure 2. Author and plastic wall. Image by O'Brien (2019).

One work is a large hanging plastic wall made of individual tiles. The see-through quality of plastic means the work changes and interacts with natural light. This work addresses photo-degradation and its impacts on the food-chain, while also responding to the environment outside the gallery. The work changes as the body and light move in the space.

This work, made of multiples, shows how we look at the world and nature as something we can construct, name and control. The 'wall' is an attempt to represent the barriers we have built that prevent us from seeing, that keep us 'safe', the walls we build that protect us, both politically and personally. This 'wall' will force the viewer to renegotiate the space. The brightly coloured and varied tiles stitched together resemble a patchwork quilt. This is a comment on one of the most common plastics in the marine environment, the microfibre. This work is made from materials that could have been 'recycled' into these fabrics. In turn, this is also a comment on the recycling system: we cannot recycle our way out of the plastic pollution problem as less than five percent of all plastic gets recycled (Parker & Olson, 2018). Many of these items are down-cycled as they are no longer fit to be the item they once were, and in some cases, this is a faster way for them to enter the natural environment.

The use of materials and products to create 'beautiful' works that become abject as the message and product become apparent

Contemporary artists have shifted the practice of using found materials beyond definitions of art and beauty to symbolise wider human practices of consumption, disposal and pollution. Sometimes the specific materials are not visible until closer inspection. Once the material is revealed, the work expands in meaning towards the political and the ecological. The works initially play with people's aesthetic sensibilities and expectations before confronting the viewer with difficult questions and realities about the state of the environment. Malcom Miles has stated: "all I say now is that I take the position that, to communicate any message, art needs first to engage the viewer" (Miles, 2014). From this perspective, there is little value in conveying information through artworks that are so abstracted or disgustingly confronting that people do not want to look, and fail to engage. Susan Sontag urges us, in her book *Regarding the Pain of Others,* to "not let the torrent of images that pour down on us convince us that we understand or make us numb to suffering... knowledge can numb as well as awaken feeling… even if we cannot completely understand, we might care" (Solnit, 2014) Sontag is referring to the horrors of war. However, I believe this quote can be used in relation to the hard-to-grasp idea of climate change and pollution.

Like Miles, I believe in the importance of getting people interested before revealing a deeper meaning, or allowing the viewer to discover the meaning on their own. This gradual realisation can render the aesthetically appealing artwork abject. Abjection is a term synonymous with the philosopher Julia Kristeva, and is associated with disgust and things that people wish to dissociate from (Kristeva, 1980). It involves the body and our habitual rejection of objects and functions that we do not wish to see or consider gross or uncomfortable (Kunst, n.d.). Chris Jordan and Tara Donovan are artists using this idea to convey their thinking.

Materials come with social or contextual meaning. Some artists, like Donovan, attempt to create works that conceal the original material. However, her straws are still recognisable as straws, invoking the social concepts of consumerism and pollution; they cannot be removed from their function in society, even if that is the artist's intention. Donovan's materials are only revealed at close range. "Up close, the image sharpened and the viewer's preconceptions changed instantly, swept away in the recognition of surprisingly familiar objects from which *Haze* was made" (Donovan, 2003). To me, this recognition makes the artwork abject.

Donovan states that there is no environmental reading in her works as she aims for a more minimalist interpretation of objects and their forms. The forms "mimic the ways of nature not necessarily mimicking nature" (Nyholm & Wagner, 2015). I disagree with her as she is actively creating 'nature' out of common pollutant products. For art writer Petra Lange-Berndt, "the term 'material' describes not prime matter but substances that are always subject to change, be it through handling, interaction with their surroundings, or the dynamic life of their chemical reactions" (Lange-Berndt, 2015, p. 105). This highlights the problems I see in Donovan's work as materials are subject to

change, and in this case the plastic items are now loaded with symbolism associated with their use in our modern society. The items she is using as her medium are now being identified as polluting, consumer items. This product is now a symbol of our modern consumer-driven society. In this work there is a realisation of the material, leading to questions of quantity. In the United States, 500 million drinking straws are used every day (Cress, 2018). To understand is the enormity of this problem, *Haze* depicts roughly 1/240th of this, or six minutes of straw usage. This really puts Donavan's 'large' installation in perspective. Her work becomes abject with access to this knowledge as it portrays the very large impact of a very small object. She says her work is representing nature, but 'plastic nature' is very real, with plastic infiltrating every habitat on earth. "At a distance, one felt that he or she was looking at a formation of encrusted minerals, a cross section of a coral reef, or wisps of a strange, opaque fog" (Donovan, 2003). However, what you are viewing is consumerism.
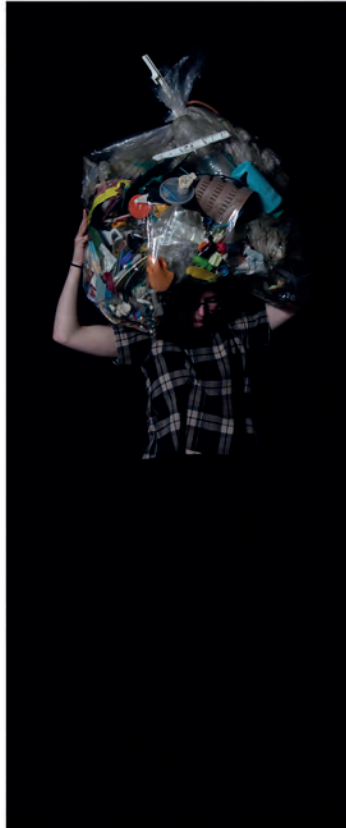
Figure 2. Author and plastic wall. Image by O'Brien (2019).

Jordan's photographic series *Midway: Message from the Gyre* (2009 – current, Figure 8.) and documentary *Albatross* (2017) are abject in the way they show the impact of plastic upon the natural world, specifically on the Laysan albatross on Midway Atoll. Both these works show graphic environmental realities through images of dying, dead and decomposing birds, all suffering their demise because of the plastic fed to them by their parents. These are eye-opening and shocking truths that demand an emotional response. The images are abject, they reveal the young birds' distressing and horrific deaths as a direct result of humanity's impact on the ocean, the consequences of our consumerism.

Do we have the courage to feel deeply enough that it transforms us, and our future?

Come with me on a journey, through the eye of beauty.

Across an ocean of grief and beyond.

(Jordan, 2017)

I want to use the abject in the way that I see it used in Donovan's simple installations of objects and in Jordan's photographs. Objects *en masse* represent numbers that in turn represent consumerism and pollution. Donovan's works are beautiful, simple forms created using unconventional materials, unaltered but disguised, using light, space and colour to turn something ordinary into something extraordinary.

Jordan's work shows us the realities our ocean is faced with today through a camera lens. Close and personal encounters with the albatross show the suffering, dying and dead birds which exploits our maternal instinct to protect and care for the sick and injured, to alleviate suffering. This moving imagery makes us care, makes us want to make a difference, as we see the beauty we have destroyed.

In my work, animals made from discarded plastic cutlery are scattered on the floor. They are the forms of animals to which we see ourselves as superior. They are very fragile, and it would be expected for some of them to be broken and destroyed at the exhibition, their tiny miniaturised forms crushed beneath human feet. Making animals out of plastic cutlery is a way for me to question what is in the food chain, using the initially disguised material, as a symbol of our waste, consumption and pollution, just one of the everyday common single use products that we throw away unnecessarily – an invisible item that has anything but an invisible impact.

CONCLUSION

This essay has explored the way contemporary artists represent numbers, mass and consumption, create immersive spaces, and challenge the meaning of the abject. These strategies are used to convey complex information to wide audiences. Specific artworks have been analysed to investigate the effectiveness of each of these strategies.

My work is an installation consisting of three main components that address issues of consumerism and waste. My work aims to convey information on environmental problems to the public while maintaining the qualities and conventions of contemporary art. I have used numbers and statistics to help people 'see' the problem in a way that they can understand, taking statistics and displaying them in reference to the human body to communicate the problem. The viewer will hopefully bring their own knowledge and life experience to the work in order to engage, and through a realisation become more aware of the problems we face. The large-scale works will immerse the viewer, beautiful at first, they become confronting through understanding. The sculptures attain the 'abject' not in the way they look, but in what they represent. I attempt to hide the explicit materials to arouse curiosity. In this way, I want to draw people to the work so our sickening realities are not initially present, then once the viewer is engaged the meanings will be revealed and this will change the reading of the work. The materials, sourced from Dunedin, centralise and locate the work and bring the problem closer to home. This could be the rubbish you threw away, a reminder of your presence, outliving you and any mention of your name.

Tori Clearwater is a Dunedin based artist and graduate of the Dunedin School of Art.

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"WHAT THE HELL AM I DOING HERE?"

THE REWARDS AND CHALLENGES OF VOLUNTEERING IN VANUATU, AND WORKING TOWARDS THE SUSTAINABLE DEVELOPMENT GOALS

Ana Terry. Interviewed by Claire Goode

INTRODUCTION

Ana Terry joined the Learning and Teaching Development team at Otago Polytechnic in August 2018. In conversation, she has often mentioned her voluntary work overseas with VSA (Volunteer Service Abroad), but has not had the opportunity to talk about it in depth. She recently remedied this, in discussion with one of her colleagues, Claire Goode. While reflecting on her experiences in Vanuatu, Ana also addressed the challenges of embedding sustainable practices in work and education across this island nation, and of working towards the United Nations' Sustainable Development Goals, which underpin all VSA assignments.

Claire: So tell me, Ana, what first attracted you to VSA volunteering?

Ana: I was contacted about an assignment opportunity while teaching at the Otago Polytechnic School of Art in 2007. And I was, I guess, always interested in the idea of living and working in an alternative cultural environment… having that opportunity. I'd lived a nomadic life growing up and living overseas during my childhood, so I was keen to do this in my adult life. I had sent my CV several years beforehand, not really imagining getting anything, because I had considered at that time that aid work involved health or agricultural expertise, not imagining that they would be interested in someone with skills in communication design and marketing. So I was quite surprised to be asked to apply for the two-year communications design assignment based in Port Vila. But as development markets have developed and changed, other skills are required... and in terms of building capacity in education and working towards the United Nations' Sustainable Development Goals, communication design is absolutely key. At the time, to be honest, I didn't even know where Vanuatu was - I had to go and find it on a map! And that was in itself, I guess, quite revealing to me to realise that in my own immediate neighbourhood in the South Pacific, I didn't know where Vanuatu was.

Figure 1. Geographical location and detail of the islands of Vanuatu. (Image attribution: World with Countries - Single Color by FreeVectorMaps.com; inset map of Vanuatu by Ana Terry)

Claire: Tell me more about that first role.

Ana: Well, the first assignment was between 2008-09, for two years, working with an NGO (non-government organisation) which has been working in the Pacific for over 25 years; they are a development theatre group, 'Wan Smolbag', aiming to create awareness and engagement around education, health, governance, the environment, youth and gender. My role was training and supporting several counterparts in designing and developing publications which supported the educational work that they do primarily through theatre and storytelling. The publications we produced were used by teachers, villages' leaders, community and health workers - locally and in the wider Pacific.

Figure 2. *40 Dei,* a Wan Smolbag play about the conflicts of Kustom culture and Christianity, domestic violence, and addiction, Port Vila 2009 (Photo credit: Ana Terry).

Claire: Can you tell me what "Wan Smolbag" means?

Ana: Wan Smolbag literally translates as "one small bag". The group started out with half a dozen actors walking from village to village with a small bag of props and performing – thus the name. Their first show was 'Sitsit Wota' (which translates as diarrhoea). It's a play about hygiene – and keeping drinking water clean. Many rural villages may only have one water source, a stream, or a single water tank supplying several families. Theatre and storytelling are very effective in engaging everyone – there is comedy, and storian. And telling stories is a big part of Ni-Vanuatu[1] culture. Plays are written and performed in response to what's happening on the ground – such as an outbreak of dengue fever, issues around sexual health, environmental issues, or whatever is happening politically at the time, such as an election. Their base in Port Vila also offers a youth centre, nutrition centre and health clinic. Over two decades, they have grown and now employ over 200 staff and have satellite youth centres on other islands. It's a big operation now, the storytelling has extended into other more easily distributed media – I mean, they now produce full feature films, TV series, and radio shows – which 25 years ago was a big deal, because radio was the only way of communicating across the archipelago then. When I joined them in 2008, they were into their third season of 'Love Patrol', a soap opera series based at Port Vila Police Station – a drama beautifully interwoven with some very big and difficult social issues.

Claire: So, that was your first assignment; can you tell us about subsequent ones?

Ana: Okay, so then I came back to New Zealand and it was a bit of a reverse culture shock – I was pretty unsettled. But, financially, I had to come home, and I had other commitments, family and I was completing my Masters – things like that. And those are considerations you need to think about when you commit to a long-term assignment.

And then I was contacted again and asked to go over and work in the agriculture sector. So, I ended up working with an agronomist who's been living in Vanuatu for over 25 years. He'd introduced vanilla growing into the country, set up a processing plant on Espiritu Santo (Vanuatu's largest island), and supported locals who grew the vanilla. And so, we worked together on producing a vanilla manual to be used by farmers with low levels of literacy – that was the assignment's primary goal.

It was what you call an 'in-line aid position'; you're given a specific short-term project which doesn't directly involve training a counterpart. However, from my point of view, volunteering is all about empowering people – so you just naturally want to do this. Otherwise, it's like, well, I'll just stay at home and do the job... and at the same time, I was working with staff members through Farm Support Association (FSA), which is a cooperative, working with local farmers, supporting them by providing education programmes and resources.

Figure 3. Vanilla growers packing freshly cured vanilla pods ready for market, Venuii, Espiritu Santo, 2012 (Photo credit: Ana Terry).

The third assignment most recently was working in communication and marketing in the tourism industry in rural Vanuatu – based in Malekula. This assignment was all about capacity building in promoting rural tourism. I worked with both the Vanuatu Tourism Organisation (VTO) and Malampa Travel, which services the Malampa Province. There is a big economic push for locals to set up small tourist operations. And there's a growing market of tourists seeking off-the-beaten-track experiences. However, locals are limited in their communication skills and ability to promote and market their businesses – whether they are offering bungalow accommodation, for example, or eco, cultural or trekking tours. Malampa Travel works as a membership-based non-profit organisation, promoting and organising tourist bookings, while VTO provides the training in tourism.

Claire: So, these were both quite different from your first assignment?

Ana: Yes, they were different contexts and industries. But essentially similar concepts of, you know… they were both indirectly and directly aligned with the Sustainable Development Goals (SDGs), working towards decreasing poverty, gender equality, increasing health and education, and so on. Ni-Vanuatu are considered 'subsistent affluent' – given they have land, they can grow their own food; they can build their own houses out of local materials – you could argue that they are living sustainably. However, it's tenuous – there are often land disputes, or if a cyclone comes through – and these are increasing...The UN World Risk index lists Vanuatu as the world's most vulnerable country to disasters. And the islands are sitting on the 'Pacific ring of fire' – earthquakes were a daily occurrence. So, what we might see as a 'sustainable way of living' is actually extremely vulnerable. The reality is everyone needs cash – to pay school fees, for healthcare, a water tank or toilet... And that is where small money-making enterprises like growing a cash crop or offering bungalow accommodation can help.

Claire: It's interesting that there's this perception that voluntary work is only in fields like construction, agriculture, or engineering, but actually, you know, your own example of communication design is quite different.

Ana: Yes, the skills required are diverse and growing. I still keep an eye on VSA assignment opportunities - I know in Papua New Guinea, for instance, they've been looking for an audio technician, to work in the fisheries, developing educational resources, in film and video, and working alongside local people, training them up to develop these educational resources. So, there's this huge scope for our teachers and our graduates to volunteer in the aid industry.

Claire: And how do the Sustainable Development Goals particularly relate to volunteering?

Ana: The SDGs underpin VSA assignments and their values. And NZ Aid is working with developing countries like Vanuatu, who are using the SDG framework as a guiding principle towards their goals of sustainability and development. I would say, in all instances, you could account for most of those 17 goals in some form in the various assignments.

Claire: So, did you have particular objectives or particular goals that you were expected to meet?

Ana: Sure… When you take on a VSA voluntary assignment, you are given a job description, with usually at least three or four objectives and these align to the SDGs. Developing these objectives is a long and negotiated process, and is carefully considered because obviously, there's a huge investment in funding foreign aid, so the success of the assignment and the goalposts are referred to constantly. It's a bit like aligning your learning objectives and assessments against your learning outcomes. These are the goalposts you return to if things start to drift off.

Aid development has changed over the decades; it used to be very much about the Westerner coming into an 'underdeveloped' country and saying, "You need to do this, this, and this to grow and develop." It's now driven by those countries that are wanting the aid, or are needing the support or development. And our concepts of what defines 'development' is changing as we consider what is sustainable.

Claire: And in terms of measuring success as a volunteer, what is your best advice?

Ana: The key thing when you go into the field, whether it's six months or two years, is to slow down and observe, really get a handle on what's going on… on the ground. You also need to evaluate where your counterpart is at – the capacity of the organisation, their skill base, where they need help and support, what is the wider context, and what is sustainable. And while evaluating, remind yourself that you come into the environment with your own cultural baggage and expectations. Then it's a negotiated process between you and your counterpart. It's a matter of sitting down and asking "How can we reach this goal? Where do you identify your strengths and weaknesses?" It's very much about establishing a peer-to-peer relationship, helping build autonomy, and also the confidence to ask for help, which, for Melanesians, can be quite difficult.

Claire: Culturally, asking for help? Why is that?

Ana: It's complex, and you notice Ni-Vanuatu men also avoid asking for help. I think it's a hangover from colonisation and conservative Christianity. Vanuatu was governed by the French and English until 1980. Even though they've had independence for several decades now, there is a sense of inadequacy and continued dependency on the "weat man" (white man) – I remember on several occasions my Ni-Vanuatu counterparts undermining their abilities. "Black man i no sam mek long weat man – hemi no save plante samting" (in other words, "a black man is not the same as a white man – he's doesn't know very much").

And also, there are gender inequalities, and strong dominant perceptions of what a woman's role is through Kustom culture.[2] This is another of the challenges of working in Melanesia.

Claire: Can you tell me a bit more about those inequalities?

Ana: Basically, I mean, the practice of a 'bride price' is still current. The husband's family pay for the bride. While using money for this has been banned, the tradition continues using other commodities of exchange – like livestock, mats, baskets, and food. The legacy of this tradition is that woman is seen as a commodity and the husband owns her.

In my work, I had to look for ways to safely support women in helping them gain a voice, but also being acutely aware of what might happen outside of that working environment if they gained that confidence – often I would worry what happened to my female counterparts when they went home…Vanuatu has one of the highest rates of domestic violence in the South Pacific.

These inequalities are also reinforced through dominant traditional Christian beliefs such as 'women are seen, not heard', and similar ideas. In Vanuatu, religions in their various forms, including Islam, are becoming widespread, and these blend with Kustom culture – which is predominantly patriarchal. It's complex…

Claire: What would you say were some of your successes?

Ana: It's incremental, sometimes when you're in amongst at all, and you're dealing with the reality on the ground, it's hard to see the success. In Vanuatu, family comes first, in all instances, and so it's challenging when you come to work with expectations of getting on with the business, and your counterpart is not there. And then you hear through the grapevine that someone's died, and they've gone back to their island, and no one knows how many weeks (or months) they will be away for – they may not even return if family commitments require it. So, you grab the moments of small successes and hang on to them! I've been really fortunate as I've been able to stay in contact with some of my counterparts – including Florence Toka who I worked with at Wan Smolbag. She's now a communications consultant – contracting. Recently, she was working alongside a designer in developing Year 1 and 2 books for government schools, produced in 60 different vernacular languages of Vanuatu. She was also the communications coordinator for the Pacific Mini Games held in Port Vila in 2017. When I heard this, I thought "Yes! The hard work then has paid off… this is capacity building." Florence also won a competition for designing the logo

for the newly formed Melanesian Spearhead Group in 2008 – that was a really a big achievement.

Claire: Wow! So, she's actually yes.... really making a difference…

Ana: Yes, and that to me, is success – her success – and she's built her confidence and skill set to be working alongside people in the industry doing good work in education and literacy, also in the cultural security and perpetuity of indigenous languages.

Claire: What were the biggest obstacles for you?

Ana: Where to begin? A lot of day-to-day basic stuff – being in a relentlessly hot tropical climate - the idea of living on a tropical island sounds idyllic – the reality is that it's hard work – there is nothing romantic about it! The logistical

realities of getting to work along dusty potholed washed-out roads, in decrepit buses falling apart, and working in an overcrowded office in tropical heat with no air con.... And then for my last assignment – living remotely – literally in a bamboo hut, with a natangora thatched roof,[3] along with rats and cockroaches, constant mould, and during a drought. It's character building!

Figure 4. Sani Bebe and Ana Terry, Malampa Travel, Malekula, 2017 (Photo credit: Don Hunter)

Language was a big obstacle to begin with too. I was basically thrown in the deep end, as all the publications I was working on were in Bislama - which is the local pidgin English. So, I had to get to grips with the language quickly.

Also, some of the broader challenges of volunteer work... there is this phenomenon known as 'aid fatigue' where countries which have been receiving decades of aid.... assumptions are made by your counterparts that if they don't do the work, you or another volunteer will. So that expectation is what you're up against sometimes. The concept of the 'cargo cult'[4] also feeds into the expectations of a continuous flow of foreign aid – particularly on the remote islands.

It's really important to, you know, regularly sit down with your counterpart and ask, "Okay, where do YOU want to go? What are your aspirations? How can I support you in this goal? What do you perceive as my role? And what is

yours in reaching our goals?'' Those conversations and reassessments were ongoing.

When I first got to Vanuatu, because I was coming from a background as a contractor, I remember asking "What's the deadline?" And the response was pretty much that there is no such thing as a deadline – you get it done when you can – when the boat comes in with that computer part, when your counterpart comes back from their island,

or whatever it may be…. when the planets align!

Claire: So, there are a lot of variables to take into consideration. What changes did you see, if any - thinking in terms of sustainability development goals - during your time, perhaps, from when you first arrived to when you left after your most recent assignment?

Ana: I think, well, there have been some changes. In terms of the SDGs – I mean, Vanuatu was the first country in the Pacific to initiate banning plastic bags in 2017, which is massive in leading by example.

In terms of some of the more immediate projects I was involved in, I assisted in the communications on turtle conservation. In the Maskelyne islands, there's a traditional harvesting of these animals for an annual feast – and they are endangered. So Wan Smolbag got involved collectively with marine scientists, locals, and with the support of village chiefs, an education and turtle monitoring programme. And so, the practice of harvesting turtles now is every two years. This is a positive outcome – sustaining their cultural values and contributing to turtle conservation.

Also, there has been a gradual shift in women's empowerment. There has been a UN programme called 'Markets for Change – Vanuatu' running since 2014 which has supported women participating in economic activities. In addition to economic empowerment, the project's focus is on market vendors – the 'mamas' are supported and encouraged to be vocal and participate in governance structures within marketplaces.

But it's incredibly complex and things like, ironically, foreign aid, can undermine this progress towards gender equality. For example, while I was working and living in Malekula, aid came in after Cyclone Pam…. clothes donated from Australia and New Zealand. Unfortunately, locals ended up with clothes that were not considered appropriate for women to be wearing – particularly in rural Vanuatu. And then when there was an attack or a young woman was raped, it was 'justified' because it's considered that they were dressed inappropriately. That sort of tension is ongoing. And I think there's a lot to reflect on here. In providing aid, we must ask ourselves, and ensure we consult on, what is appropriate in that cultural context? Working towards goals like gender equality, it's nuanced and culturally specific.

Claire: So, donating things – the islands can become almost dumping grounds?

Ana: In some instances, yes. I'll give you an example… One of the best libraries I've come across in Vanuatu was at the Malekula Culture Centre – great for tourists or volunteers, but no locals used it. I found a highly relevant technical book – on building a missile! Most of the books were not appropriate or useful. Ni-Vanuatu, while often fluent in speaking several different languages, have low levels of literacy. These books had been donated over the years by Western libraries, volunteers, and, ironically, linguists studying and recording local languages. But they were not accessible, I mean in terms of their content, relevance and level, to the local people.

Claire: What about technology?

Ana: Communication advances have made a huge difference to the islands. Even on the remotest island, cellular technology was surprisingly reliable. Cell phones are so vital – because transport is unreliable and the coral roads are often washed out... so the 'mamas' coming from the villages to sell fresh produce at the local market, can check in before harvesting if the transport is going to be available – or if there has there been a big rainfall which will stop them from getting there. Getting accurate information on cyclones and weather events has also dramatically improved through cellular technology. I remember the hourly text messages coming through when Cyclone Donna - a Category 2 - was dancing around the top of our island for about 48 tense hours. We were lucky that the centre of it never hit us but it moved north and took out a whole island – about 1000 locals lost their homes and ended up sheltering in caves - with little water or food for more than two weeks.

Figure 5. Mamas' market, at Lakatoro, Malekula, 2016 (Photo credit: Ana Terry).

Claire: In terms of your own professional practice, how has VSA volunteering impacted on your learning and your skills?

Ana: I think the experience of going into that kind of context is very rewarding – it takes you out of your comfort zone. And it's project based – hands-on facilitating with limited resources. I think that this kind of opportunity is really useful for teachers. Taking on a VSA voluntary assignment challenges you. You have to stop and take stock, and think, how do I manage this task and work with my counterpart on the ground in this complex and alien context?

I think this process of evaluation and adaptation has been useful to my teaching becoming more learner-focused.

Claire: I imagine your ability to adapt to change and uncertainty is very strong as well. So, the ability to adapt becomes key?

Ana: Yes, you just have to, you have to act on the fly. Regularly writing reports also assists in guiding you back to the assignment objectives. What have I achieved? What's realisable? Do we need to review these objectives? Has the goalpost shifted in some shape or form, given the context and the reality on the ground? And often they do!

Claire: What would you say to anyone considering volunteering overseas?

Ana: As an opportunity for personal and professional growth, it was invaluable. I mean, you know, at the time, it's a struggle, it's challenging, and some days I'd ask, "What the hell am I doing here!?" ...it's challenging, but I think in terms of getting an idea of you know, how 90% of the world's population live – a real lived experience – it's priceless. But, you know, there are all these other aspects impacting on developing countries; dealing with climate change, for example, things are shifting and changing dramatically in our Pacific Island nations. And also, while you're on the ground doing the work, you are also aware of the politics – that you are occupying a space as a volunteer… representing a nation – New Zealand, in this case. The increase in Chinese aid in Vanuatu is enormous, the amount of work being done on infrastructure like roading and ports – and, as much as these improve Vanuatu's economy, it's also about China's political presence.

Figure 6. A typical wash out after heavy rainfall. Lakatoro, Vanuatu, 2017 (Photo credit: Ana Terry).

Claire: Are there aspects of volunteering that you would like to see change?

Ana: One of the things that I would have liked to have had was the capacity to be able to continue mentoring in a formal role with my counterparts. Because I think that… what happens is, people come in for a year or two years, do all this work, and then they leave. And I think there's a lack of continuity for our counterparts, suddenly being left in the lurch… or possibly another volunteer comes in, and they need to then adjust again, you know… it's providing that consistency and support.

Claire: And what about the future in terms of sustainable development goals? In terms of your individual experience, how do you see things developing?

Ana: It's constantly on the radar. I think socialising the SDGs is vital.... and in the communications field, that is what all three assignments were about. It's about working with your counterparts, the key stakeholders, and with those organisations… educating the educators increases their capacity and awareness, and the knowledge starts to initiate changes in understanding and behaviour.

Two years ago, for example, New Zealand supermarkets thought they would lose business if they didn't provide plastic bags to their shoppers – but with education, awareness, and community pressure, an attitudinal shift has occurred. But we need to move quicker in terms of climate change.

I think what we call 'developing countries' have so much to offer us in reviewing what is sustainable, how much land do we need? How big a house do we really need? What are our personal priorities? Is life just about making money to the detriment of our relationships? How do we achieve a sustainable balance in all aspects of living, with each other, and on the planet?

Claire: Do you think there is anything that educational institutions could do better to support the Pacific nations?

Ana: Awareness. Providing and supporting opportunities for students from Pacific countries to come and learn in New Zealand through scholarships and vice-versa – giving our learners opportunities to experience these environments and ways of life.

The VSA *Univol* Programme, for example, which has been running for the last 10 years has been very successful. Students in their second or third year of their degree can apply and go on a short-term voluntary assignment. They end up doing some great work and, in some instances, it can set them up on their career path. One *Univol* I worked alongside in 2008, for example, has ended up working for MFAT.[5] He is now working in the area of disaster management in Vanuatu. It's a fantastic opportunity, and it would be great if Otago Polytechnic could partner up with VSA and provide opportunities for our learners to experience this sort of voluntary development work. There is huge scope for this. Volunteering used to be perceived as something you did when you retired, but this is no longer the case… I think people are more and more socially aware and want to be contributing to their communities, locally and internationally. A healthy community is about supporting our neighbours!

Ana Terry and **Claire Goode** are Learning and Teaching Specialists in the Learning and Teaching Development Team at Otago Polytechnic.

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ENDNOTES

1 The Ni-Vanuatu are the Melanesian people that make up the population of Vanuatu.

2 "Kustom culture" is the term used for the indigenous custom culture of Vanuatu.

3 Leaf roofing is made with leaves from the Natangora (or sago palm) tree.

4 A cargo cult is a belief system generated from early contact with explorers and colonisers, where commodities are often gifted. The belief is that, if certain rituals are performed, modern commodities and technologies will be supplied by more advanced societies.

5 The New Zealand Ministry of Foreign Affairs and Trade.

OCEAN ACIDIFICATION-IT WILL TAKE YOUR BREATH AWAY

Meg Brasell-Jones and Pam McKinlay

INTRODUCTION

Humans have developed a disturbing, self-destructive predilection to cause major destruction, pollution and chaos in our world – arguably more so than any other species inhabiting planet Earth. Humans, however, also have the crucial ability to reflect, be creative and disseminate complex ideas. As we become increasingly aware of the effects of human overconsumption and overpopulation in a world of finite resources, we need to become increasingly *active,* to use our collective abilities to draw attention to our uniquely human practices, to respond, to halt, to assess and restore. And . . . we need to breathe, if we want any kind of future at all.

OCEAN ACIDIFICATION

Our planet is more ocean than land, so it is not surprising that more *life* exists in this underwater domain. From water quality to climate change, what we do on land has long term and immediate impacts on our coastal and ocean environment. Many of the effects we are observing today are caused by our addiction to fossil fuels. We now see the consequence of adding excess carbon dioxide (CO_2) into our atmosphere, including the warming of our oceans and atmosphere, increased frequency and severity of extreme weather and rising sea levels.

The threats to the ocean are manifold including ocean warming, hypoxia (low oxygen), over-fishing, and ocean acidification (to name but a few). The degree of impact will depend upon the part of Earth that you inhabit. Ocean acidification, which can be described as the evil twin to climate change, is a major threat to the health of the marine ecosystem (Figure 1.). The oceans absorb about quarter of the CO_2 we emit into the atmosphere, which produces carbonic acid and increases the acidity of the seawater (National Institute of Water and Atmospheric Research [NIWA], n.d.). Ocean acidification is a significant, additional stressor for calcifying organisms and will increasingly become an issue as we continue to pump CO_2 into the atmosphere. Changes in seawater acidity affect the ability of corals and shellfish to build and maintain their shells and skeletons. The changes in acidity also affects the sensory system of fish, with negative consequences affecting their sight, hearing and navigation.
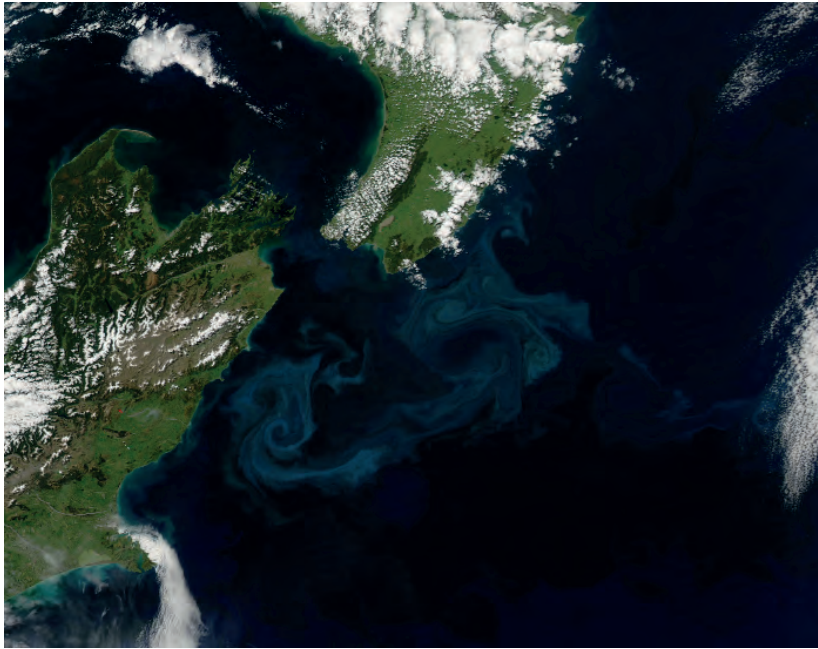
Figure 1. Image of the Day for October 28, 2009. Instrument: Aqua — MODIS. A phytoplankton bloom colored the waters east of New Zealand on October 25, 2009. NASA image by Jeff Schmaltz, MODIS Rapid Response Team.

"EVERY SECOND BREATH WE TAKE WAS MADE IN THE OCEAN"

The oceans are the seas of all life on our planet supporting life within it and producing half of the air we breathe on land. Dr Ro Allen, at a 'Meet the Scientist' session during Ōku Moana (My Oceans), at the NZ International Science Festival, noted that "every second breath we take was made in the ocean." At an event where a species of plankton, *Syracosphaera azureaplaneta,* was named after the television series 'Blue Planet', world-renowned natural historian Sir David Attenborough stated,

> *If you said that plankton, the phytoplankton, the green oxygen-producing plankton in the oceans*
> *is more important to our atmosphere than the whole of the rainforest, which I think is true, people*
> *would be astonished.* (Sir David Attenborough, quoted in Shukman, 2018)

While everyone in New Zealand is reaping the benefits of burning carbon (individually by driving cars, buying fast fashion, taking a holiday, and so on), there are a number of large industries whose economic models are predicated on short financial gains at the expense of the environmental benefits provided by the marine ecosystems. The tiny plant-like organism is regarded as a key element of the marine ecosystem and is described as being the "beating heart" of the ocean.

> *They are an essential element in the whole cycle of oxygen production and carbon dioxide and*
> *all the rest of it, and you mess about with this sort of thing and the echoes and the reverberat*
> *ons and the consequences extend throughout the atmosphere. (Sir David Attenborough, ibid.)*

We all live in an open room and we all have a stake in our oceans' future.

Scientists exploring the fossil records of the planet reveal that there have been several periods of life flourishing on Earth and several periods of evolutionary collapse. The periods of collapse are called extinction events, the most dramatic of which concluded 252 million years ago, at the end of the Permian era. At this time, conditions were ripe for bacteria, harmful to most life on the planet, to thrive and release noxious gases into the air. It is estimated that up to 95 percent of marine and 70 percent of terrestrial species went extinct. While the cause of excessive atmospheric carbon at that time was the result of cataclysmic volcanic activity on a young planet Earth, this graphically illustrates the consequences of massive global warming. Under those conditions, the resulting bacterial blooms wiped out life-sustaining phytoplankton, exhausting the air of life-sustaining oxygen and the resulting extinction event is given the infamous non-de-plume 'The Great Dying.' Carl Zimmer, in *The Sixth Extinction,* described the world of the end-Permian era as a "truly grotesque place" where glassy, purple seas released poisonous bubbles that rose "to a pale green sky" (Kolbert, 2014). This may seem completely far-fetched as we bask under balmy blue skies, breathing relatively clean air and focus our attention on the nuisance of plastic pollution and climate change, but scientists now report that we are in the midst of the next extinction event. Zimmer's evocative description serves as a dire warning of a world our descendants may not live to inherit. It prompts the questions: What are we going to do about this! What can *I* do about this?

ART-ICULATING THE DATA

The sixth Art and Science series, 2017-2018, embarked on an art-science collaboration with a theme of 'Oceans'. The project participants involved 27 artists and 20 scientists from a range of institutions including University of Otago (researchers from Surveying, Physics, Anatomy, Chemistry, Botany, Marince Science, Te Koronga (Indigenous Science), Dunedin School of Art, Otago Polytechnic School of Design, Cawthron Institute (New Zealand's largest independent science organisation), Landcare Research, National Institute of Water and Atmospheric Research (NIWA), Sustainable Seas National Science Challenge, CARIM (Coastal Acidification: Rate, Impacts & Management), Biodiversity Research Centre, and the University of British Columbia. The aim of the project was not illustration of the science but an artistic response to the research. Tackling the complexities of our changing marine world, artists and scientists interacted over several months to produce works that interpreted and extended science research in new contexts and imagine new generative interactions between science and art (Dunedin School of Art, 2018).

The project co-leaders for this original Art+Oceans Project and Exhibition were Dr Jenny Rock and Pam McKinlay. Pam is an artist with a background in applied science and history of art. As an artist, she works predominantly in sculpture, weaving and ceramics. She works in collaboration with other artists locally and nationally in community outreach and education projects around the theme of climate change, sustainability and biodiversity, and currently she works part-time at the Dunedin School of Art. Pam worked alongside Jenny, who has a background in science and art. Jenny has spent more than 20 years as a scientific researcher (particularly in marine biology) and is also an intaglio and relief printmaker, as well as occasional poet. She is currently a Senior Lecturer in Science Communication (University of Otago) focusing on aesthetics, participatory practice, sensory cognition, and ArtScience.

In the 2017-2018 edition of the Art and Science project, 'Oceans', the number of participants blossomed (to almost twice the size as previous projects). The exhibition had a long tail of satellite exhibitions and mini exhibitions: Ōku Moana (My Oceans) in The International (NZ) Science Festival (McKinlay, 2018), The Sustainable Seas National Science Challenge Conference and The Commonwealth Ocean Acidification Action Group Workshop (Gibb, 2019); each with different reconfigurations and iterations of the travelling exhibition. The Art+Oceans project had strong environmental leanings and we hoped with each iteration to reach a new audience and inspire the public to engage with environmental science, relevant to all our futures (Bingham, n.d.). All creatives/exhibitors were current or past students of the Dunedin School of Art or staff at Otago Polytechnic.

FROM GALLERY TO STREET

An opportunity arose in May 2019 to take another iteration of the exhibition literally to the streets, when Phantom Billstickers agreed to do a limited poster run in association with the curatorial team for the exhibition. Several sequential poster sites were earmarked for our gallery/exhibition space where we would run up to five framed poster sites in a row (at size MAX - A0). The 'street gallery' sites chosen were, in terms of foot traffic and high-profile locations (such as supermarkets, bus stops and high density tourism/pedestrian areas). We also booked two 'super sites' (these are the size of 4xA0 prints) for scaled visibility.

This opportunity required expertise in communication and poster design and Meg Brasell-Jones was approached to collaborate. Meg brought an essential element of critical and sustainable thinking to this communication design challenge. She has a varied background that includes visual communication design but also an invested interest in sustainability, ecology, graphic activism and art. As a communication team, Pam and Meg worked through a set of predetermined expectations to make use of the poster format opportunity.

EXPECTATIONS

During early planning, we discussed five potential levels of engagement:

1. Give a visual gift: showcase a series of beautiful images on the street, something inspiring to look at - so if people paused and noticed and liked what they saw, this would be a win - a stopping to smell the roses moment and a raising of winter spirits.

2. Draw attention to the 'ocean health label': provide a connection between each image and the notion of "oceans".

3. Make the connection to Ocean Acidification: through interpreting the ocean health label or maybe just wondering what Ocean Acidification is. This subliminal query might be answered at a later encounter in the viewer's life.

4. Engage further by reading the information at the bottom of poster: the quote by Sir David Attenborough often gets the response, "Wow, I did not know that!" (and the knowledge that Sir David Attenborough said it, carries the authority of truth and popular acceptance).

5. Fuel reaction on social media: at the awesome end of the response scale.

6. Inspire others to take further action - beyond expectations!

TRANSLATION – MEDIATING THE IMAGE AND TEXT

The design process involved reformatting or translating the presentation of the individual artworks from traditional gallery walls to the urban gallery of city streets. We noted in preliminary discussions that not all works (or photos of the works) would translate successfully to the billsticker streetscape. There were twelve images from the original exhibition in the first selection list for the posters, which then sorted itself to eight; with the file size of images provided becoming a determining factor in the selection of the final six. All of them provided other-worldly interpretations and expressions of a sententious change that affects all life in and out of the oceans, and work to support the underlying messages around our collective vulnerability.

The requirement to privilege the artwork in the composition meant compromises. One of the challenges of the designer is to synthesize text and image; to complement and enhance, without trampling artistic expression. Text, and in fact any additional graphic devices added to an image, ultimately changes or reframes the artwork. From a communication perspective, however, it was necessary to add text and graphic devices to develop a more informative means of conveying the message, and to thematically link such disparate, albeit creative, images. Helvetica, as ubiquitous as water, was chosen as a complementary typeface for its universally-recognized, clean structure, and association with so much instruction in society.

During the process of negotiation between the image and the message, an 'Ocean Health Label' was conceived (Figure 2.). This graphic device is based on the pared-back, disciplined pharmaceutical label. It is both generic (of almost universal blandness) in translation across different products and functionally direct in its communication. For the purposes of the Oceans campaign, it was also adopted as a visual reminder of improving one's health. The label was further developed to include a fading white line – this, to bring to mind a litmus scale for measuring pH or acidity. The label was placed systematically throughout the series, but always with a consideration for the original focal point of the image. The black banner in the posters, gave uniformity and a weighted base to the composition, as well as a position for acknowledgements and links to further information.

Figure 2. Ocean Health Label

COMMUNICATION CHALLENGE

How would we explicitly link the message of increasing carbon emissions in the atmosphere to ocean acidification? How could we make an emotional connection with this message using the artworks from the exhibition as the carrying images? At each iteration of the posters, the text was pared down. The final black banner still retained image credit acknowledging the participating artists and scientists, but after many drafts we settled on using a signature quote to encapsulate a message that might resonate with the most people who took the time to read on the streets. It was felt that the aforementioned quote by Sir David Attenborough, summed up the message best (Figure 3.).
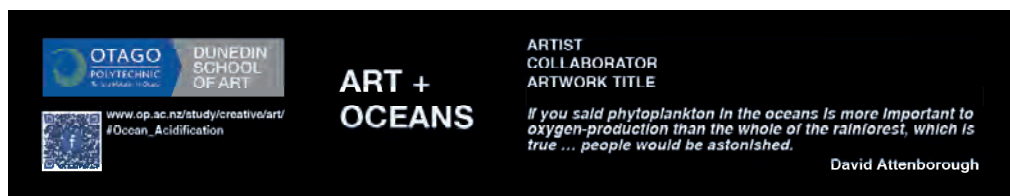
Figure 3. Informative Banner

BEYOND THE STREET

To further its reach, a Facebook page was set up as an online interface for the poster campaign (Ocean Acidification - Poster Campaign, 2019). This was indicated on the posters with a Q-code and, after some research, using the hashtag #Ocean_Acidification across the three main social media platforms, Facebook, Twitter and Instagram. Happily, the timing of the campaign, 30 June – 21 July, coincided with the Puaka Matariki Festival. We became a late entrant in the Festival Programme with a community night of celebration to officially mark the launch of the campaign in Ōtepoti/Dunedin. Dr Christina McGraw, Senior lecturer in Chemistry McGraw Research Group Analytical and Marine Chemistry, was invited to speak at the launch of the event. Christina was one of the original scientists who took part in Art+Oceans and was also the co-chair of The Commonwealth Ocean Acidification Action Group Workshop held at the University of Otago, a conference at which several other artists had exhibited at a mini exhibition earlier in the year, 17 – 19 February, 2019. The launch event was held at Heron Hall at Knox Community Halls, partly due to the proximity of the halls to the Phantom Billsticker sites and partly again to emphasize the community facing action of the poster exhibition/campaign. Other speakers that evening included local leaders of the School Strike for Climate whose intelligence and heartfelt message is a reminder to their elders that we need to do things differently. A feature of the evening was sharing food, music and *hongi* (sharing of breath). This extended to an invitation for all to be photographed in front of the launch posters, a set of which were on display in the Hall venue, or to step outside into the Matariki night and take a selfie in front of the posters on the street at a site opposite the Church and tag it to the Facebook page with #Ocean_Acidification. The artwork, the science, the designed poster series and an online presence thus came together to form a realised campaign (Figures 4-9).
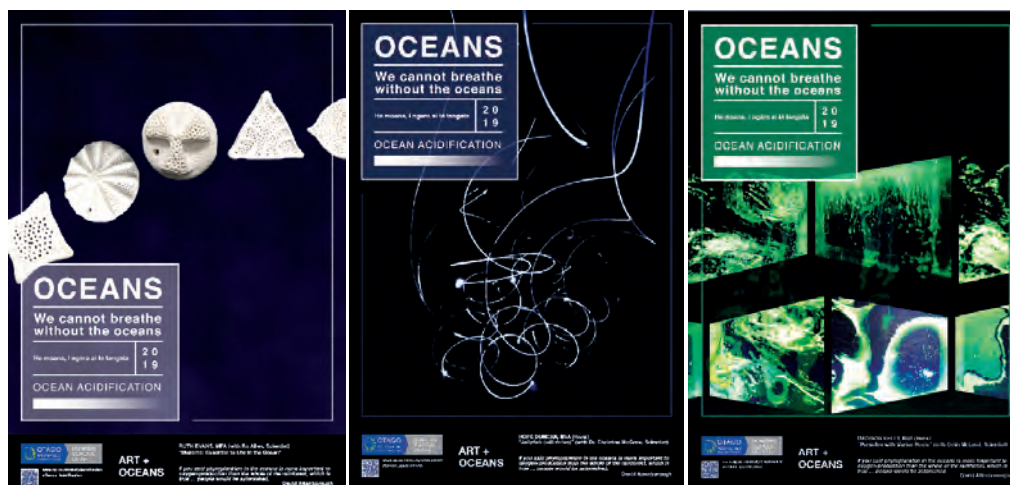
IMAGE CREDITS

Figure 4. Poster #1 Ruth Evans, MFA, *The great carbon trappers: how does ocean acidification affect diatoms?* (with Ro Allen, Scientist). *"If you said phytoplankton in the oceans is more important to oxygen-production than the whole of the rainforest, which is true … people would be astonished."* David Attenborough Wednesday, 18th April 2018.

Figure 5. Poster #2 Hope Duncan, BOT (Occupational Therapy) and Grad Dip in Art, *Jellyfish (will thrive),* (with Christina McGraw, Scientist). While marine species with shells begin to dissolve with increased acidification, jellyfish are predicted to become more abundant. The ocean absorbs 30-50% of CO2 gas. An acidifying ocean is no place to be a creature that needs to make its own shell.

Figure 6. Poster #3 Madison Kelly, BVA Hons, *Drawing to Discern Parasites, (*with Colin MacLeod, Scientist). Fluorescent pigment is used to visualise changes enacted by ocean acidification in parasites with marine hosts. *Toitū te marae a Tane-Mahuta, Toitū te marae a Tangaroa, Toitū te tangata. If the land is well and the sea is well, the people will thrive.*

Figure 7. Poster #4 Pam Mckinlay (Dip HSc, BA) and Jesse James Pickery, BVA, *Call of the Ocean*, (With Anne-Marie Jackson et al). Kaitiakitanga comes from a spiritual place – if the spiritual aspects have been adhered to, then right conduct will follow. *He moana, I ngaro ai te tangata. Without the ocean we are lost.*

Figure 8. Poster #5 Jessica Ritchie, MFA, *What Transpires from a Collection of Encounters*, (with Candida Savage, Scientist). Subtle changes can have cumulative effects. When will we reach a tipping point in global decay and destruction of crucial ecosystems?

Figure 9. Poster #6 Thomas Lord, BVA, and Blair Thomson, BSc (Hons) in Ecology, *Marine Microbial Ecology,* (with Blair Thomson, Scientist). Marine microbes are the "gatekeepers of the carbon cycle" playing essential roles in global cycles which regulate climate and underpins productivity and stability of oceanic food webs.

CONCLUSION

There are myriad of possible responses to address the effects of climate change and this is part of our ongoing contribution to its development. We have much to learn and much to do as a species, to manage the negative, but inevitable consequences of such epic change. One place to start was by bringing perspectives and knowledge together with a shared goal. *Oceans* was initially conceived as a collaboration between artist and scientist, but became an important catalyst for a continuation of the conversation with, well, anyone who wanted to take note. This was enabled by an evolution of one project to another; via a cohesive visual language that held its own among the bombardment of messages in our visual, urban environment (usually so focused on relentless consumption). As such, the artworks were reframed as a series of message-bearing posters. This may seem like a drop in the proverbial ocean, but we did *something.* And what is knowledge without action?

A living poem from the *Bull and the Burning Ocean and other Modern Tales from the Sea* (poems and performance written by Pam McKinlay)

IV

There's something in the water.

You put it there.

The breath of the ocean thickened,

And pastures sullied under the sea.

Bleached references sketch out a lost coraline city in ghost writing

like a drought just hit under water.

As you combust, so shall we corrode;

fire skies reflected beneath the water.

No sound of silent scream as acid on shell

Nowhere to shelter under the sky in our burning sea

Silence of the dawn chorus in reef and sand.

In the commodification of everything

you monetised the searoses in now sunburnt waters.
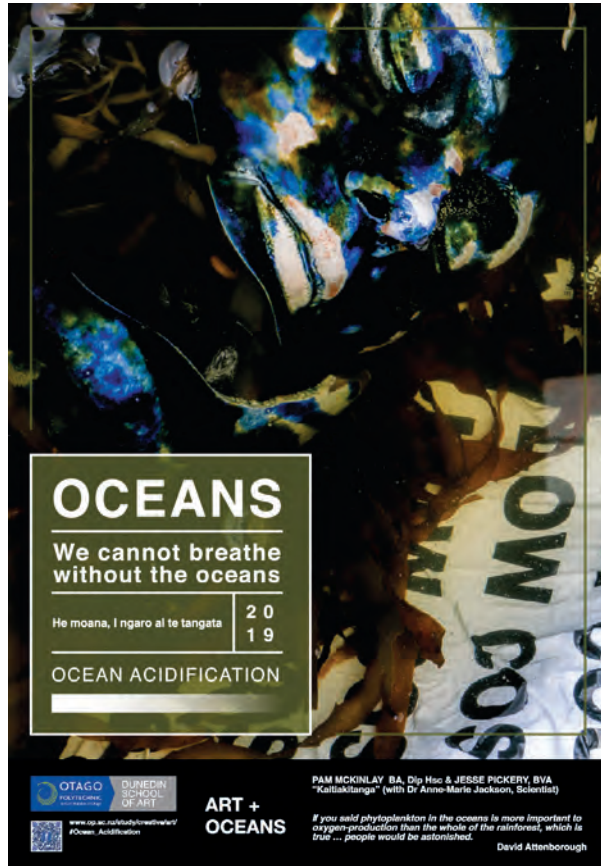
As fish among men if only

You would breathe our water.

Figure 10. Phantom Poster #4 in series – based on image by Pam McKinlay and Jesse-James Pickery, *Call of the Ocean,* 2018.

BIOS

Pam McKinlay has a background in applied science and history of art. She works predominantly in sculpture, weaving, ceramics and photography in collaboration with other artists locally and nationally, in community outreach and education projects around the theme of climate change, sustainability and biodiversity. She works part-time in the Research and Post-graduate office and Dunedin School of Art at Otago Polytechnic.

Meg Brasell-Jones is a Senior Lecturer in visual communication design at The College of Art, Design and Architecture (ADA), Otago Polytechnic. Her research expertise is in design, social responsibility and sustainability. She is also a practicing creative, producing commercial graphic design as well as personal work, in the medium of painting, mixed media and stitch, with a particular interest in engaging in social commentary.

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ACKNOWLEDGEMENTS

SOCIAL INNOVATION TO IMPROVE VISION SCREENING FOR CHILDREN IN NEW ZEALAND

Mary Butler

INTRODUCTION

There are stories of children jumping up 12 reading levels within one school term when they start wearing glasses. Other stories tell of children who hate school for years and who then pick up confidence and start to read when they get their glasses (Russell, 2019). Children are a vulnerable population who depend on the adults in their lives to meet their needs for basic resources like spectacles. The availability of sufficient eye care services to children can be helped by simple referral pathways between education and health systems, including clear processes that aid follow-up, and the provision of spectacles (Burnett et al., 2018). In 2019, 1000 years after spectacles were invented, it is still possible for New Zealand children to go without spectacles throughout their school years without anyone noticing.

In September 2015, the UN General Assembly adopted the Sustainable Development Goals (SDGs) to stimulate action in areas of critical importance for humanity and the planet. The SDGs are built on the commitment to leave no one behind. These goals can also help to address the areas where countries like New Zealand might be falling behind, such as vision health for children. The SDG for Health (Goal 3: Good Health and Well-being) aims to "Ensure healthy lives and promote well-being for all at all ages" and in especially to "Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks" (Goal 3.D). This provides good linkages with the World Health Organisation Global Action Plan on Universal Eye Health, which calls for access to comprehensive and equitable eye care services for all, with an emphasis on vulnerable groups. Early detection and effective management of eye health conditions in children and youth would also contribute to achieve the SDG on Education (Goal 4), by reducing drop-out rates and improving academic excellence. Correction of refractive errors (that is, using spectacles) can an enormous difference to learning and general education.

At present, New Zealand provides two opportunities for vision screening for children. The first is the B4 School Check at the age of four when children are screened for amblyopia ('lazy eyes'), but not for other conditions that might affect their capacity to read such as refractive errors (long sightedness and short sightedness), or eye coordination. At the age of 10-11, children are again tested, but this time it is only for distance vision. In both of these situations, parents need to respond to the findings of the screening and to do something, if necessary. It is increasingly recognised that these screening opportunities are neither identifying all the children who have problems, nor providing ways of addressing the problems even if they are picked up (Davison & Russell, 2019).

Given the high prevalence of visual impairment due to uncorrected refractive errors in children, and the simplicity of treatment, the detection and correction of refractive errors is a significant public health issue. Refractive error (need for spectacles) is defined as the inability of an eye to bring parallel rays of light into focus on the retina resulting in a blurred image. There are three types of refractive error: myopia (short-sightedness, which compromises distance vision); hypermetropia (long-sightedness, compromising near vision); and stigmatism, caused by a non-spherical cornea, which impairs both distance and near vision (Evans, 2018).

Uncorrected refractive error is an important cause of visual impairment in children (Resnikoff, 2008). A meta-analysis of the prevalence of different conditions in children indicates that, the 11.7 percent have myopia, 4.6 percent have hyperopia, and 14.9 percent have astigmatism. The proportions vary across the world and we do not know what the percentages are in New Zealand. However, there is evidence that severe short sightedness (myopia) is becoming much more common (Hashemi et al., 2018). In terms of the time spent on visual-related academic tasks in school, 47 percent of activity involves near tasks, nine percent involves computer tasks, 15 percent involves distance-to-near tasks, and 29 percent involves distance tasks (Narayanasamy et al., 2016).

Children need to be able to see to make good use of educational opportunities at school, since 80 percent of the learning process is dependent on vision (AOA, 2017). Refractive errors and binocular vison conditions cause eyestrain, blurry vision, and diplopia putting these children at a disadvantage (Renner, 2017). Preschool children with uncorrected hyperopia score significantly worse on the Test of Preschool Early Literacy (TOPEL) when compared to children who had normal vision (Kulp, 2016). Even marginally reduced visual acuity is associated with a lower performance in mathematics (Cueto et al., 2017). In addition, children who just fail a basic vision screening test (i.e. not the full optometry test) are show to be disadvantaged in spelling grammar, reading and numeracy (White et al., 2017). It seems that reduced vision conditions cause poor focus, perseverance and class participation, affecting academic performance and leading to psychosocial stress (Dudovitz, 2016).

On the other hand, an improvement in learning has been demonstrated within six months of receiving spectacles in a lower socioeconomic area in the US (Renner, 2017). In an experimental study, Glewwe, Park and Zhao (2016), randomly assigned glasses to primary school students in China and found that providing the children with glasses increased achievement. In a qualitative study, participants described how receiving corrective lenses improved classroom attention, task persistence, and willingness to practice academic skills (Dudovitz, 2016).

There is wide variation in the vision screening protocols used worldwide (Burnett et al., 2018). We know that screening programs are expensive, and yet something needs to be done to improve the situation for children. In this project, we decided to trial a protocol where the children would be made responsible for screening the vision of their classmates. The hypothesis was that this method might allow significant numbers of children to be screened in a short period of time, while the children also learn about their eye sight. We wanted to examine whether such a screening process could be integrated into the school curriculum. The involvement of the children in this way could potentially build sustainability into the screening process. Ideally, it might be possible to arrive at a situation where vision screening could be a normal part of the school curriculum.

METHOD

We chose to use a screening toolkit called the Eyes Right Toolkit (ERT). This is a screening test that was originally developed for older adults (Jessa, 2009). It can be used to test both near and distance acuity, and also includes contrast sensitivity testing. It was found to be 80 percent sensitive for older adults and the question was whether it might also be sensitive to visual impairment in schoolchildren. The advantage of the ERT is that it comes as a standardised kit so that it can be used by lay people (Royal National Institute of Blind People [RNIB], 2017), and includes a booklet explaining how to do the test, a flipchart, a measuring tape, marking charts, and letters to be sent home with the results of the screening. A simple video demonstrating how to use the ERT is available on YouTube (Thomas Pocklington Trust, 2016).

The ERT was developed by an occupational therapist employed by the Pocklington Trust and has been used widely as a means of raising awareness about low vision in the UK. Each kit costs about $30 and the author was granted copyright permission to develop and publish the ERT for the New Zealand context. The first print run of 30 units

was done in collaboration with Retina NZ. An app was developed by third year information technology students and this can be found in the Google Play Store under: 'Otago Polytechnic – Eyes Right Toolkit.'

Ethics permission was obtained through the Otago Polytechnic Committee (Ethics B) in May 2018. We approached a decile one school and received permission to complete an interactive educational session for students aged 14 and 15 years in place of one of their physical education classes. Letters were sent to parents, offering an opt-out option (passive permission) and information was also sent out in a school newsletter.

The educational session was carried out by two occupational therapy students as part of their final year community project. This session was divided into three parts: (a) a presentation about common eye problems and ways of protecting the eyes against computer vision syndrome, myopia, and UV damage; (b) a vision simulation exercise, where students were given a series of tasks to complete with low vision goggles, including writing/texting, and playing table tennis; and (c) a demonstration of how to do the ERT screening, followed by an exercise where students screened each other. Each schoolchild received a letter at the end of the screening. This letter said either that they had passed the screening, or that they had not passed. Students who did not pass the screening test received a 50 percent discount voucher for a local optometrist. At the end of the session, students were invited to fill in a feedback form.

RESULTS

Seven classes completed the classroom session over two weeks in August /September 2018. In total, 122 year students from Years 9 and 10 (aged 14 and 15) were screened. There were no students who opted out of the classes, however one student who was non-literate was offered an alternative form of screening. One non-verbal student was able to complete the screening by typing the letters onto his assistive talk technology.

Of those who took the test, 17 percent (21) failed the screening and were given a referral letter to take home (with a discount voucher for a local optometrist). At the end of one month, none of the children who failed the vision screening (or their parents) had taken up the option of using the half price vouchers to visit the optometrist. At this point, a reminder was sent to all parents through the school newsletter and one family took up the opportunity to go to the optometrist.

Teachers indicated informally that they were pleased with how the class session had gone. They valued the exercise and suggested that they would like the vision screening to be repeated. They were surprised that so many children failed the test. Schoolchildren were asked for feedback about the teaching session overall and about the screening tool in particular. In general, it appeared that the students enjoyed the class and learned from the key messages (see Figure 1).

Feedback about the teaching session

"It was useful learning what some common eye problems are and what can cause them"

"It helped me understand what other people might live with"

"It let me know I could see well, and all about the harmful stuff that can happen to my eyes and how I can protect them"

"It was good fun"

"I really enjoyed this session"

"That eye health is important"

"The consequences of screen time"

"About different eye diseases and the effects also 20/20/20 thing when you use devices"

Feedback about the screening tool

"It was really good to use because the instructions were clear and easy to understand"

"It was good, but I feel it could've been bit more complex"

"It was simple but hard to find the right page"

"I found out that I need an eye test"

"I learned about eye diseases and another way to test eyesight"

Figure 1. Feedback from school children about the evaluation of the session

DISCUSSION

In 2017, a charity called the Essilor Vision Foundation screened 3000 primary school children in low decile areas in the North Island of New Zealand, and found that 30 percent of these school students required a full optometry assessment (Collins, 2017). In this project, it was found that just 17 percent of children at age failed the vision screening. Although this seems like a high percentage, it is not as high as that found by the Essilor Foundation. There are some differences between the ERT and usual vision screening for children. For example, near vision testing is not usually included in vision screening for children. In addition, the ERT includes a test of contrast sensitivity. This is potentially important because contrast sensitivity is the most comprehensive single means of evaluating the visual system's response to pattern information, and has a role in mobility, recognition of faces and the ability to undertake daily living tasks (Milling, Connor, & Newsham, 2014). However, contrast sensitivity is not usually included in vision screening for children either. It is not known whether the ERT is more or less sensitive than other screening assessments and this will require further research.

The fact that almost no parent took up the suggestion to have a full optometric assessment was one of the most interesting findings from this study. This was a decile one school, so it might be expected that cost was an issue for those families in a lower socioeconomic bracket. The 50 percent discount voucher was clearly not enough of an incentive to persuade parents to take their children to see an optometrist. A recent systematic review (Evans, 2018) indicated that provision of a prescription only leads to poor uptake of follow up with an optometrist. This means that even if children are screened, there needs to be more work done to ensure that there is adequate follow up. There is funding available including a 'spectacle subsidy' up to the age of 15 for children who come from families with a community services card. This entitles them to $287.50 per year, which pays for the optometry assessment, and includes $138.00 that can go towards frames. In 2018, 26,660 claims for the subsidy were approved. However, optometrists claim that this is just the tip of the iceberg and there are many more claims that could be

made (Russell, 2019). It seems clear that more research is needed to explore why parents find it difficult to access optometric services in the New Zealand context. If this is found to be a significant problem, then research is needed to help design cost effective solutions and to design a user journey that provides delivery of spectacles to those children who need them.

In previous research, it has been found that vision screening generally needs to be paired with provision of free/cheap spectacles in order to improve the number of children who have and who wear the spectacles they need. In the New Zealand Essilor project (Collins, 2017), each child was given two pairs of spectacles. One of these was kept at the school, and the other was sent home with the children. The Essilor project echoes similar projects in the US, such as 'Vision to Learn', which is a school-based programme that provides free corrective lenses to low-income students (Dudovitz, 2016). These projects demonstrate the power of providing vision care in schools, rather than in clinics. Two pairs of spectacles are necessary because one year after a similar project was conducted in the US, only 28.9 percent children in a lower socioeconomic area still had their glasses, and the rest were either lost or broken (Renner, 2017). The two pairs of spectacles method offers a useful reminder of the need to ensure that glasses are actually available to the child to assist with learning in school.

One of the findings is that there should be an alternative version of the ERT for those students who are non-literate. This could be done using the 'tumbling E' or 'tumbling C' variety of test. It is particularly important that children who are learning disabled receive the screening because of the high association between visual impairment and learning disability. Van Splunder (2006) demonstrated that 14 percent of the population with intellectual disability also have a visual impairment and 40 percent of these go undetected into adulthood.

One of the aims of this study was to demonstrate that vision screening can be successfully administered by school students and it was extremely effective in doing this. It has previously been found that using teachers to conduct vision screenings can be a cost cutting measure for programs (Burnett et al., 2018). This small research project goes a step further to suggest that children can conduct vision screening of each other in the context of the school curriculum. It was demonstrated that schoolchildren could be taught to administer the vision screening program efficiently and effectively. Feedback indicated that children enjoyed the process and learned from it. They did not need to lose time from their education, because the vision screening exercise was integrated into the curriculum. The use of the ERT, combined with messages about eye health, was seen as appropriate classroom material in the physical education/health program. It is likely that vision screening could also be fitted into other aspects of the curriculum. For example, if it were integrated into the science curriculum, children could be taught about the concept of fair testing. The important point is that 122 pupils were able to receive screening, with no additional resourcing from the school.

Social innovation is needed in order to meet SDG goals for health and education. An aspect of inequity that has received little attention is the impact on learning of even small variations in vision function for children. It is important to ensure a ready supply of free/cheap spectacles for children, and an awareness of the impact of visual impairment on learning. Children should not have to struggle through school, thinking that they are stupid, when there is a simple solution. Instead of needing to find funding for expensive public health specialists to screen children for their vision, we propose that children could take control of this element of their own well-being. New Zealand is a small country with limited resources and it is necessary to find smart solutions to the problems of primary health care including vision screening. In developing countries, there are models where teachers have integrated vision screening into their teaching process (Latorre-Arteaga et al., 2016). Similar processes could be adopted in NZ and what is learned here could be shared back into developing countries in order to meet SDG goals.

Mary Butler is a Professor in the college of Health and Wellbeing at Otago Polytechnic.

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ENVIRONMENTAL SOCIAL AND GOVERNANCE SUSTAINABILITY- KA MUA, KA MURI

Marianna Cherrington

Investing in sustainability requires legacy thinking; for organisations seeking more robust and sustainable operations, time-honoured and holistic perspectives may offer inspiration.

ABSTRACT

Sustainability is a dynamic concept in the corporate world. The intensifying public demand for responsibility and transparency in business is initiating new collaboration, integral to corporate social performance. Governance and investment decisions require reliable information based on quantitative and qualitative data, and calls for new ways to look back and to look forward. In Aotearoa New Zealand, the tradition of kaitiakitanga (guardianship) may offer time-honoured, traditional insights into new and dynamic ways of doing business in a more balanced way. The unique contribution of this paper is in its synopsis of Environmental, Social and Governance (ESG) sustainability ratings as a measure of corporate social performance with a novel view on how kaitiakitanga (guardianship) and taonga (treasured things) can redefine performance by augmenting visionary governance.

NOTIONS OF SUSTAINABILITY – ESG SUSTAINABILITY RATINGS

From a management standpoint, the notion of sustainability seems to be evolving. In the not so distant past, arguably many corporations derided environmental initiatives as fringe or as an opponent to profitability; but profit at all costs has its consequences. Many firms began to self-regulate in response to global eco-accidents and scandals. Corporate social responsibility (CSR) grew in momentum, and the three pillars of 'people, planet and profit' with the triple bottom line became one means of evaluating CSR. Nowadays, consumers are demanding more transparency and less rhetoric. Environmental, social and governance (ESG) ratings are a means of measuring ethical sustainability impacts of an investment in a firm. ESG scores represent a valuable new source of data for investment decisions, impacting both return and risk potential. Yet there are many providers of ESG ratings and methodologies vary greatly among providers; they should be comparatively explored (Huber et al., 2017). With careful integration, ESG data can have important benefits for investors and management (Malinak et al., 2018). As there is a significant and positive financial correlation between ESG ratings and return on assets (Peiris & Evans, 2010), sustainability is becoming a legitimate and evidential corporate social performance (CSP) tool that provides a level of accountability to a variety of stakeholders.

THE ESG INTEGRATION FRAMEWORK

The current trend for greater corporate transparency is a seemingly irreversible force. Decision-makers rely on ESG ratings provided by third parties, and the ratings can have huge financial implications. In response, a universally acknowledged ESG framework was established in 2005 through the Principles for Responsible Investment Initiative (PRI) and included a research level within a security level and inside a portfolio level (CFA Institute & Principles for Responsible Investment [PRI], 2018). The research integration consists of three components: information gathering, materiality analysis, and active ownership assessment. The *Guidance* document gives the holistic definition of ESG integration is "the explicit and systematic inclusion of ESG factors in investment analysis and investment decisions" (CFA & PRI, 2018, p. 9). The Framework is not a perfect process; it is a reference for integration and analysis techniques that firms should customise. To mitigate the inherent subjectivity of ESG data, ISO standards can be used to measure ESG factors along with sustainability reporting and assurance methods (Rezaee, 2016).

ARTIFICIAL INTELLIGENCE

Traditional analytical methods abound for such adaptation but artificial intelligence (AI) is now being employed to filter swathes of data on factors that most relate to performance (Cherrington et al., 2019b) including economic and ethical indicators (In et al., 2019). AI is a new technology in the financial technology and investment industries, where it can be shown that data which includes ESG ratings are effective tools for constructing portfolios and selecting stocks, especially for long term value creation (Malinak, Du, & Bala, 2018). The benefit for firms is a clearer vision of how to allocate scarce or threatened resources through models or novel insights; deep learning advances can help realise a multitude of sustainable opportunities (Cherrington et al., in press). Nevertheless, the more data that investors access, the greater is the number of sources used (some of questionable accuracy), and true clarity about firms at the forefront of sustainability may actually diminish. This hunger for data and the ability of AI to 'learn to learn' and filter big data (Karelberg, 2018) is creating radical transparency for firms. As the dynamic nature of environmental problems, such as climate change progress and accelerate, AI innovations may prove vital in approaches to ESG interpretation.

THE ESG RATINGS IMPLICATIONS

ESG ratings not only provide investors with a means of assessing sustainability for their investment decisions, they inform governance decisions and eventually filter consumer perception (Pagano, Sinclair, & Yang, 2018, p. 339). With the speed of social media and recommendation systems, perception can make or break a firm, and the long-term perspective that ESG ratings should afford is susceptible to being side-tracked. The very evidence that ESG ratings are meant to offer has been shown to lack convergence of measurement concepts, in that different ratings neither coincide in distribution nor in risk (In et al., 2019). ESG risk analysis also reveals that expected loss is highly correlated to the underlying data (Dorfleitner, Halbritter, & Nguyen, 2015). These factors imply a greater onus on the user of ESG ratings.

LOOKING BACK TO LOOK FORWARD

Emerging themes over the decades of sustainability research link the '4Ps of sustainability research', where firms use principles and policies to instigate a more practice and performance-driven approach to sustainability efforts. Ethics are also playing a unifying role in the creation of sustainability value and in the evolution of business use of sustainability knowledge (Kordestani, Peighambari, & Foster, 2015). One of the current trends in ESG matters is for greater community involvement and stewardship, even in such areas as health and education (Kell, 2014). Firms are also taking a more holistic view of customer experience and sustainability. For example, Air New Zealand is looking back over more than 75 years in the airline industry connecting Aotearoa to their Pacific islands and the world. Their vision for at least another 75 years aims to "supercharge New Zealand's success socially, environmentally and economically" (Air New Zealand, 2018, p. 6). This bold vision inextricably links the success and performance of Air New Zealand with Aotearoa New Zealand and its people and their wellbeing; it looks back to look forward.

Could it be that Air New Zealand has realised that Te Ao Māori (the Māori world-view) has a unique place in our business culture? That may be a leap, yet Te Ao Maori is similarly interwoven; it is simple in its complexity.

Māori have a long history of being entrepreneurial and adaptable (Dawson, 2012) and continue to make their mark in business; Māori management "gives the concept of management an identity, a character, a face, a place, a time and an alternative source of management principles" (Mika, & O'Sullivan, p.6, 2014). The Māori whakatuaki (proverb) *Ka mua, ka muri* (look back to look forward) is commonly used and practiced in protocols so that traditional ways inform the new and build on a strong foundation. It involves communication, sharing, and being held to account while reaching out aspirationally. "If that sounds a bit grandiose, let's bring it down to earth" (Air New Zealand, 2018, p. 9). Trends in business come and go, but indigenous cultures have been reflecting upon and working collaboratively with the environment, society and 'governance' for a very long time.

KA MUA, KA MURI – ALTERNATIVE SOURCES

What are these traditional practices and alternative sources of management principles that are relevant today? A full discourse is beyond the scope of this paper; a few noteworthy Māori concepts are particularly illustrative.

Taonga (treasured things) have evolved to mean the inclusion of land resources, seascape and prized objects; intangible things may be taonga, such as knowledge and tikanga (customary practices). Taonga are important indicators for Māori tribal identity, kaitiakitanga (guardianship) and mana (the supernatural force in person, place or object). In Aotearoa New Zealand, a landmark political decision granted legal personhood to the Whanganui river; connecting taonga and kaitiakitanga with legal dualism. Therefore, this is type of anthropocentric approach can play an emerging role in environmental management (Charpleix, 2018).

Taonga tuku iho (something handed down) is underpinned by te reo Māori (the Māori Language), tikanga and mātauranga Māori (Māori knowledge) and "stimulates new perspectives and allows evaluation of previously inaccessible ecological data, yet is currently undervalued and underestimated" (Wehi, Whaanga, & Roa, 2009).

Whakataukī (proverbs) are used to reprise truths or cultural norms into the current context, as *Ka mua, ka muri*. One of the most widely whakataukī used throughout all New Zealand (if only in its truncated form) is:

> Hutia te rito o te harakeke. Kei hea te komako, e ko? Ki mai ki ahau, he aha te mea nui o te ao? Maku e ki atu He tangata, he tangata, he tangata.

Pluck the heart from the flax bush - where will the bellbird be? Ask me, what is the most important thing in the world? I will reply, it is people, it is people, it is people.

Although many-layered, this whakataukī is like a gauge of sustainability. It underpins the need to balance the natural world with people (Tipene-Matua et al., 2009). The flax bush is a prodigious resource, an asset to be sustained, but it dies when its core is attacked; the bellbird's call is like that of a gifted orator. The answer is in the harmony of people within the environment. This profound whakataukī can be used to recall and weave a focused vision of sustainability.

Kaitiakitanga (guardianship) refers to the deep connection Māori have with the natural world. "The Māori resource management term kaitiakitanga is commonly used in legal or environmental contexts" (Kawharu, 2000, p. 349); it is a way of being with the environment as stewards and protectors (Barlow & Wineti, 1991, p.173). Māori as tangata whenua (indigenous people) are increasingly involved in attempts to provide suitable cultural responses to environmental issues and have these rights under Te Tiriti o Waitangi (The Treaty of Waitangi). The relevance of kaitiakitanga in today's society is indisputable, yet empowerment of indigenous conservations and related aspirations still face many challenges. (Roberts et al., 1995). Meanwhile, the idea of kaitiakitanga is increasingly used in political discourse, to negotiate government policy. Kaitiakitanga weaves together ancestral, environmental and social fibres of identity, purpose and practice, therefore it cannot be fully appreciated without notions such as rangatiratanga (the right to exercise authority), mauri (life force), tapu (sacredness) and rāhui (ban or reserve) (Kawharu, 1998). The Māori concept of identity, being defined as 'of a mountain and of a river', is foreign to many in many contexts; reflections on the essence and implications of this way of being, in terms of business sustainability, can be confronting. Hence kaitiakitanga and whakapapa (genealogy) bind the relationship between human beings, the environment and spirituality realm - "reciprocity operates to maintain balance between all elements, a feature which perhaps distinguishes kaitiakitanga from other management regimes" (Kawharu, 2000, p. 367).

Mahi tahi (collaboration) is a vital mechanism for the practice and reinforcement of customs and processes, the transfer of knowledge, monitoring the environment and maintaining community interaction and resilience. These concepts are essential for manaakitanga (caring of others) and their environments (Lyver et al., 2018).

Te Tiriti o Waitangi establishes the principle of partnership between the Crown and Māori as an overarching tenet, from which other key principles have been derived (Te Puni Kokiri, 2001) and therefore Māori and the Crown are partners in resource management.

> Ko tā rātou, ko te noho ā-Tiriti he rite ki te noho rangapū, arā; he wāhanga ki a koe, he wāhanga ki a au.

> The Treaty is like a partnership, that is: you have a part and I have a part (Te Ururoa Flavell, 2006).

Firms must operate under the law, so Māori perspectives should inform investment and governance decisions. More than ever, organisations require innovative business approaches that deliver profits and create shared stakeholder value. A relational approach with Māori can reframe a "profit at the expense of communities and ecologies mentality" (Spiller et al., 2011). Kaitiakitanga, in its full connotation, has the potential to enrich approaches to governance, so that wisdom is consciously created through relationship.

REDEFINING PERFORMANCE

Sustainable development is multi-faceted. ESG ratings, as a measure of sustainability, suffer from definitional complexity, measurement realities and interpretational issues (Escrig-Olmedo et al., 2014). Investors may prefer the simplicity of ESG ratings, but from a governance perspective, or for climate change mitigation, that simplicity may hide the knowledge to be gained by seeing a bigger picture. We have the means to capture complex interaction with traditional truths and wisdom (ka mua, ka muri) and through artificial intelligence and deep learning (looking back to look forward). The world faces daunting challenges. Single metrics cannot condense the complexities our environment, our society, that our leaders now face; a true account of our actions and decisions is required.

> Whāia te iti kahurangi ki te tūohu koe me he maunga teitei.

> Seek the treasure you value most dearly; if you bow your head, let it be to a lofty mountain.

This whakataukī is about pursuing lofty goals to attain what is truly valuable. Let us not be lazy, but rather aspire to a more holistic and all-encompassing vision of ESG sustainability.

Marianna Cherrington is a Senior Lecturer at Otago Polytechnic Auckland International Campus.

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E-SCOOTERS WITHIN DUNEDIN CITY: A SUSTAINABLE OUTREACH PROJECT

Emma Anderton, Gemma Clydesdale, Hannah Collins, Derelle Ferguson, Georgia Hatton, Emily McRae, Gabriella Perry, Shana Pohe, Eliza Poulter, Hannah Press, Genevieve Scurr, Hannah Van Der Geest, and Dr Jean Ross.

Figure 1. Parked Lime Scooters. Source: Authors.

Figure 2. Lime Scooters in Dunedin. Source: Authors.

INTRODUCTION

As third-year nursing students, part of our course requirements for our Primary Health clinical placement was to develop a health promotion activity for a chosen community. Our group began this project by identifying the controversy of e-scooters within the Dunedin City, based on news articles, word-of-mouth and personal views. The e-scooter community is rapidly growing within Dunedin (Figure 1. and 2.) since the launch and distribution of 300 'Lime' scooters on 10 January, 2019 (personal correspondence, 2019). Within six months, this number had grown to 850. Our enthusiasm to identify the benefits and risks of e-scooters began to grow once we identified a geographical area that we called the 'e-scooter community'. This community was created by our group as the location in which we viewed the majority of e-scooters being used. We identified members within the geographical area who use or are impacted by the use of e-scooters as the population of interest.

We spoke to a range of professionals within the community to assist us in primary data collection. From there we evaluated both the positive and negative implications of e-scooters within the community. We then compared them to the United Nations Sustainable Development Goals to identify how they contribute to creating a sustainable future.

GEOGRAPHICAL AREA

Dunedin City is located on the east coast of the South Island, surrounding the Otago Harbour. The city is set amongst the hills and holds some of the steepest streets in the world. As the terrain in Dunedin is a combination of both flat land and hills, the benefits of e-scooters are limited to areas where there is flat land. The majority of the larger institutions such as the university, polytechnic, stadium, multiple supermarkets, and malls are all located on the

flat part of North and Central Dunedin, and individuals can easily use the e-scooters to access these institutions.

Dunedin has a coastal and temperate climate bringing warm weather in summer, occasionally reaching a temperature that would be considered hot (University of Otago, n.d.). In winter temperatures are often cooler, bringing an occasional snowfall. Frost and black ice are familiar with the winter months in Dunedin.

We created a geographical area based on our personal views of e-scooter prevalence/usage within Dunedin. This area reached from North Dunedin, to South Dunedin and up to Mornington. We focussed our project on the chosen geographical area, and collected secondary data on that area and the surrounding areas within Dunedin City using the Anderson and McFarlane community assessment wheel (Anderson & McFarlane, 2000).

E-SCOOTERS IN THE COMMUNITY

An electric scooter is designed like a traditional push scooter with two wheels but is larger in size with an electric motor (New Zealand Transport Agency [NZTA], 2019). These scooters are a method of sustainable travel and are available in many areas within New Zealand. They are designed to be used on the footpath, the road as well as designated cycle lanes (NZTA, 2019). A helmet is not legally required to use an e-scooter but is recommended (NZTA, 2019). On the road, these scooters must be operated as close to the side of the road as possible (NZTA, 2019). There are many brands of e-scooters such as BEAM, Flamingo, WAVE, Jump and Lime (Deguara, 2019). In Dunedin, 'Lime' is an e-scooter option available to the public. Through the use of e-scooters and smart bikes, Lime aims to minimise traffic congestion, and promote healthier living. They believe that this can be achieved with e-scooters without subsidies or public funding (Lime, n.d. (b)). The most common users of e-scooters in Dunedin were those between 18-25 years of age (Community member, personal communication, 2019).

Dunedin has a range of transport options available, making it easy to travel around the city. There is a bus service that provides public transport around the city and surrounding areas. At the time of writing, an adult fare to travel one zone was $2.60, or $1.92 with a GoCard (Otago Regional Council, 2019). The average starting fare for taxi companies in Dunedin is $3.00, from there the tariff is usually $3.00 per km (Backpacker Guide NZ, 2019). The addition of e-scooters to Dunedin provides a new way of transportation, the cost of Lime scooters are $1.00 to unlock plus $0.38 per minute. The majority of households own at least one private vehicle which is the most popular mode of transport within our geographic location. However, as the roads become more congested, and when considering the price and difficulty of parking, it is not a surprise that e-scooters are becoming increasingly popular for their accessibility, sustainability, connection to nature, and fun way to get from 'A' to 'B'.

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

The United Nations developed 17 goals (Figure 3.) to achieve a more sustainable future. These goals recognise current challenges the globe face including: poverty, inequality, climate, environmental degradation, prosperity, peace, and justice. The Sustainable Development Goals highlight the need for all 17 to be implemented by the target year of 2030 (United Nations, n.d.). As part of our project, we considered how e-scooters could relate to these goals and contribute towards a healthier more sustainable future.

Figure 3. United Nations 17 Sustainable Development Goals. Source: https://upload.wikimedia.org/wikipedia/commons/4/46/ Sustainable_Development_Goals.jpg

The authors have found that the addition of e-scooters to the community have contributed to meeting nine of the Sustainable Development Goals created by the United Nations, specifically Goals 3, 4, 7, 8, 9, 11, 12, 13, and 17.

Goal 3: Good health and wellbeing. "Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development" (United Nations, n.d.).

Active transport such as e-scooters contributes to better health and well-being, and better mental well-being, while also enhances connectedness for individuals in the community. Other benefits include improved social well-being and a greater sense of community (Healthy Spaces & Places 2016).

Goal 4: Quality education. "Obtaining a quality education is the foundation to improving people's lives and sustainable development" (United Nations, n.d.).

E-scooters appeared somewhat overnight. They have required no education to be given about their use and how to stay safe whilst using this method of transport. This information must be pursued by an individual and is often difficult to find. There is a range of informative videos around the use of Lime scooters that have been launched by

the company. They are easy to access on YouTube and easy to understand. Those using and being affected by the use of scooters would benefit from compulsory education around how this transport is to be used and how those who aren't using it can keep safe.

Goal 7: Affordable and clean energy. "Energy is central to nearly every major challenge and opportunity" (United Nations, n.d.).

E-scooters are gradually becoming a new means of transport globally. E-scooters have the ability to incorporate solar panels within them, although the technology is not there yet. With the transition to solar-powered e-scooters, not only would our carbon footprint decrease, but also would create a cleaner, more sustainable environment- thus, intertwining with the United Nation's Goal 11 *Sustainable Cities and Communities*.

Goal 8: Decent work and economic growth. "Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs" (United Nations, n.d.).

Through the introduction of e-scooters to Dunedin, jobs have been created. Lime employs approximately 25-30 staff who hold roles such as supply chain managers and lawyers. They are also contract approximately 100 juicers who, as independent contractors, can decide upon their own hours of work (Professional in the community, personal communication, 2019).

Goal 9: Industry, innovation and infrastructure. "Investments in infrastructure are crucial to achieving sustainable development" (United Nations, n.d.).

The Dunedin City Council has a 10-year plan that incorporates changes to the infrastructure of Dunedin. Dunedin is a growing city and developments of cycle ways and the bus hub will improve access to the city centre. They encourage residents to cycle and use other forms of transport such as e-scooters as an environmentally-friendly mode of transport to, from and around the city (Dunedin City Council, n.d.)().

Goal 11: Sustainable cities and communities. "There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more." (United Nations, n.d.).

The release of e-scooters in the city of Dunedin provides a sustainable, affordable mode of transport. E-scooters are changing the way pedestrians are moving around the city. It has been witnessed and evidenced that people are choosing to use e-scooters to travel from 'A' to 'B' rather than driving their cars. This has led Dunedin people taking new routes which benefit shop owners that sit outside of the traditional one-way-system. E-scooters are quiet, which means no noise pollution, they are also carbon-free which will change the air we breathe. The addition of e-scooters to Dunedin hopes for the streets to become cleaner, healthier and safer, giving the city more of a community feel.

Goal 12: Responsible production and consumption. "Responsible Production and Consumption" (United Nations, n.d.).

E-scooters offer a 100 percent carbon-free mode of transportation, which will help reduce air pollution by decreasing the number of vehicles on the roads (Fourtane, 2019). E-scooters offer a mode of transport that is environmentally and economically friendly than other modes of transport (cars, trucks, taxis and Uber cars, public transport).

Goal 13: Climate action. "Climate change is a global challenge that affects everyone, everywhere" (United Nations, n.d.).

E-scooters in the community provide an alternative form of transportation that contributes significantly less to the emission of carbon dioxide than other forms of transportation (Nocerino, Colorni, Lia, & Luè, 2016). Carbon dioxide emissions largely affects climate change and therefore through the option of a cleaner mechanism of

transportation e-scooters are able to contribute to this goal of taking climate action (Dijk, Orsato, & Kemp, 2013).

Goal 17: Partnership for the goals. "Revitalize the global partnership for sustainable development" (United Nations, n.d.).

New Zealand government agencies are working together to promote the safe and sustainable use of e-scooters, encouraging a more sustainable future due to decreasing our car-centric society. Leading e-scooter companies in New Zealand are learning from other countries that have implemented active transport and micro-mobility. E-scooters are a step towards a more sustainable world, however, the world must work in partnership for efforts to be effective.

PROS AND CONS OF E-SCOOTERS

From the authors' primary and secondary data collection, it is clear that there are strong positive and negative impacts to users and non-users around the use of e-scooters on the streets.

Mental Health Benefits

As alluded to in Goal 3 of the United Nations Sustainable Development Goals, **Good health and wellbeing**, e-scooters have the ability to improve mental health. E-scooters encourage physical exercise when compared to sitting in a car or other mode of transport (Micro-Mobility Scooter Worldwide, n.d.), but more crucially, they offer an increased connection with nature which is known to improve mental well-being. According to the Mental Health Foundation (2019), five ways of achieving well-being include: feeling connected, being active, giving, taking notice, and continue to keep learning. The Mental Health Foundation claims that you can introduce any of these actions into your life, any time, and begin to feel the benefits. An e-scooter rider experiences three of these five mentioned actions: feeling connected, being active, and taking notice. An e-scooter user feels more connected to their environment and takes notice of things they may not have noticed about their surroundings while travelling in another form of transport. This encourages mindfulness and a sense of groundedness which is important to mental well-being. Overall, there is not a lot of literature to support the hypothesis that e-scooters and other forms of micro-mobility directly improve mental well-being, but as a group, we feel confident that e-scooters have the ability to do so due to the increased connection to nature and environment.

Business Opportunities

As noted above under Goal 8, the arrival of Lime e-scooters in January 2019 has directly increased the opportunity for jobs. In addition, Shaw (2019) discusses how business retailers in Auckland's downtown and CBD area have had an increase in foot traffic to their stores since the arrival of e-scooters. The arrival of e-scooters to Dunedin has brought about opportunities for different businesses. E-scooter companies such as Lime in Dunedin, park e-scooters at certain locations throughout the city giving an opportunity for businesses in that area to have different foot traffic going past the stores and allowing more opportunity for sales.

Carbon Free

E-scooters are a sustainable mode of transport, being 100 percent carbon-free. This year the government introduced The Climate Change Response (Zero-Carbon) Amendment Bill into Parliament. The Bill was introduced as a "landmark action" to help combat climate change (Ensor, 2019). The addition of e-scooters and other forms of electric transport supports New Zealand's pledge to be carbon-free by 2050 (New Zealand Foreign Affairs and Trade, 2018).

Sustainability

Through the equitable distribution of shared scooters, the aim is to reduce human dependence on personal automobiles for short distance transportation to leave future generations with a cleaner, healthier planet (Lime, n.d. (a)). E-scooters are a quick and affordable mode of transportation for short distances, and members of the community use e-scooters as a way of commuting to and from work, the grocery store, doctor's appointments and more. Lime escooters also has an option for riders to donate part of their ride to local foundations in their area or globally. .

Potential for Injury due to Lack of Helmet Use

A study completed in the US found that over a one year period, of the 249 people presenting to the emergency department with e-scooter related injuries, 40.2 percent of the injuries were head injuries (Trivedi, Liu, & Antonio, 2019). The World Health Organisation (n.d.) indicates head injuries to be a leading cause of death and disability, and identifies that wearing a helmet decreases the risk and severity of injuries by approximately 72 percent. In New Zealand, helmets are not legally required when riding an e-scooter, however the NZTA "highly recommends" they are used (NZTA, 2019).

Demotes Physical Exercise

Lime (2018) reports that around 80 percent of trips people take on their e-scooters have replaced trip that would have otherwise been taken by walking or cycling. 'Passive' modes of transport have been blamed for contributing to insufficient physical activity. The World Health Organization has identified that, worldwide, insufficient physical activity is one of the leading risk factors for death and is a key risk factor for diseases such as diabetes, cancer and cardiovascular diseases (World Health Organisation, 2018).

Impact on the Blind, Hearing Impaired, and Pedestrians

The vulnerable population affected by e-scooter use has been recognised to include visual and hearing impaired individuals. E-scooters are permitted to be driven on the footpath, as well as on the road and in some bicycle lanes. The parking, or discarding, of e-scooters on footpaths has also caused safety issues to pedestrians, especially to those who are visually impaired. Blind and visually impaired pedestrians have tripped over them and sustained injuries. Better parking of e-scooters is essential to maintain safety to all pedestrians on footpaths (Lawton, 2019a).

As e-scooters are able to be ridden on footpaths, this has risks for many hearing and visually impaired individuals.

Limited Noise

Very few e-scooters have bells on them and their silent operation makes it very hard for people to hear them coming (Lawton, 2019a). Individuals that are visually impaired are taught to listen for approaching vehicles and predict their path by the sound of deceleration and acceleration. E-scooters don't have these cues and the lack of cues causes a significant impact on these individuals physically and emotionally (Lawton, 2019a). The Blind Foundation's Chris Orr said 'footpaths should be prioritised as being safe for pedestrians' and suggests that e-scooters in New Zealand should be required to have a noise at all times while the vehicle is running (Lawton, 2019b).

Speed

E-scooters in New Zealand can reach a maximum speed of 25km/h (Lime, n.d. (b)). This has a huge impact on all pedestrians on the footpath, especially if they cannot hear or see the scooter coming. A member of the blind community believes that e-scooters should not be allowed on the footpaths after her many bad experiences with them (Lawton, 2019a). On one occasion she was crossing the street with her daughter, and the driver of the e-scooter continued to drive towards them at speed, expecting them to get out of the way, and as a consequence she was run over (Lawton, 2019a). The blind and visually impaired community have recently noticed an increased use of aids due to the safety risks created by e-scooters on the footpaths. This has resulted in individuals feeling very unsafe on the street, and using their aids make them appear 'different' from other pedestrians (Lawton, 2019a).

Financial Limitations

The use of e-scooters in Dunedin is limited by the need for users to have access to a credit or debit card and a smartphone that has data. "We know from some of our previous research that possession of these items is low amongst some socio-economic groups. We also know that even some people who do have access to a smartphone struggle to afford the data to be able to use its connectivity functions" (Fitt & Curl, 2019, p. 19). Some areas, such as South Dunedin, have been identified as having the highest socioeconomic deprivation score (10) within the Dunedin area, and 280 South Dunedin households reported having no access to telecommunications (New Zealand Parliament, 2017). Therefore, the use of e-scooters is likely to be restricted due to financial constraints.

IDENTIFIED HEALTH NEEDS

The number of e-scooters available in the Central and North Dunedin area is rapidly increasing. There is, however, very little education around the proper use of these scooters and how they can be an accessible method of transport. The topic of e-scooters is frequently in the media, and very rarely highlights the endless possibilities of this transport. The constant negative comments deter the wider community from experiencing and understanding all of the positive aspects of e-scooters. This is a method of transport which is carbon-free, sustainable, decreases demand on parking, roads, and could potentially bring many business opportunities to our selected area. However, as well as these positive aspects of e-scooters, there are many areas that need to improve in order to protect those using these scooters, and those who aren't.

After engaging with the community assessment wheel, the World Health Organisation (1986) who promotes the Ottawa Charter, and the United Nations Sustainable Development Goals, we have identified three areas in which change must be made to improve the health and wellness of riders and non-riders alike. Firstly, in order for e-scooters to be used in a way that increases well-being, proper hygiene needs to be a priority. The handle-bars of e-scooters facilitates the spread of infectious diseases and puts the affected population at risk of becoming unwell. This can also place strain on our health system and services. The second health concern is around the lack of education riders have in regards to riding the e-scooters safely. When e-scooters are used incorrectly, it increases the risk of injury to both users and non-users. The final concern is the lack of promotion and understanding of how e-scooters contribute to a healthy, more sustainable future.

RECOMMENDATIONS AND RESOURCES DEVELOPED

Our first identified health need is focussed in infection control. E-scooters are a fun, new form of transport that can be used in many positive ways. It can reduce the carbon footprint, as well as significantly impact a user's well-being. In order maximise the benefits of e-scooters, we have identified that proper hygiene needs to be a priority.

A review of research lead us to develop a pop-up prompt in the Lime Scooter application to remind users to practice safe hand-hygiene. Below is the pop-up that the authors created, which we hope to see on the Lime app when users are finishing their ride (Figure 4 & 5.). The idea of this pop-up is to spark the idea for riders to participate in hand hygiene for their own safety. This allows the rider to make an informed decision about their health and hygiene.

Figure 4. E-Scooter Application Pop-up to Prompt Hand Hygiene. Source: Authors

Figure 5. How To Wash Hands Resource. Source: Authors

Our second identified need was around the safety concerns that e-scooters pose. Whether you are a user or a non-user of this form of active transport, there is a potential risk for harm. After speaking with professionals in the community and researching secondary data through online articles and websites, it was clear that e-scooters posed a threat to people's health and wellbeing through injury, some cases more severe than others. Our research led us to a health promotion resource that demonstrates to the public how to correctly ride an e-scooter. The digital image shown below (Figure 6.) demonstrates the misuse of an e-scooter that may lead to injury.

Figure 6. Digital image promoting safe e-scooter use. Source: Authors

Our final identified health need, looks at the benefits e-scooters possess for the health of the environment from a rider perspective. By promoting the use of e-scooters within Dunedin, our city can progress further toward being a sustainable, environmentally friendly city. Many professionals that we spoke to in the community see Dunedin following the global sustainable leader, Amsterdam (Personal communication, 2019). Our research identifies that as we gradually eliminate issues such as traffic congestion, parking and costs, Dunedin citizens can also improve their mental wellbeing whilst riding e-scooters. As we begin to reduce carbon emissions, much like Amsterdam, we can tackle the climate change crisis.

We identified the general population of scooter users to be 18-25 years of age (Professional in the community, personal communication, 2019). Our group thought the publication of a newsletter article could aide those who don't commonly use e-scooters such as over the age of 25, or those with a lack of knowledge. The below image (Figure 7.) is what the authors developed to have published in Critic (the Otago University student magazine) and the Otago Daily Times to reach the older generations.

Figure 7. E-scooter Promotion. Source: Authors

CONCLUSION

The number of e-scooters available in the Central and North Dunedin area is rapidly increasing. Due to the lack of education, riders and non-riders are being negatively impacted. There is very little education around the proper use of these scooters and how they can be an accessible method of transport. We identified that while there are significant benefits to e-scooters, there are also many areas that could be further improved to encourage safety. These include the lack of helmet laws, the risk to pedestrians from speed and silence (especially to those who are visually impaired), and poor hand hygiene.

The topic of e-scooters is frequently in the media, although the endless possibilities of this transport are very rarely highlighted. The constant negative comments deter the wider community from experiencing and understanding all of the positive aspects of these devices. This is a method of transport which is carbon-free, sustainable and decreases demand for parking, roads and could potentially bring many business opportunities to our selected area.

The authors hope to raise awareness and improve health outcomes for both users of e-scooters as well as non-users. We believe that through the implementation of these recommendations we will be able to help the community achieve a healthier, more sustainable future.

The authors of this article are learners in the Bachelor of Nursing at Otago Polytechnic, who co-authored with Associate Professor Jean Ross

Correspondance to Jean Ros, Otago Polytechnic, Dunedin. Email jean.ross@op.ac.nz

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DESIGNING A SUSTAINABLE BUILDING: A REFLECTIVE TEACHING CASE

Mazin Bahho

INTRODUCTION

The development of design ideas is at the core of education in creative based fields where the employment of skills and experiences is by nature a reflective practice inquiry. In the architectural studio, classes are organised around *set* projects of design usually drawn from *real world* practice (Schön, 1983; Schön, 1987). The teacher's position here is to find opportunities to consider the role of creative processes and technical knowledge in developing *workable* situations (Heath, 1984, p.74). On a similar note, Seferin (2010) stated any architectural project is bound by its context, so the kind of information, approach, and structure needed are directly related to the given context of the design problem.

This research is a case study with the empirical material consisting of investigations based on the designing process of a demonstration sustainable building project by a group of students. It also provides a perspective on how a sustainable building can potentially influence the values held by the students involved with it, and how this experience can inform and enrich their environmental values.
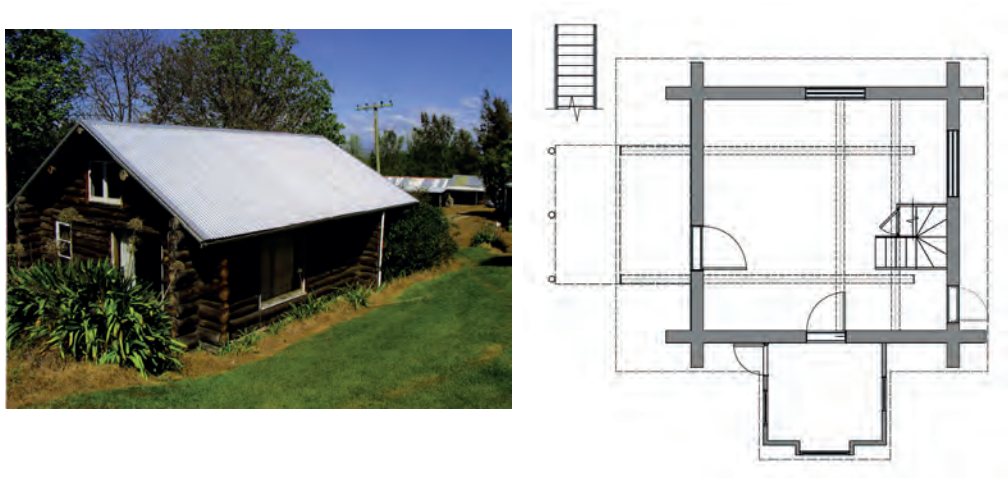

Figure 1. Views of the Log Cabin, (a) from the northwest, (b) ground floor plan, the log cabin before the improvements.

The building in question is a 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(a)). The Otatara Hills site is an example of a place that has strong historic, cultural, and spiritual associations with local Māori (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. The reuse of 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 and includes 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 1(b)). Although a building of solid log walls might not seem an ideal starting point for a demonstration sustainable building, without retrofitting, this unoccupied building would have continued to deteriorate and might well have been demolished. The problem was to find ways to minimise the environmental impact of the converted building that would be both appropriate and affordable.

AIMS

The aim of the study is to educate the students about what sustainable living practices are through engaging in a reflective practice inquiry of designing a demonstration project for sustainable building. This also includes the process of creating a brief for the demonstration project, *what* can be learnt in terms of environmental knowledge, and in what way this example may contribute to inspiring the behaviour of those who will come to be in contact with it. Acknowledging this, the case study is conducted with an outcome and a process in mind.

The brief for the LC was complicated because the design was to be developed by a group of students as part of teaching. At the time, the LC had no particular function beyond serving as a demonstration building for the public, and the costs of retrofitting had to be sourced through sponsorship. As it was to act as a demonstration building, the techniques and methods incorporated within it had to be appropriate to the building types and materials found locally. Beyond this, making sense of sustainable design in architecture tends to be confusing considering the quantity of information on the subjects of green and sustainable buildings (Guy & Farmer, 2001).

SETTING UP THE PROJECT

Sustainable building practice can be seen as a set of environmental, technical, social, and ethical issues with the general objective of reducing human impact on the earth. Accordingly, the project strategy was first established to create a framework for retrofitting and refurbishing the LC at Otatara.

Project design team

As mentioned before, the concept for the project's refurbishment would be generated and developed by students at EIT. Eventually these students would become part of this research investigation. Thus, rather than supplying a brief for the project retrofit, this was to be discussed and generated by a group of Second Year students in the EIT Visual Arts and Design (VAD) programme as part of a Design Studio course. The educational aim was to adopt a reflective teaching method that would enable meaningful learning (Smith, Hedley, & Molloy, 2009; Schön, 1983). To facilitate working with a group of students who want to influence behaviour through design (Tromp, Hekkert, & Verbeek, 2011), the need for responsible environmental attitudes to manifest the context of sustainability and

ecology through design was discussed, coupled with applying *design thinking* in dealing with environmental, social and ethical issues in addition to the technical and architectural context (Dorst, 2011).

Nineteen design students were invited to take part in formulating the initial concepts, and six opted to become involved, with the remainder choosing to work on other projects for various reasons. Consideration was given to writing the project brief criteria so that they would fit with the teaching curriculum.

Aims and guideline to students

In response to the context of the brief, the integrated and interactive model adopted in the design studio aimed to address the demands of the project while enabling specific and meaningful generic learning. The teaching model was outlined by defining the learning strategy and describing the structure and content of study (Smith et al., 2009; Schön, 1983).

At the beginning, the students were presented with a set of aims and guidelines for the building refurbishment. These were established by comparing standards and recommendations from a number of national and international sources in order to find out what characterizes a sustainable building.

A design strategy was then 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 (Net ZEB); using recycled building materials and components; treating wastewater; and reducing mains water use and the burden on existing infrastructure through collecting rainwater. The challenge to the students was to integrate these approaches and consider the environmental impact of materials. The results would be checked against passive solar energy targets (Passive House Institute New Zealand [PHINZ], 2014), and the renewable energy systems production checked against modelled consumption once a design was established.

In relation to specification of sustainable materials, the student designers looked at sources including the Building Research Association of New Zealand (BRANZ) and the Building Research Establishment (BRE) in the UK, for guidance. They were also to refer to the UK Code for Sustainable Homes (CSH) as a guide to overall building performance (CLG, 2006) and CO_2 emissions reduction (Sleeuw, 2011).

The project approach incorporating the teaching stages of the module was explained, see Figure 2. The students were also advised of being involved as actors in the research project.
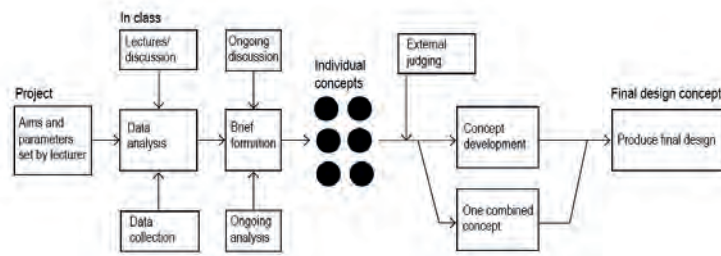

Figure 2. Flow diagram of the LC concept design process.

Using the parameters identified, the students were given a project timeline (Figure 3).

Weeks	Period	Activity
29, 30	16 July – 27 July	Stage 1: Research
31, 32, 33	30 July – 17 August	Stage 2: Design Concept – preliminary
34, 35	20 August – 31 August	Stage 2: Design Concept – presentation
36, 37, 38, 41	3 Sep – 21 Sep	Stage 3: Development design-preliminary
42, 43, 44	8 Oct – 2 Nov	Stage 3: Development design – final presentation

Figure 3. The project brief timeline.

Project design criteria

Using the parameters identified, the LC project brief was discussed with the students and the following aspects were explained as part of the data collection and analysis stage (Stage 1): indoor thermal comfort, passive solar design, a Net ZEB, impact of materials, recycling of materials, wastewater and sewage treatment, and water conservation. These aspects were first examined separately, although recognising there will be interactions.

THE PROJECT BRIEF

The students worked as a group to formulate a project brief and to establish a framework for retrofitting and improving the LC to become a demonstration sustainable building (Bahho, Vale, & Milfont, 2015).

Research and data collection

Based on the project design criteria above, the purpose of the design brief was to enable the student designers to create a concept for refurbishing the LC and to document it. The intention was to think of, and deal with, the fundamental issues of how the building could be constructed, and to think about how those who live in such buildings should operate them. These views were enhanced during the studio sessions through showing a series of sustainable building projects, such as Roaf's Oxford House, 1995 (Roaf, Fuentes, & Thomas, 2001), Vale and Vale's New Autonomous House, 1993 (Vale & Vale, 2002), Thomas Herzog's Housing Development Project in Munich, Germany, 1982 (Ingeborg, Herzog-Loibl, & Meseure, 2002), and talking about how the architects' views might have influenced the project.

Updating guideline topics

In the process of formulating the project brief, and based on CSH, the students were asked to discuss and explore sustainable practices applicable and suitable for the concept design. Each student was asked to gather and analyse information on one specified research topic chosen from indoor thermal comfort, passive design, Net ZEBs, impact of materials, recycling, wastewater and sewage treatment, and water conservation. Two students looked at the first three topics because of their interrelated data and complexity leaving the other four topics to one student each to investigate.

As a result of the data analysis and conversations, the students decided to update the classification of topics given in the project brief guidelines. Indoor thermal comfort and passive solar design topics were combined into an *energy conservation* category and a *renewable energy systems* category was introduced to complement the Net ZEB energy objective. They introduced a *healthy indoor air* category to include natural lighting and ventilation as well as material toxicity, and a *sustainable landscape* category. The focused environmental themes and their categories are shown in Figure 4 and compared with the CSH criteria.

THE PROJECT CONCEPT DESIGN

In response to the context of the project brief, an integrated and interactive model was adopted in the design studio aimed at addressing the demands of the project while enabling student exploration. The teaching model was outlined by defining the learning strategy and describing the structure and content of study.

The learning strategy

Through the design studio, the students were exposed to a number of experiences that focused on two areas: the first was *how to design*, introduced by engaging with the design process within the generic framework of analysis, synthesis, and evaluation; and the second was to reveal knowledge about aspects or situations through the act of designing. So the emphasis shifted from facilitating an understanding of design and designing to focusing on the ability of design to reveal new understandings of ecological and sustainability issues. The latter included giving consideration to social issues (Bahho, 2013).

As all students in the group would have experiences of the built environment as users, their understandings and everyday experiences were used as a starting point, through studio and group discussions, to inform what was to be designed, its effects on the relationships between people and the environment, and the associated design processes.

Category	LC Project Brief Requirements	CSH Standards
Energy conservation	To utilise solar design for passive heating and cooling, as well as making use of natural lighting and ventilation.	A 'zero carbon home'* is rated at 6-Star level (heating, lighting, hot water, and all other energy uses in the home) (CLG, 2006, p.10).
Renewable energy systems	To include solar photovoltaic systems, solar hot water heating systems, and eco types of electric lighting and Energy Star appliances.	
Impact of materials	To consider embodied energy of materials used for framing and finishing.	The total building points under CSH material calculator achieve the score of 15 points. Scores are added for; roof structure and finishes, external walls, floors, internal walls, and windows and doors (CLG, 2006, p.16).
Materials recycling and reusing	To use recycled materials and building components in the retrofitting, such as window joinery, and bathroom fixtures and fittings.	
Wastewater and sewage treatment	To recycle grey water and to treat black water.	On-site treatment of solid waste from the building (CLG, 2006, p.11).
Water conservation	To save rainwater by storing the roof runoff	Internal potable water consumption is less than 80 litres per person per day (CLG, 2006, pp.10, 15).
Healthy indoor air	To consider achieving minimum average daylight and ventilation factors. To include the use of low or no-VOC paints, durable and formaldehyde-free materials.	To meet the minimum standards of daylight (CLG, 2006, p.21)
Sustainable landscape	To include the use of drought tolerant plants, and high efficiency irrigation system. To consider including a glasshouse to grow veggies all year round.	Not included in CSH, added specifically to the project.

* The terms zero carbon and zero energy are interchangeable in their application to define buildings with very high-energy efficiency ratings (EPBD, 2011, p.7).

Figure 4. LC project brief category requirements compared to CSH criteria.

Learning structure and content

The studio format can be described within the three key areas of class organisation, the establishment of key design concepts as core content, and supporting resources and documentation.

The class organisation demanded a less formal and a more collaborative approach considering the small student group, in a responsive and flexible environment. The content material was delivered in a design studio setting rather than formal lectures. Two weekly sessions broken down to three hours of critique and six hours of tutorials formed the teaching and learning focus of the project design. The last three hours of tutorials were dedicated to forums and workshops to discuss, resolve, and consolidate a number of issues related to the project design so that students would have a holistic understanding of the issues being explored.

The core content was driven by themes intended to introduce relevant design knowledge and skills as well as to develop a designer way of thinking. The content was delivered within three interactive components. The first was the *context* component, which introduced the importance of ecological considerations and addressing environmental issues through design in relation to the built environment. These ideas were discussed during consolidation sessions in the afternoon tutorials. The student group sat with the author, who was the main teacher, to discuss and resolve various aspects of the building design in a workshop setting. This was intended to widen the ideas, for discussion of relevant issues and concerns, and particularly for performing project-related calculations. The *process* component consisted of exploring techniques and issues of design thinking by introducing relevant theory focusing on the process, not the completed work. It was delivered as part of the critique and during the morning part of the tutorials, focusing on the building project solutions and what skills were needed to design the building retrofit. Finally the *communication* component introduced a variety of techniques of visual communication in the context of design language. These skill sessions were also delivered during the afternoon part of the tutorials.

The core resources and documentation supporting the project design activities were recorded in the studio workbook in three areas. The first, *design guidelines and criteria,* would enable the students to commence the project design work. The learning occurred through focused engagement with the resource material that had to be selected, reviewed, and interrogated critically through the design activities. Secondly, *documentation of processes* including all exploratory and reflective work in response to the activities related to the project. This enabled the students to externalise their processing and, subsequently, to allow both students and staff to use it as a basis for reflection and evaluation. Lastly, the *visual diary* was a vehicle to record and critique issues related to the project graphically, through which students could develop skills in drawing and visual representation.

PROJECT DESIGN CONCEPT

During the design concept stage (Stage 2), the students visited the site and analysed the building and its surroundings (Figure 5). Later, each student investigated and initiated a personal concept for the refurbishment where visualisations of the student's inspirations, beliefs, and creative solutions could be manifested.

Figure 5. Students' site and building visit at the research stage (Bahho, 2018, p.172).

The students went to various sources for information and inspiration. In addition, they were presented with lectures covering fundamental concepts of sustainable design including relevant examples. They were referred to particular library and online resources (Kwok & Grondzik, 2007; Lehman & Crocker, 2012; Mithraratne, Vale, & Vale, 2007; Reardon, 2008; Wilhide, 2002, Yeang, 2008). A trip to the First Light House in Waimarama, Hawke's Bay, was organised. The house was designed and built as part of the Victoria University of Wellington's School of Architecture syllabus for the 2011 Solar Decathlon competition (Victoria University of Wellington [VUW], 2011). Figures 6 and 7 show one student's concept stage submission.

Student designers pre-engagement focus group interview

At this point of the design stage, the first student focus group was conducted to investigate knowledge and concerns about sustainability issues, before their engagement in the project. This and analysis of the results is described in detail below in the section titled 'STUDENT DESIGNER FOCUS GROUPS.'
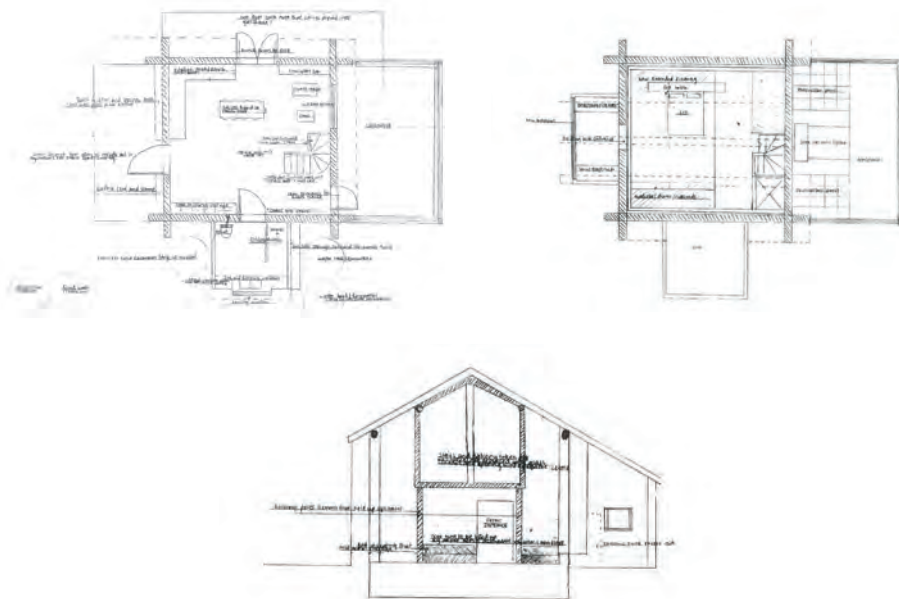

Figure 6. An example of one student concept design submission (Bahho, 2018, p.173).
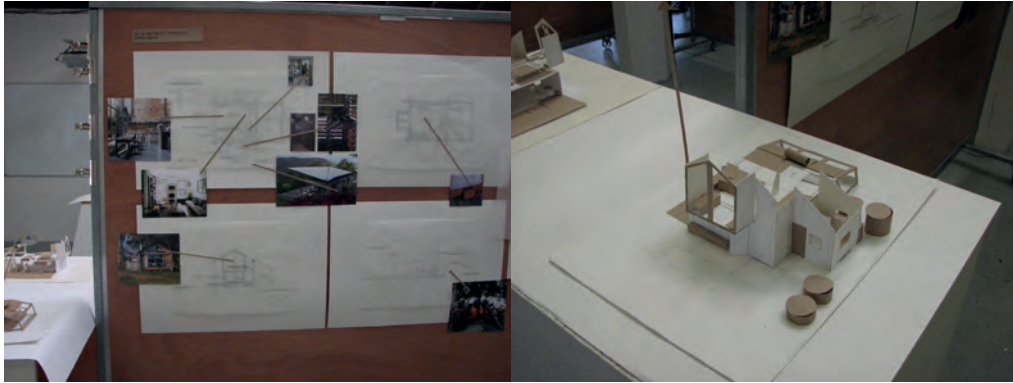
Figure 7. The presentation of the student concept shown in Figure 6 (Bahho, 2018, p.173).

Sustainable building practices, considerations and solutions

The intentions of the project were to find solutions and techniques for sustainable building practices that would be *generic* and easy-to-apply, so as to motivate anticipated visitors to adopt environmentally responsible improvements in their homes. The related discussions took place in Stage 2 and continued in Stage 3, the development stage of the project. The topics developed by the students and noted above are described in more detail here:

Energy conservation and renewable energy systems

For passive solar techniques, studio discussions focused on improving the thermal insulation and airtightness of the building, and evaluating this with the BRANZ Annual Loss Factor (ALF) tool for calculating the energy performance of a New Zealand house (Bassett & Stoecklein, 1980). As a result, students decided on a layer of roof insulation and wall insulation within an additional internal timber frame to the external log wall. The uninsulated concrete slab presented a problem. Ideally its mass should be part of the passive solar design (BRANZ, 2013) but not without insulation. Rather than digging up and relaying the slab, the students proposed a thin layer of under-floor insulation with a tile finish so as to use as much of the existing building as possible.

Furthermore, the students suggested adding a *greenhouse* to the existing structure, facing north so the direct solar gain would heat the air, which would be vented by convection into the interior living space (Energy Efficiency and Conservation Authority [EECA] 1994; Gong, Akashi, & Sumiyoshi, 2012; Kachadorian, 1997).

Building	Heating Energy demand (kWh/m²year)	Results
Log Cabin Project	16.52	ALF calculates the LC requires 1,203 kWh/year of heating energy for the total area of 73 m²
Passive House	15	A certified Passive House has to meet a specific space conditioning demand of not more than 15 kWh/m²year (Grove-Smith & Schneider, 2011).
Typical NZ house	28.94	Average energy use in a typical NZ house of 132 m² is 3,820 kWh/year (Isaacs et al., 2010).

Figure 8. Comparison of expected Required Heat Energy (RHE) in LC with other values.

The Required Heat Energy (RHE) for the LC project design was compared to the PHINZ standards and also to average New Zealand home energy use from the New Zealand Home and Energy End-use Project (HEEP) (Isaacs et al., 2010) (Figure 8). It was significant to get the RHE of the LC design close to the Passive House energy demand specifications especially considering the LC is a retrofit project. The proposed design easily complied with Clause H1 of the NZBC, with a Building Performance Index (BPI) of 0.85 kWh/(m². °C. month) compared to the required 1.55 kWh/(m². °C. month).

A solar photovoltaic panel system to generate the energy required was endorsed and its capacity, size, and location investigated using BRANZ resources (Figures 10 and 11). Hot water was intended to come from a redundant evacuated tube collector solar hot water system relocated from the Caretaker's House on EIT campus.

To maximize energy savings, students suggested using power efficient Energy Star® rated appliances and installing energy-saving Halcyon LED lights throughout, although maximum use would be made of daylight. Being an existing building, window size and orientation were already determined. Students discussed improving the thermal performance of the windows together with lighting and ventilation in the studio.
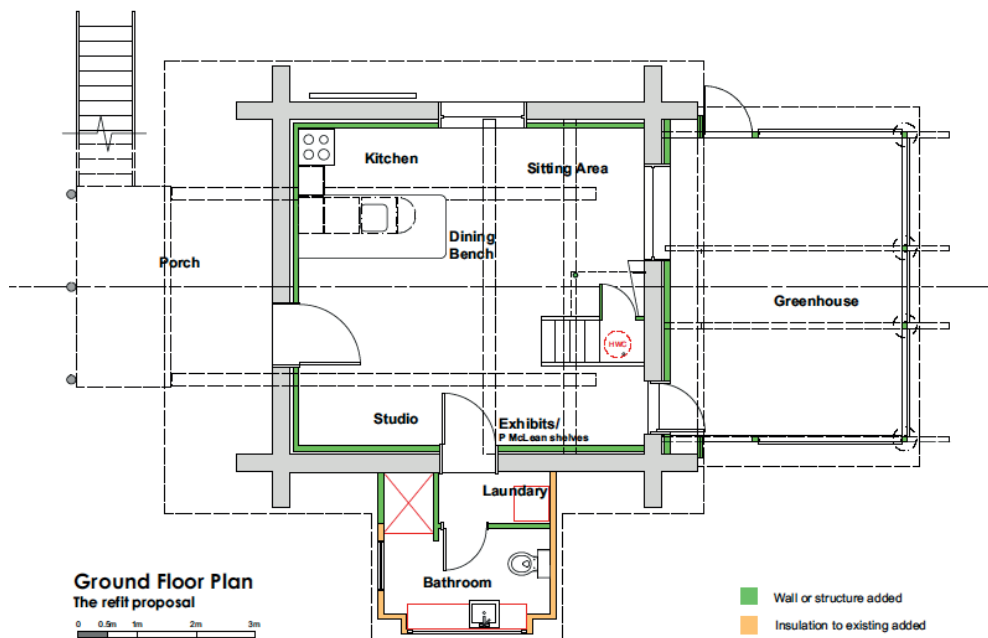

Figure 9. The combined student concept design, ground floor plan (Bahho, 2018, p.177).
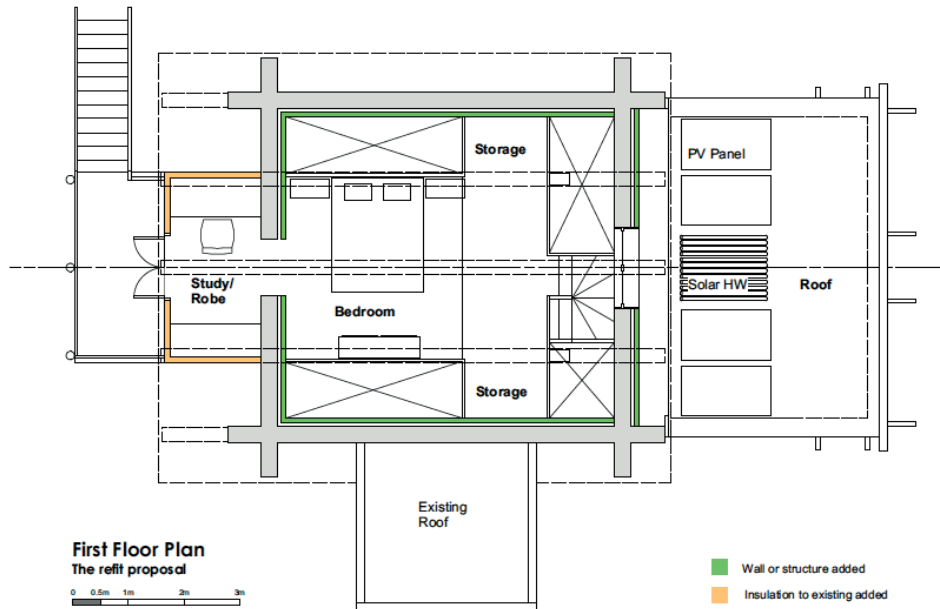
Figure 10. The combined student concept design, first floor plan (Bahho, 2018, p.177).

Sustainable building materials and techniques

Timber, as a renewable structural building material with low embodied energy (Sustainable Design Award, 2004), was chosen for the framing of the greenhouse and the new internal lining to the external log walls, see Figures 9, 10, and 11. The consolidation discussions fixed on this as being recycled timber as much as possible. Fibreglass Pink Batts® were preferred for insulation as they are locally made and use up to 80 percent recycled glass (Pink Batts®, 2011).

For windows, recycled timber would be used for repairs and to make them suitable for new double-glazing units to replace the single glass. Some thin window sections such as those in the bathroom and French doors, meant some could be secondary glazed without completely replacing them with new double glazed units (EECA, 2017). Recycled single glazed window frames would be used for the greenhouse walls. The existing kitchen joinery would be repaired and retrofitted, and recycled bathroom fixtures would be installed, including shower, basin, and toilet.

The design students were careful to specify low-embodied energy materials as well as recycled materials and building components wherever practical.
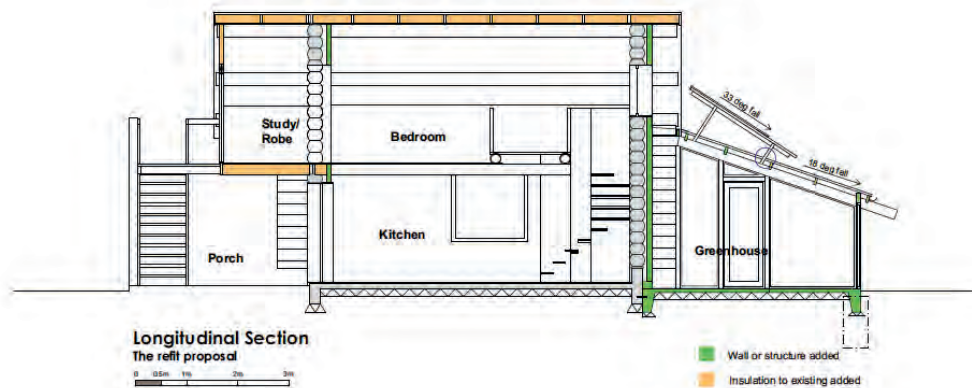
Figure 11. The combined student concept design, longitudinal section (Bahho, 2018, p.178).

Sewage and wastewater treatment

Low-flow toilet fixtures and aerators were discussed as a means of saving water, although these are initially expensive. The group discussed trying to find sponsors who would be keen to provide the products and showcase them to the public, or sourcing a recycled toilet, shower, and washbasin. Eventually, the second option was adopted. A similar discussion occurred with regards to the choice of a washing machine which was between the preferred low star-rated appliance for its low water usage and energy saving, and a recycled option should the new one be unaffordable.
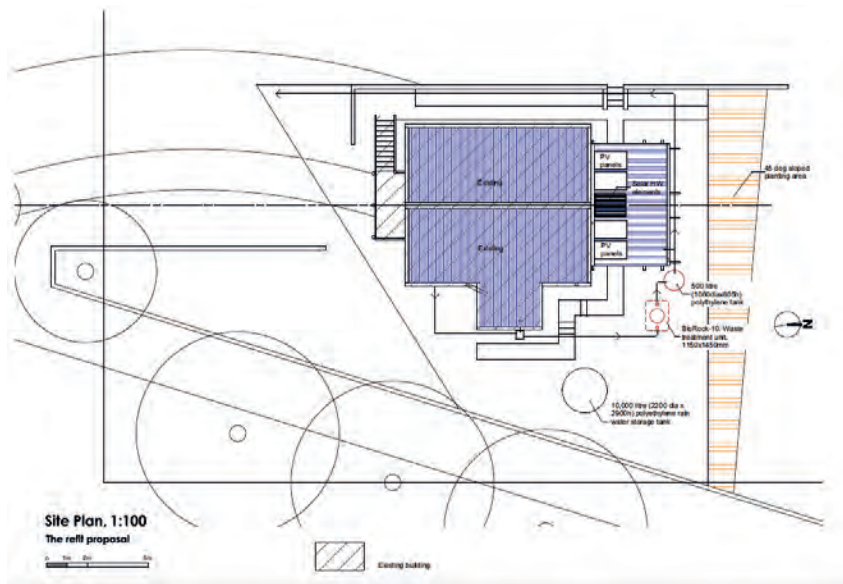

Figure 12. The combined student concept design, site plan (Bahho, 2018).

The students suggested using a sewage and wastewater treatment plant. The recycled effluent would be used in the greenhouse and any excess would be discharged to a nearby drip-line effluent field (Figure 12). Studio discussions found all types of sewage treatment plant had positive and negative points. Bio sewage systems that use worms and other organisms would be organic but were not suitable for low occupation or intermittent use. On the other hand, a septic wastewater treatment plant could handle low flow rates but would need a small pump to reuse the treated effluent. However, this could be added to an existing septic tank, hence making it suitable for demonstrating what people could do at home, see Figure 12.

Capillary mats were proposed as an effective irrigation method to rationalise the use of treated wastewater in the greenhouse (Paparozzi & Meyer, 2012).

Water conservation

Roof runoff would be stored in rain storage tank and used for drinking, cooking, and washing. The students used a Water Consumption Calculator to find the annual water consumption (CSG Network, 2012). Since the estimate of collectable roof runoff is below demand, the balance of water needed would come either from savings in use or using the existing mains water connection (Figure 12).

Healthy indoor air

Discussions revolved around natural lighting, ventilation, and eliminating building materials containing toxic substances to achieve healthy indoor air.

During consolidation sessions, desktop calculations were carried out for each room to estimate the natural lighting and found it meet the terms of the UK Department of Environment, Transport and Regions' Guide (1998) and the New Zealand Standards (AS/NZS 1680.1, 2006). In terms of ventilation, the existing net opening areas fell within the New Zealand Building Code for ventilation requirements (Department of Building and Housing, 2011).

Low or no volatile organic compound (VOC) paints would be used throughout the project. Studio discussions were based around students' findings on set VOC levels. Durable and formaldehyde-free wood-based materials and products were chosen for new and retrofit components. Studio discussions focused on the effects of formaldehyde as a carcinogen.

Judging the design concepts

The design concept stage of the project brief was completed and six concepts were put on display (Figures 6 and 7). In order to achieve impartiality in selecting the concept to take to the next stage, the submissions were judged by an independent team outside the teaching staff. This was a panel of an architect with experience in designing sustainable buildings, the Head of School of Arts and Design (now the *ideaschool*©), and the building development officer at EIT. After examining the submissions, the panel could not decide on a clear winner but opted to select favoured elements and particular solutions from individual concepts in order to form a *combined design concept* (Figures 9, 10, 11, and 12). In their feedback report, the panel provided recommended criteria for the combined design concept, summarised as follows:

- to be mindful of the history of the place and site,

- to fully utilise what previously exists of the LC,

- to maintain the integrity of the LC structure,

- to ensure multiple reasons for any proposed design decision, and

- to pay further attention to rationalising building services.

PROJECT DESIGN DEVELOPMENT

The outlines of the combined design concept were decided by the group. Stage 3 of the project brief started with each student assigned a particular part of the combined concept to explore and develop in further detail. The six topics were passive solar design, the proposed greenhouse, the kitchen retrofit, the proposed bathroom, and the interior space retrofit, and external works including wastewater treatment, water conservation, landscape, and exterior ground works.

Each student addressed key design targets related to their assigned task and produced a number of solutions to fulfil the criteria of the project brief. The results showed a developing sensitivity towards defining and executing the design ideas, while showing consideration for the intentions of the combined Stage 2 concept. The results arrived at by the students were specific to the LC's particular situation.

For the development work, the studio delivery pattern and its associated learning strategy and learning contexts used in the earlier stage were repeated here.

Six months after the end of the LC design project, a post-engagement focus group interview was undertaken with an added question on the actions they might have performed as a result of taking part in the project.

Project refurbishment working drawings

The student's design work was compiled by the author to form the basis for a set of working drawings and project specifications. All the necessary measures were taken to ensure compliance with the New Zealand Building Code. A building consent application was made to Napier City Council and a building permit later issued to authorise the building works.

STUDENT DESIGNER FOCUS GROUPS

Two focus groups were conducted with the student designers, pre- and post-engagement.

Pre-engagement focus group analysis

The aim of the first focus group discussion was to establish a benchmark of the participants' understandings of, and concerns for, environmental issues before engaging in the project.

Participants and procedure

A focus group was conducted with the six student designers prior to their involvement with the design stage of the project. The discussions explored responses to a two-part question: *How concerned are you about the harm that humans are causing to the environment? Looking ahead to the year 2050, are you concerned about the consequences of environmental problems in relation to each of the following clusters: the biosphere, yourself, and other people.* The second question was based on Schultz's (2001) three clusters of environmental attitudes related to environmental concerns. These are egoistic (me, my health, my lifestyle, and my future), altruistic (all people, children, my children, and people in New Zealand), and biospheric (plants, marine life, animals, and birds). This type of question has been used before in New Zealand, so the results can be compared with other studies (Milfont, 2007, pp. 32–34). The focus group session took place in a lecture room at the EIT campus. An hour was set aside for discussion. The author was the only non-participant present and the discussion was recorded. The student participants contributed to the discussion in varying degrees.

Data analysis

Analysis of the data to identify recurrent themes was based on the *thematic analysis* guidelines (Braun & Clarke, 2006). The recorded data was first transcribed. Quotes were then extracted and each referenced to the time the comment was made at the focus group. All quotes in the discussion below were extracted verbatim from the transcripts.

After becoming familiarised with the data, an initial list of codes was generated from the various topics brought up by the students (Braun & Clarke, 2006). This was done across the data set, rather than for each question individually in order to identify commonalities running through the data. Working from the perspective of environmental attitudes, the aim was to find out why individuals chose to be involved in the project as part of their education at EIT. To achieve this, repeated rounds of reading and categorising the data led to the emergence of broad themes, and specific sub-themes within these, all derived from the data (Braun & Clarke, 2006; Boyatzis, 1998). An **initial** thematic map was prepared. The themes identified were "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon" (Boyatzis, 1998, p.63). These were then reviewed and refined through repeated investigation both of pattern and commonality to create a **developed** thematic map (Braun & Clarke, 2006). Direct quotes from the transcripts were grouped under similar thematic headings to provide a clear illustration of each theme in the participants' own words, and to give an indication of the number of participants who addressed each theme (or sub-theme). From this, a **final** thematic map emerged. While frequency is not necessarily a measure of significance, it offers a sense of the extent to which a particular experience was common across responses, and so the extent to which it might represent a shared understanding, or agreement with others.

RESULTS

Consequent to review and refinement, three main themes emerged (Figure 13):

1. support for responsible environmental behaviour;

2. the need to be environmentally motivated, and

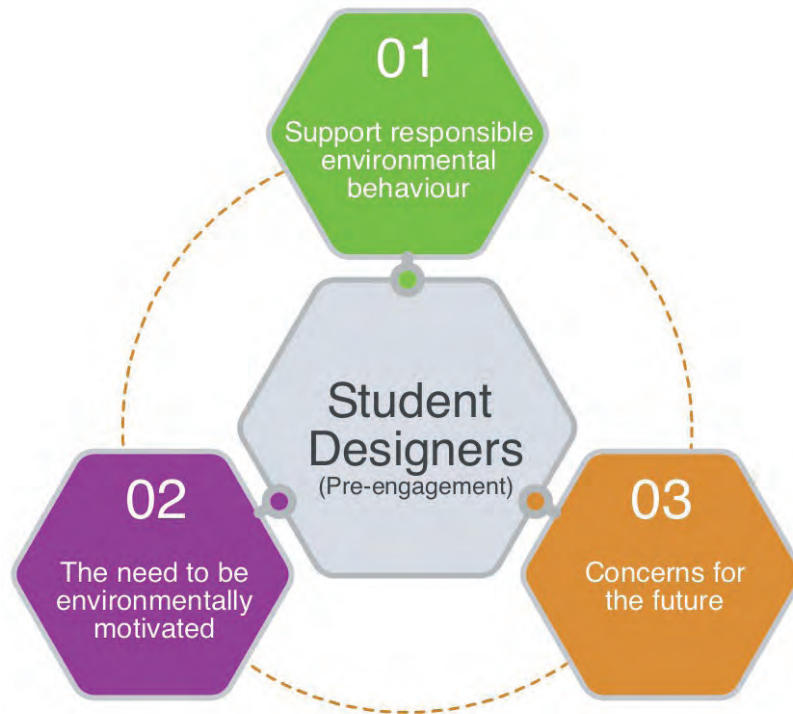3. concerns about the future as result of human activities.

Figure 13. Final thematic map from the student designer pre-engagement focus group themes

These three main themes are discussed below individually.

(1) Support for responsible environmental behaviour

The students stressed the importance of living sustainably with an emphasis on health, valuing sustainable living patterns, and being in an ecological and organic living environment. There was a notable call for nurturing responsible environmental attitudes in the community through inspiring the behaviour of others, supporting environmental actions, and being passionate about animals and ecosystems. Concerns for environmental behaviour ranged from concerns for self (health and nutrition) to taking a wider view that could still incorporate self (concern for organic living environment).

(2) The need to be environmentally motivated

The students highlighted the importance of environmental motivation through discussion and practice at the various levels of self, family, and community. There was also emphasis on the need to acquire in-depth environmental knowledge. They saw involvement with the LC project as an opportunity to focus beyond basic ecological knowledge and issue awareness (Hungerford & Volk, 1990). They also stressed communicating information, including the role of the media.

(3) Concerns about the future as a result of human activities

All participants shared a sense of concern and a degree of pessimism when it came to envisioning the future of the world, due to general concerns about rapid population expansion and increasing demand for materials placing

stress on space and resources. Students felt this could result in adverse consequences and environmental problems for the future of the planet and its ecosystems. The importance of preserving natural capital for current and future generations was also emphasised. Furthermore, the contemporary consumerist culture of obtaining more and more material possessions was perceived as putting extra pressure on resources and causing an increase in the gap between rich and poor.

DISCUSSION

For a qualitative analysis, the group of six participants is small, however the level and type of information extracted was focused, rich, and diverse. The open-ended questions allowed participants to communicate their own experiences in their own words. As such, the themes identified reflected the spontaneous use of common terms and offered powerful evidence of shared ideas on what it means to be sustainable in New Zealand today. Moreover, observations of commonly experienced reactions to unsustainable practices suggested the participants had strong passion, motivation, and intention to be sustainable, and some would also try to influence others to behave sustainably and be ecologically responsible. It also offered an insight into why this group of individuals became involved in the project. Reactions to the two-part question showed the need for in-depth knowledge about sustainable topics and practices so the students could feel confident in taking ownership of environmental issues and subsequently use this knowledge to empower others to hold sustainable values and know of environmental action strategies. The analysis offered qualitative evidence for basic understanding of self, others, and the biosphere in relation to social, environmental, and economic platforms, and that the students had the knowledge and intention to act sustainably. Further, it added to the claim that green practices are also political, rather than just being issues of personal interest.

Post-engagement focus group analysis

A post-engagement focus group discussion was conducted with the same group to compare data and look for any effects that might be linked to having been involved in the LC project concept design.

Participants and procedure

This focus group was conducted with five of the participant students six months after their involvement with the LC project concept design. Having moved to another town, the sixth student was not available although a similar interview was arranged at a later date. The thematic analysis uses data from both the focus group and the interview. Both sessions aimed to explore responses to the same questions posed in the first focus group: *How concerned are you about the harm that humans are causing to the environment? Looking ahead to the year 2050, are you concerned about the environmental problems in relation to each of the following valued object groups: the biosphere, yourself, and other people.* In this post involvement discussion, an additional question was asked: *Did the experience of being involved in the design of the LC project affect the way you acted recently in relation to sustainability?*

The focus group with the five student designers took place in a meeting room at the EIT campus, while the meeting with sixth student was in the library. An hour was allocated for both. The author was the only person present in both meetings and both discussions were recorded.

Data analysis

Thematic analysis was also used to identify recurrent themes in the data (Braun & Clarke, 2006). The process adopted was similar to that explained above.

RESULTS

Upon arriving at a satisfactory thematic map of the data, the dominant themes were organised (Braun & Clarke, 2006) (Figure 14). This produced three main themes, which are discussed below:

1. willingness to enable environmental practices;

2. having the motivation to support environmental actions; and

3. seeking in-depth and ongoing knowledge of environmental issues.
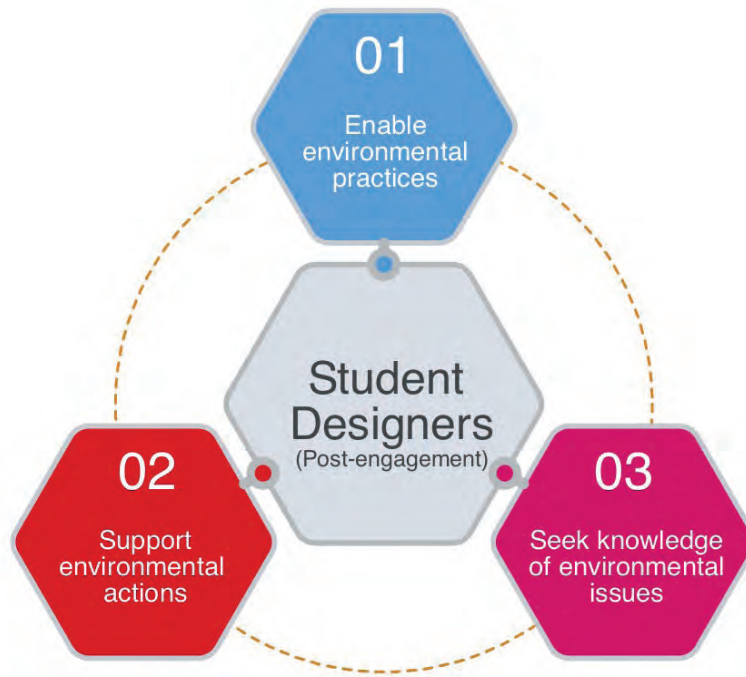

Figure 14. Final thematic map from the student designer post-engagement focus group themes

(1) Willingness to enable environmental practices

The students stressed the importance of using energy and other natural resources responsibly, and were motivated to choose sustainable options in spite of cost, at least at times. The participants were also keen to acquire in-depth knowledge of the effects of environmentally harmful food growing and processing practices.

(2) Having the motivation to support environmental actions

Post involvement in the LC project, a number of students tried to convince those close to them to act in an environmentally responsive way. They showed willingness to support others make environmentally sound decisions and assist them to change their environmental behaviour, thus demonstrating ownership and empowerment qualities (Hungerford & Volk, 1990). As evidence of this, students highlighted the importance of supporting and educating others to act sustainably, being self-motivated in pursuing environmental initiatives, and encouraging others to adopt sustainable practices.

(3) Seeking in-depth and ongoing knowledge of environmental issues

The students asserted the significance of continuously pursuing knowledge about matters related to ecology and the environment. This included the ability to define the characteristics of a sustainable practice, the ability to recognize the need to extend personal knowledge of environmental issues, and the hope their knowledge could be applied in new and emerging job opportunities related to sustainability. They highlighted the significance of conservationist living patterns.

DISCUSSION

Interviews with the students who chose to be involved in designing the LC project highlighted the significance of living sustainably, valuing ecological and organic living practices, stressing the importance of using energy and other natural resources responsibly, and being motivated to choose sustainable options in spite of cost, at least at times. The participants were keen to acquire in-depth knowledge about environmental matters, particularly focusing on the effects of non-environmentally harmful food growing and processing practices.

Subsequent to their involvement in designing the LC, the student designers' passion for supporting and educating others to act sustainably was observed. They were self-motivated to pursue environmental initiatives, and realised the significance of encouraging others to make environmental investments. The discussion revealed a number of instances where participant students demonstrated active pro-environmental behaviour, such as convincing a close friend to invest in purchasing photovoltaic technology for a lower electricity bill in the face of reduced income and more time at home after retirement. This demonstrated strong pro-environmental intentions and awareness of adverse consequences (Joireman et al., 2001). Another student concerned about health and nutrition, encouraged flatmates to start looking at the ingredients as a guide to food product choices, showing social altruistic concerns (Schultz, 2001). A third student offered to help friends establish a social media network page to exchange information on environmental and health interests, demonstrating ascription of responsibility beliefs (Stern et al., 1999).

CONCLUSIONS

The paper discusses how the LC project was set up and the reflective process of establishing a framework for retrofitting the building to become a demonstration project for sustainable construction and a facility to inspire responsible environmental behaviour. It describes the involvement of a group of students at EIT and how it went about creating a brief and design concepts for the building. It also demonstrates a process for helping the students

look at standards and extract design criteria that suit this specific project in terms of building sustainability, given the wide body of knowledge about what a sustainable building might be. This paper also investigated whether this engagement has influenced their environmental values.

Reflecting on the teaching process, the focus on retrofitting an existing building and outlining specific aspects of sustainability that were then set in the aims and parameters, meant that each one needed to be understood, discussed, and applied successfully. The students were engaged and motivated by the power of the context: sustainability. The learning occurred actively and the teaching of design and environment -related principles was delivered side-by-side with the development of skills and their application. Emphasis was on facilitated learning rather than instructive and the structure challenged students to engage in a proactive manner in order to gain deeper understanding. The development of knowledge of design and the ability to design were demonstrated through: firstly, the project design work, which integrated individual aspects of dealing with independent components of the context and the whole process of evolving a workable final design proposal; secondly, the level of complexity embedded in the project outcomes and the evaluation and integration of a wide volume of knowledge, the latter guided by the project brief; thirdly, the ability to communicate ideas and solutions, and the ability to work as a group to deliver an effective mode of representation for the project concept at different stages of the process; and finally, the level of engagement of all six student designers in the LC project demonstrated developing generic and specific knowledge, and exhibited a passion for the subject, together with critical thinking, reflection, and the ability to integrate and apply different concepts at a level appropriate for Second Year undergraduate students.

This research used the process of designing and retrofitting a sustainable project to investigate the values held by those who did elect to become involved in the process. As might be expected, people chose to be involved with the LC project for various reasons. However, pre-engagement studies showed that those who became involved tended to have at least a heightened awareness of sustainability issues and for some students, values and attitudes that reflected this interest. The latter included a willingness to adopt sustainable practices, appreciate ecological and organic living methods, and support the responsible use of natural resources. The project's context of converting a near-derelict existing building to being a sustainable one was also important in inspiring individuals to do something tangible and beneficial for both sustainability and the local community. In general, those who chose to engage with the project expressed a passion for nature, culture, and ecology, as well as having the intention to act.

The student designers seem to have been affected by their experience of and knowledge gained through the LC project design by quickly taking steps towards acquiring and adopting environmental values with passion. The students took ownership of the project and worked enthusiastically with developing awareness of sustainable building methods and concern for ecological living practices. Post-engagement interviews demonstrated an evolving responsible environmental behaviour in valuing ecological and organic living practices, and stressed the sensible use of energy and other natural resources, and often opting for sustainable choices despite the cost. Individually, students also developed skills for investigating and evaluating environmental options, particularly living and diet options, and using new media platforms for communication. Consequent to their involvement in the design of the LC concept, student designers demonstrated intention to take sustainable actions. Armed with environmental knowledge, the students were motivated to pursue ecologically inspired initiatives, both at a personal level and in empowering others to adopt sustainable actions.

Commenting on the relationship between design and sustainability, Chapman (2009) stated, "The sustainability crisis is a behavioural issue, and not one simply of technology, production, and volume.

Mazin Bahho is a Senior Lecturer of Design at Eastern Institute of Technology

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A SUSTAINABLE COMPUTER REUSE JOURNEY

Hamish Smith, Rob Broadley, and Peter Brook

ABSTRACT

There is growing interest in how e-waste can be reused, before being recycled, within organisations that produce a lot of computer-based e-waste. However, unless the time is taken to plan a sustainable model of reuse with an organisation then the default course of action is often to send batches of e-waste to be recycled because of limited resources. In this paper, we describe how a model of reuse was created at an educational institution in Dunedin, New Zealand, and discuss the first attempts to implement that model. The issue of sustaining the resources needed for the reuse of computer systems into the future is highlighted, and an approach to reusing computer systems within the confines of those resource limitations is presented. We expect this model to be useful in supporting approaches in future rounds of computer reuse.

Keywords: recycling, reuse, e-waste, computer systems, sustainability, sustainable models, sustainability education

INTRODUCTION

This paper presents a "computer reuse" model of repurposing computer systems for further reuse before recycling. Through combining this model with a "pop-up" approach to the implementation of the model, a sustainable approach to repurposing computers at Otago Polytechnic has been achieved. This approach has been shaped by necessity as resource restrictions have modified what we can do. The approach is presented as a sustainable solution for an environment where these same restrictions exist.

BACKGROUND

It was estimated in 2017 that New Zealand produced around about 95 kilotonnes of e-waste annually (Baldé et al., 2017). The Dunedin City Council (DCC) has set a priority on take-back schemes for computer waste in order to improve what is done with e-waste. (DCC, 2019). The initiative for repurposing computer systems and related equipment at Otago Polytechnic is not new. There has been a number of attempts at setting up projects for the repurposing of computer equipment but none of these projects have been sustained beyond a year or two.

Our journey towards a computer reuse model began about four years ago, when a staff member opened the door of a storeroom in D Block at Otago Polytechnic to discover a number of computers stacked in there. When he asked why the computers were stored there, he was told that they had come out of some of the D Block computer rooms but no one had the time or physical space at the moment to do anything with them. He stood

and looked at those computers and felt frustrated that we were in the situation where computers that still could be used by someone were depreciating in a storeroom. When he voiced his frustration, he discovered that everyone else involved shared the same frustration but the lack of a sustainable model for reusing the computers meant that nothing was being done.

The computers would eventually be sent to an e-waste centre to get as much of the components/materials recycled as possible.

THE NEED FOR A MODEL

Even though the recycling of e-waste provides a way of both reducing harm in the disposal of harmful substances and reusing materials, it does not decrease the rate of consumerism. In his article for **Forbes** titled "Recycling Is Not The Answer To The E-Waste Crisis", Vaute (2018) states "recycling is first and foremost a removal from circulation, and therefore an implicit incentive to produce and buy new." Understanding this does not lessen the need for responsible recycling of e-waste and meeting the related challenges but it does highlight the need of longer life cycles for electronic equipment. Vaute (2018) goes on to identify that in order to "produce less to pollute less" we need to give electronic equipment second and third lives. The challenge is how to balance that with keeping good quality of life for consumers.

We formed a group consisting of two lecturers, a system administrator and a third year IT student in order to try to find a solution. After some discussion, we came up with a model of the possible flows of computers/parts within a computer reuse project (see Figure 1). Even though the model proposed an ideal way of operating that we were uncertain if we could achieve in its entirety, it gave us a framework from which we could start.
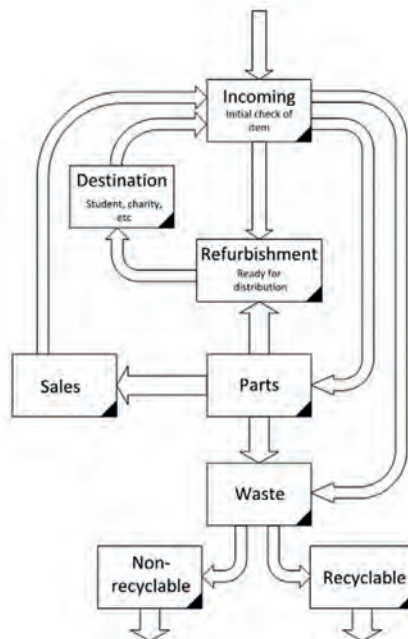

Figure 1. Computer Reuse Project Model – Possible Flows of Computer Systems/Parts

MODEL DESCRIPTION

The model (Figure 1) begins with an incoming computer system that is checked for the possibilities of reuse. The decision is then made to do one of three things: (1) the system is refurbished with an operating system and other software to be donated, (2) if the first action is not possible then the system is stripped for parts, or (3) the system becomes e-waste.

If the refurbished system is to be donated then the person receiving the computer system is given the option of returning the system once they have no use for it. This encourages not only a "second life" for the computer system but possibly a "third life" or even a "fourth life". This will continue until there is no more demand for the system to be refurbished.

Before the system is considered waste, it is examined to see if any parts are still useable, either to refurbish an existing system or for someone else to use. If there are useable parts then those parts may either be used to repair systems for refurbishment or given away/sold. The possible selling of parts would be a way of recouping some of the costs and improve the financial sustainability of the proposed model.

Finally if reuse is not possible, then the system/parts would be considered waste and would be responsibly recycled where possible.

FIRST IMPLEMENTATION OF THE MODEL

Even though we had created a model, we now needed to consider how we would implement the model in our context. We realised that we might not be able to implement the whole model at once and that we needed to start focussed on what is the most important first. Otago Polytechnic has Ō Mātou Whāika ā-Rautaki (Our Strategic Goals) which state that we want to "Lead the way in sustainable practice" (Otago Polytechnic, n.d.). This includes operating sustainably and encouraging both our students and our community to operate sustainably. We therefore set a focus on getting the computers refurbished and out to the community as soon as possible, and to involve some of the IT students at Otago Polytechnic. We decided that selling refurbished equipment within our first undertaking of the model was too complicated to implement.

We then identified four important resources needed to implement a computer reuse project in a way that was sustainable. These four resources were space, labour/time, equipment and funding. We set out to get commitment from students to provide the labour/time for the project. We found that even though many students would give a verbal commitment to volunteer, not all would actually do the work unsupervised. We therefore got commitment from one student to run the volunteers and make sure the work was being done, however most of the time he did the work himself. We already had equipment for doing the work, as the students already work on computers as part of their course work. We decided that we would operate a zero budget and work only with donated resources and volunteered time. The biggest barrier was therefore space. We explored different options and at one time got an offer of a house at Otago Polytechnic but then got the offer retracted, as the space was needed. We went on a search all around the local campus and quickly discovered that we could get no commitment on space to do the work. In 2017/2018 we managed to get temporary spaces, firstly in an unused office and then in a student project space that was not being fully used at the time.

We could only successfully operate in this manner due to all the work that has already gone on at Otago Polytechnic to have structures in place that support sustainable project initiatives. The actual gifting of the computers is relatively simple due to the Standard Terms of Gifting that already exist. (see Figure 2).
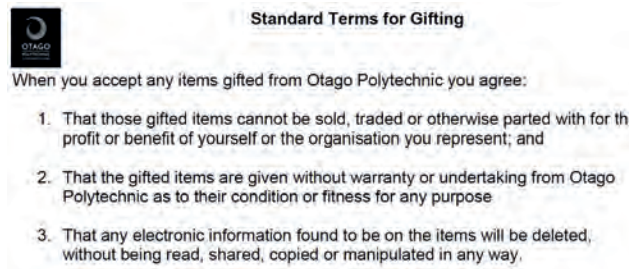
Figure 2. Standard Terms for Gifting- Otago Polytechnic

By the end of 2018, we had refurbished over 90 computers in the two year period, and these computers were being used by all sorts of organisations and individuals not only in the local community but also elsewhere in New Zealand and our Pacific neighbours.

"POP-UP" IMPLEMENTATION OF THE MODEL

At the start of 2019 we faced the same issue of not having a permanent space for the repurposing of the computer systems. We realised that this is probably going to be the reality for the near future and both the resources of available labour and space would constantly change from semester to semester, as our cohort of students and available rooms changed. We therefore decided to have a "pop-up" approach to implementing the model where we would see what commitment we can get from the students and at the same time make use of whatever space is available to us in the immediate vicinity of where the computer systems are stored. If either of these resources is not available in a particular semester then we will simply not run the project during that semester. By understanding this and constructing our processes around this approach, we are able to commit where and when we can in a manner that is sustainable into the future.

CONCLUSION

We have given away 46 computers so far in 2019 and though the potential is there to do more, we now have a sustainable approach to computer reuse that can be adapted to whatever resources are available. We have not yet fully realised our original model, as we have not yet achieved an income stream to provide a financial fund for the project. However, through using existing resources we have managed to continue to operate on a zero budget. In the time that we have been running this project, other projects have started up within Otago Polytechnic and the surrounding community where e-waste is being reused before recycled. We have already started exploring how we can better work together with some of these projects and pool limited resources. This project only works due to the individuals across Otago Polytechnic who volunteer their time to this project and through the support of the wider community. The students involved are learning what it means to be a sustainable practitioner and are now being challenged about how we can all further improve our sustainable practices. This project can only be described as a win-win-win-win for all involved: Otago Polytechnic, the students, our community and our environment.

Hamish Smith and **Peter Brooks** are lecturer in Information Technology at Otago Polytechnic.

Rob Broadley is a systems administrator at Otago Polytechnic.

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