

# USING AN OUTDOOR LEARNING SPACE TO TEACH SUSTAINABILITY AND MATERIAL PROCESSES IN THE PRODUCT DESIGN

Richard FIRTH<sup>1</sup>, Einar STOLTENBERG<sup>2</sup>, Trent JENNINGS<sup>3</sup>

<sup>1,3</sup>School of Arts and Creative Industries Edinburgh Napier University

<sup>2</sup>Oslo and Akershus University College of Applied Sciences

*Keywords: Materials, sustainability, learning space, international collaboration, ecology, material experimentation*

## ABSTRACT

The world is facing environmental changes that are increasingly affecting how we think about manufacturing, the consumption of products and use of resources. Within the HE product design community, thinking and designing sustainability' has evolved to become a natural part of the curriculum. Paradoxical as the rise in awareness of sustainability increases there is growing concern within HE product design of the loss of workshop facilities and as a consequence a demise in teaching traditional object-making skills and material experimentation. We suggest the loss of workshops and tangible 'learning by making skills' also creates a lost opportunity for a rich learning resource to address sustainable thinking, design and manufacture 'praxis' within HE design education. Furthermore, as learning spaces are frequently discussed in design research, there seems to be little focus on how the use of an outdoor environment might influence learning outcomes particularly with regard to material teaching and sustainability.

This 'case study' of two jewellery workshops, used outdoor learning spaces to explore both its impact on learning outcomes and to introduce some key principles of sustainable working methodologies and practices. Academics and students mainly from Norway and Scotland collaborated on this international research project. Participants made models from disposable packaging materials, which were cast in tin, in the sand on a local beach, using found timber to create a heat source for melting the metal. This approach of using traditional making skills, materials and nature was found to be a relevant contribution to a sustainable discourse.

## 1 INTRODUCTION

The rapid 'global' increase in environmental changes, has given rise to a real sense of urgency for a raised awareness, discourse and action for living, producing and consuming sustainably. Within the HE product design community sustainability has become a natural progression and integration into most curriculum. Conventionally, the production of commercial 3D Products uses industrial manufacturing processes that deploy a linear production-consumption system. Typically this process has resulted in impacts on environmental deterioration at both ends, and various stages in between, of the production process. In the past 45 years, sustainable design activities have made this waste and inefficiency marginally less wasteful and inefficient (Chapman, 2009). So even though sustainability is a focus area within product design education it seems that we need to strengthen the issue in order to let design activities make a difference. Chapman claims that the search for solutions to mass consumption are

driven primarily by two things: legislative demands brought about by the European Union's Waste Electrical and Electronic Equipment Directive, and the awakening ecological consciousness of consumers and designers who have a growing awareness of our impact upon the biosphere (Chapman, 2009).

We believe it is critical to heighten Product Design students' awareness of the importance of designing sustainably, and to teach design and making skills that empower them to design manufactured objects responsibly when considering the impact on the environment. Often we see in HE design curricular students not always linking theory focused modules with practiced based ones. Our own students have described a 'disconnect' between studio, lecture theatre and workshop environments. Reacting to these issues our case study's primary mode of delivery was 'learning by doing' and engaging students with the experience of physically making objects. This physical making mode of delivery also aims to address some of the current debate over the diminishing traditional workshop facilities in HE product design globally, and the concern from industry that students are increasingly lacking in physical making skills and material experiences.

## **2 BACKGROUND**

### **2.1 Demise of workshop facilities and Object making skills**

Apple's chief designer, Jonathan Ive, has spoken publically warning about the consequences of the diminishing of workshop facilities in HE:

So many of the designers that we interview don't know how to make stuff, because workshops in design schools are expensive and computers are cheaper ... that's just tragic, that you can spend four years of your life studying the design of three dimensional objects and not make one (Dezeen, 2014b).

One recent example of this statement is Bucks New University in London, which is closing its renowned undergraduate programmes in furniture design. Neil Austin, head of the furniture design course, said, 'Creative courses are a little bit messy and a little bit big— they need workshops, they need facilities and they need space to play' (Dezeen, 2014a). This has alarming impacts on the lack of practical object-making skills that students acquire while attending HE institutions. Several researchers have emphasised the importance of hands-on experience and the connection between crafts and process (Adamson, 2007, Crawford, 2009, Sennett, 2008). This also chimes with the words of the arts and design writer and critic, Peter Dormer, who stated, 'the constructive rules of craft are only learned by actually doing the activity' (Dormer, 1994). Traditional object-making processes serve to develop principles and disciplines from which students are empowered to explore and engage with new object-making technologies. This competence is important for new product design graduates who will face the challenges of working in industry once they graduate.

### **2.2 Action and Reflection**

In our own institutes the subject of sustainability is often taught 'theoretically' in lecture theatres with little practical experiences to inform the teaching. We often see a lack of joined up thinking between lecture and studio, and many students have trouble integrating theory with practice. According to Schön's (Schön, 1983) description, reflection often takes form of a reflective conversation with a situation. Amongst others, a discovery of new levels in a situation emerges in this conversation. In addition, the conversation can reveal recognition of feelings a situation can evoke, consciousness of choices made and the grounds for them, and ideas and anticipations that help to address meaning (Vince, 2002). Viewing it from this

perspective, reflection is about learning from experiences, as John Dewey (Dewey, 1997) claimed.

What (an individual) has learned in the way of knowledge and skill in one situation becomes an instrument of understanding and dealing effectively with the situations that follow. The process goes on as long as life and learning continue (Dewey, 1938).

It is important to emphasize that the mentioned writers all view reflection as more than opinions on a theme or a situation. A reflective process should raise questions of a social, political, or cultural character and challenge assumptions and 'certainties' that underlie practice (Kemmis, 1985, Reynolds, 2011). The process of reflection was considered a lasting and ongoing process by Schön (Schön, 1983) which he described as 'reflection-in-action.' In this way, he introduced the idea of reflection being not only a glance at the past on something that had been or was a retrospective process, but also an ongoing action to connect knowledge and practical experiences. John Sandars' (Sandars, 2009) definition of reflection corresponds with Schön's view. He described it as a:

...metacognitive process that occurs before, during and after situations with the purpose of developing greater understanding of both the self and the situation so that future encounters with the situation are informed from previous encounter (Sandars, 2009).

### **2.3 Deep Ecology**

Since the mid-eighteenth century, more of nature has been destroyed than in all prior history. In the past 50 years alone, the human race has stripped the world of one-fourth of its topsoil and a third of its forest cover. In total, one-third of all the planet's resources have been consumed within the past four decades (Hawken et al., 2010). This is not only due to increased world population, but even more a result of increased human consumption. During the last decade alone, the consumption of household goods and services in the UK has risen by 67 per cent (Chapman, 2009). Through his theory on deep ecology (Næss et al., 1989) the Norwegian philosopher Arne Næss devoted the major part of his career to discuss solutions to challenges like these. Even though his theory is not new it is currently viewed as one of the most important theoretical oriented environmental profiles in USA. Næss basically stated that there are two ecology movements, which are competing for our attention. The first is concerned mostly with pollution, resource depletion and the usefulness of the Earth to humans. The second is concerned with the diversity, richness, and intrinsic value of all the Earth. This is the Deep Ecology movement. Furthermore, it is a philosophical system with holistic thinking and a world view based on an ecological understanding of the world and humans place within this world. It emphasizes a positive coherence between all living things and a set of general guidelines for thinking and action. In his book, *Ecology, community and lifestyle: outline of an ecosophy* (Næss et al., 1989), Næss presented his theory Ecosophy T and outlined an 18 point list to be used as a tool for a sustainable discourse. Throughout his career he developed his theories further and in 1984 he developed, together with George Sessions eight basic principles of Deep Ecology.

### **2.4 Research Question**

In the context of HE product design, and the aforementioned issues regarding diminished workshop resources, and its impact on students making skills and experience with materials, we can see further lost opportunities to engage students with tangible/practical issues around sustainability. It is interesting to approach different learning methodologies and spaces and to observe its effect on teaching and learning situations. Learning spaces are frequently discussed in design research, but there seems to be little focus on how the use of an outdoor

environment might influence the learning outcomes within the context of teaching sustainable working methodologies and material processes. This led us to investigate how an outdoor environment might influence the learning outcomes within sustainability and material teaching?

### **3 METHOD**

A two-day ‘hands on’ ‘studio and beach based jewellery workshop delivered in Edinburgh, Scotland in October 2014 is the main basis for this case study (Yin, 2009). This was supported by a similar one day ‘beach based only’ workshop conducted in Lillestrøm, Norway in September 2015. Participatory observation (Clark et al., 2009) was used to study how students were responding to the playful, simple project structure. Deep Ecology (Næss et al., 1989) was used to discuss the impact on environmental sustainability this method can have on the learning process.

#### **3.1 The sand casting workshops**

The workshop in Edinburgh was developed through an established Norwegian/Scottish research and teaching collaboration. Thirty product design students and five teaching staff, representing both Scotland and Norway participated in the workshop; we were also joined by a local professional sand casting company. We structured the workshop around a ‘lost Styrofoam’ casting process. Day one of the workshop was conducted indoors, in the university’s studio space. Students were asked to make jewellery models out of Styrofoam, which they sourced from discarded packaging materials. On day two, the project workshop relocated to a local beach. The Styrofoam models were dug into the sand, leaving one part of the model emerging above the surface of the sand. The attendees built a fire from driftwood found on the beach to melt pewter. The melted metal was poured onto the Styrofoam, melting and replacing it to create a perfectly matched cast. The cast artefact was then dug out of the sand and cooled in the sea. We also experimented with aluminium casting, which required using propane as a heat source rather than the fire due to the higher melting point of the material. Part of the finishing work on the casts was done on-site, but the unpredictability of the outdoor environment meant a trip back to the university to complete the rest of the projects. A second workshop was later conducted on a small beach near Lillestrøm in Norway. This workshop differed from the Edinburgh workshop in that all designing, iteration, model making and casting was conducted on the beach and used lost Styrofoam and pewter as the model and casting materials only. Three staff members, 12 Norwegian and two German students participated.

### **4 FINDINGS**

The workshops led to a variety of findings. Of relevance for this article is the potential this type of ‘out doors’ learning and teaching workshops have for conducting a sustainability discourse with students. It was found to be a relevant tool for discussing both pros and cons regarding a sustainable production process. Næss’ Deep Ecology was found to be an interesting and relevant theory for a design discourse. The theory emphasises relational thinking, holistic thinking and system thinking, themes that are relevant to 3D design education. It opened up discussions regarding issues such as preservation and maintenance of the natural environment, why we ‘when possible’ should aim to use local materials and resources. Furthermore it helped to generate more general discussions regarding pollution. The environment provided us with natural resources such as timber, water and sand. Sand was needed for the casting process, but was also useful to use as a drawing board when lecturing on the beach.

The workshops led some students to experiment in ways that may not have happened in a school workshop. For example, some students took ownership of their learning, and started to cast into patterns that they carved into the sand, while others cast directly into shells and similar objects that they found on the beach, which created some unexpected outcomes. Students clearly gained new insights into working with materials and a craft process. Many had difficulty understanding the transformation from Styrofoam to metal, and how that affects issues such as dimension and weight in a jewellery piece. The beach as a learning space proved the possibility to combine theoretical and practical knowledge in a tangible and holistic teaching and learning approach. Further impacts of the workshop have resulted in developments to modules and programmes developments at both the participating universities.

## **5 DISCUSSION**

### **5.1 Teaching material processes, teaching by doing**

A material process can be taught through theoretical lectures. We are not against lectures, but suggest opportunities to consider other 'hands on' modes of delivery that can either complement, blend, or standalone alongside lectures. This approach is not new within design education, pedagogical methods like problem based learning and project based learning (Thomas, 2000) have proved successful models (Lantada et al., 2013). Several researchers have emphasised the importance of hands-on experience and the connection between crafts and process (Adamson, 2007, Crawford, 2009, Sennett, 2008). On the beach we could both talk theoretically and at the same time physically experience issues like the melting point of pewter and the casting process.

Using the beach as a learning space, unexpected learning occurred that would not have happened in a school workshop or be learned purely through theory. For example, students experimented with casting into found objects on the beach such as shells. In another example a student wanted to try aluminium casting by melting soda cans they found on the beach. It did not work how they intended, but it did create an interesting set of tests and discussion on aluminium alloys and melting temperatures. These 'site based' experiences would not have occurred through teaching from a purely theoretical and studio-based perspective. According to Dormer (Dormer, 1994) and Crawford (Crawford, 2009), these types of skills and knowledge are best learned through experience.

Another interesting observation was revealed when several students had difficulty predicting the outcomes of the different stages of the project process. For example Styrofoam, which we used to create the original models, is an extremely lightweight material, and what is perceived as a logical size and scale for jewellery when modelled in Styrofoam, might not be appropriate after it is cast in pewter. Students were told about these issues prior to modelling their designs, thereby gaining theoretical knowledge; at that stage, however, they did not yet have practical experience in order to successfully develop and control the successive processes and production of their objects. This example shows how skills acquired through hands-on experience is important for gaining material understanding. Furthermore it corresponds with the work of Sennett (Sennett, 2008), who emphasizes the importance of the close connection between the hand and the head, and views this as a dialog between a concrete practice and a way of thinking, which can evolve into discovering and solving problems. On the second workshop in Norway, all the modelling work was done on the beach. This gave room for more experimentation with Styrofoam and made it possible to make corrections to the models in order to enhance both the technical and aesthetic side of the casting process. Students could make multiple iterations by making a model, reflect on the result, enhance the model, cast again, and make new outcomes. This chimes well with the aforementioned definition on reflection by Sanders (Sandars, 2009) and Schön's (Schön,

1983) theory on reflection in action. It opens up for learning and insights that are difficult, if not impossible to learn through lectures.

## 5.2 Sustainable working methodologies

This type of workshop can contribute to a sustainability discourse. One way of discussing this is through Arne Næss’ theory on ‘deep ecology’ (Næss et al., 1989). We looked at issues of sustainability the product design programme at Edinburgh Napier University addresses, and chose to use Deep Ecology and Ecosophy T (Næss et al., 1989) as a tool for this discussion *see figure 1*. Ecosophy T is a holistic and comprehensive theory. We chose Ecosophy T’s eighteen points rather than the eight basic Deep Ecology principles Næss later developed with Georges Sessions. This was done because we found the eighteen points a better tool for a discourse due to them being descriptive, and more elaborated in his writings. This paper does not focus on all of Næss’ eighteen points. Even though these eighteen points are all closely connected the points that seemed to be of most relevance for this research was chosen. However, it is possible to focus on other points through future workshops. Ecosophy T was not used directly as a discussion tool with the students during the workshop, but we used it as a tool for us to see the relevance of the findings. Furthermore, we wanted to discuss whether this theory could be relevant for future workshops where we wanted to include the theoretical view this theory offers into the discussion with the students.

Deep ecology – Næss’ 18 points	Issues of sustainability the University of Napier’s programme wants to address
<ol style="list-style-type: none"> <li>1. <i>Pollution</i><sup>2</sup></li> <li>2. Recourses/ dividing recourses</li> <li>3. Population stabilization</li> <li>4. Classlessness</li> <li>5. Self-governing</li> <li>6. Decentralization</li> <li>7. Local societies</li> <li>8. District development</li> <li>9. <i>Self-preservation</i><sup>2</sup></li> <li>10. Division of labour</li> <li>11. <i>Complexity</i><sup>2</sup></li> <li>12. <i>Diversity</i><sup>2</sup></li> <li>13. Preservation of diverse cultures</li> <li>14. <i>Symbioses (mutual benefits)</i><sup>2</sup></li> <li>15. Egalitarianism</li> <li>16. Fight against humans self-domestication</li> <li>17. <i>Field thinking- interplay in nature-gestalt thinking</i><sup>2</sup></li> <li>18. Docta Ignorantia</li> </ol>	<ol style="list-style-type: none"> <li>1. <i>Manufacturing process</i><sup>1</sup></li> <li>2. <i>Waste materials</i><sup>1</sup></li> <li>3. Logistics /transportation</li> <li>4. <i>Energy in making</i><sup>1</sup></li> <li>5. <i>Resources needed to manufacture</i><sup>1</sup></li> <li>6. <i>Impact on environment</i><sup>1</sup></li> <li>7. Durability</li> </ol> <p><sup>1</sup> Areas we addressed through the workshop</p> <p><sup>2</sup> Points of relevance for this paper</p>

Figure 1.

Through his ideas on complexity, Næss claimed that mature and stable ecosystems are characterized by great inventiveness and the multiple uses of resources, and that every society has alternative ways to satisfy its needs: if one factor reduces the possibilities, there are alternatives within the local community. The process of casting in the sand of the beach is an example of seizing other possibilities within the community when workshops aren’t available. Furthermore, this can be discussed through the idea of Self-preservation. This is about using “soft” and “close” technology. Techniques that to a low degree reduces the environmental qualities and diminish local resources. It emphasises that materials and tools can be found

locally and also creates meaningful work for the practitioner. In this workshop it was important to use local resources, preserve the natural environment and create meaningful work for the students. Also the idea of diversity is of relevance. It discusses, amongst others, different ways of expressions, use of geographical and climatically peculiarities and investigations into different art forms. All factors of relevance for an outdoor jewellery design workshop.

The concept of deep ecology is interesting from a design perspective, because it emphasises the importance of relational thinking, holistic thinking and system thinking. These are all factors of importance within a holistic design paradigm. In deep ecology, everything is connected with everything else through a mutual, dependent relationship in a long-term perspective. It is a symbiosis, where all parties extract mutual benefits from each other through true companionship and that every action affects all life around us. In this workshop we used natural resources, sand, water and timber materials found on the beach. Wood is by many regarded as a climate natural heat source due to it being a renewable source (Treindustrien, 2013). In many countries wood is a limited recourse, but in countries like Norway woodlands are increasing. When burnt or rotting it releases CO<sub>2</sub>. However, carbon is one of the most important building blocks for growing trees and they use CO<sub>2</sub> from the biosphere. It can thereby be argued that wood is climate neutral due to the natural circulation. In Norway it binds up 70 per cent of the CO<sub>2</sub>. The materials used for making models were discarded Styrofoam, mainly used for packaging electrical equipment retrieved from garbage. This can be argued to be a sustainable approach since we did not bring new materials into use. It was also important to leave the beach unspoiled after use, which facilitated a discussion on responsible working approaches and the importance of maintaining a clean nature environment where all living species can enjoy and flourish. These experiences demonstrate important and tangible contributions to relational and sustainable thinking in design education and facilitate a way of experiencing, ecological praxis first-hand.

### **5.3 So, how sustainable were our sustainable workshops?**

During our research we were mindful to always critique our methods and monitor how sustainable our workshops were. For example wood creates smoke and particles in the air, this increases if the wood is wet, which is likely if it is found outdoors. Styrofoam burns up and vaporises into the air. In a factory these fumes could have been rinsed/processed before reaching the biosphere. It is also reasonable to assume that small particles of Styrofoam were left in the sand that we were unable to detect when clearing the sites. This was certainly a challenge on the second workshop where all the Styrofoam modelling was done on the beach. However, the ability to see and discuss these issues using a small scale, short term workshop was an invaluable teaching resource that engaged students and opened up reflective discussions of a situation. The workshops created an arena where theory, previous knowledge and new experiences could interact. It was a unique situation we found interesting and a situation that would be hard to create in the more controlled environment of a lecture theatre.

## **6 CONCLUSION**

### **6.1 Holistic teaching and learning experience**

Deep ecology and Ecosophy T (Næss et al., 1989) is not commonly used as a sustainability theory within Product Design education. However there seems to be a potential for a holistic discourse through the view this theory offers. Our research demonstrated the value of using a holistic learning and teaching approach. Our case study integrated learning by doing, physical manipulating materials and working at site relevant outdoor environment, which proved an

effective model to introduce sustainable production issues. This working methodology exemplified a workflow of Theory, Action and Reflection. The outdoors setting was particularly effective to help our students experience nature and to engage all their senses which helped to physical contextualise some of the learning experiences.

## **6.2 Impacts on teaching**

The experiences from these workshops have impacted on our teaching practices and curricular changes in both of the participating institutions. The knowledge gained has been used through more conventional teaching methods to teach Deep Ecology to students on both bachelor and Master levels in Lillestrøm. Furthermore, the Edinburgh workshop has led to a discourse on workshop activity at the Norwegian University College which led to the implementation of several one- to three-day, material-based elective courses. The second workshop in Lillestrøm was a direct result of this.

## **6.3 Public engagement and peer to peer learning**

The workshops have also generated similar ‘public engagement projects’ out with the Universities. For example, one of the participating students in Edinburgh was inspired by the workshop and performed a similar workshop with his Scout group. The Edinburgh team have also been invited to run the project with a local secondary school after presenting the paper at the IJADE conference in Glasgow 2015. This workshop will be run by students from the Edinburgh Napier University Product Design Department, who participated in the original workshop. A terrific example of learners becoming educators, taking ownership of their studies and promoting sustainable design practices to secondary school and the wider community.

## **6.4 Future discussions on sustainability**

Within these workshops it was important to use local resources, preserve the natural environment and create meaningful work for the students. Næss’ idea of diversity (Næss et al., 1989) is of relevance as it discusses, amongst others, different ways of expressions, use of geographical and climatically peculiarities and investigations into different art forms. All factors of relevance for an outdoor jewellery design workshop. The learning outcomes identified (Kennedy et al., 2007) in this study are relevant issues in product design education concerning knowledge, skills, and general competence. Having knowledge can be to understand the impact between production and environment. Skills, in this context is about manipulation of materials. A general competence is to understand that our actions affects nature and the species in it. This case study is based on two workshops, but the phenomena identified has the potential to stimulate and foster similar outdoor object-making events. To us the workshops proved a useful arena for having a discussion on sustainability. We believe it is likely that others who try similar workshops using an outdoor environment and using natural resources will experience similar findings.

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