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AN INTEGRATED APPROACH TO SUSTAINABLE DESIGN EDUCATION

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ABSTRACT

Since the early 90s Loughborough University has included sustainability in its teaching, but in 2000 an education for sustainability programme was developed by Eddie Norman to further engage second year students with the sustainable design agenda. Sustainable design thinking is now integrated into other parts of degree level teaching within all years. Sustainable design also plays an important role in postgraduate studies within the department. The Department of Design and Technology has been involved in a number of research projects related to sustainable design which include the development of a number of tools, and the dissemination of new understanding for professional designers to get to grips with sustainability. Loughborough University has also been strongly involved with the development of sustainable design resources for schools. These initiatives are presented and the similarities and differences between these approaches are discussed. A view of the importance of developing an integrated approach to design for sustainability, that builds knowledge as a student's education continues, is presented along with reflections on how this approach better prepares future designers for industry.

Keywords: Sustainable design, education, pedagogy, integration

1 INTRODUCTION

Sustainable design is a rapidly growing area. Companies are being self-driven by internal and external stimuli including growing consumer awareness and by the rise in legislation such as the Waste Electrical and Electronic Equipment (WEEE) directive and the Restriction of Hazardous Substances (RoHS) directive. It is now widely recognised that sustainability must be considered in the way we design, produce and use products and packaging. But the implementation of sustainability is difficult and requires support, tools and guidance. Few companies have the expertise to implement sustainable thinking or to document the outcomes of sustainable decision-making in a way that can be understood by their stakeholders and the wider public.

A solution to these problems is to develop the ability to tackle sustainability before designers enter professional practice and it became clear that sustainability was a key issue for design education [1]. This paper reflects on the Department of Design and Technology's involvement in developing sustainable design education from Key Stage 3 (11-14) through to degree and postgraduate level through to education for sustainability for professional designers. This subject is still emerging within design education, Dewberry & Fletcher [2] and Bhamra et al [3] have outlined some of the key literature in the field.

2 SUSTAINABILITY AT LOUGHBOROUGH UNIVERSITY

Since the early 90s Loughborough University has included 'green design' within its industrial design curriculum. Year 1 students studied Mackenzie's *Green Design* [4] and year 3 students were encouraged to write dissertations relating to sustainable design. However there had been a long standing desire within the Department of Design and Technology to develop more in-depth sustainable design teaching. Motivated by internal drivers for programme innovation [5], in 2000 an education for sustainability programme was developed to further engage second year students with the sustainable design agenda. With help from the International Ecotechnology Research Centre (IERC) at Cranfield University, two new modules were developed: *Issues is sustainable development* during semester 1, which consisted of background learning, and in semester 2, *design for sustainable development* in which the students would develop sustainable concepts (for a more in-depth overview of the initial sustainable design programme see [5]). The decision to develop the undergraduate modules at Loughborough was based on the existence of a number of resources that could be drawn upon, these included:

- The EcoIndicator Manuals for Designers, by the Pre Consultancy [6],
- The UNEP manual *Ecodesign: a promising approach to sustainable design and production* [7],
- A Guide to EcoReDesign: improving the environmental performance of manufactured products, [8],
- The Demi website, www.demi.org.uk, developed for design students in higher education [9, now offline],
- The biothinking website, www.biothinking.com [10],
- *The Journal of sustainable product design* [11], and later,
- The book *Sustainable solutions: developing products and services for the future* [12].

Seven years on sustainability thinking is now integrated more widely throughout degree level teaching and Tracy Bhamra and Vicky Lofthouse are now full time members of staff in the Department of Design and Technology at Loughborough University. The second year sustainable design module still exists and has now attracted interest from a number of companies who provide live projects for the students to undertake in semester 2. This adds an extra motivational dimension to the module and also provides the students with an experience of dealing with real industrial clients. In 2000/2001 25 students opted to take the module. In 2007/2008 86 students have opted to take the module. The module specification has remained similar to that which is indicated above, however the resources which the module draws upon are updated each year. Sustainable design is still introduced to the first years, who are required to write an essay including sustainable design considerations. The third year also includes elements of sustainable design, with students being encouraged to select design briefs which focus on, or include sustainability. A masters course in sustainable design has also been developed and 'education for sustainable design' is now included within the PGCE course within the Department.

Within the past 8 years there have been a number of PhDs relating to sustainability, those specifically relating to sustainable design education include investigations into design decision-making [13] [14] and investigating sustainable design websites and their effectiveness [15]. The Department of Design and Technology has also been

involved in a number of education for sustainability research projects, these include: 'Informationinspiration', [16] and SortED [17], a resource regarding the WEEE legislation.

3 SUSTAINABILITY IN SCHOOLS

At the same time as the initial degree level modules were being developed at Loughborough University, Practical Action (then ITDG), a sustainable development charity, was also developing education for sustainable design in schools and asked Loughborough University to be involved in their work. Having developed a successful sustainable technology website [18], for Key Stages 3 and 4, Practical Action wanted to extend education for sustainable design into the post-16 curriculum. What resulted was *The Sustainable Design Award*. This aimed to integrate thinking about sustainability into 16+ students work (see [19]). The scheme needed to fit within the existing post-16 curriculum and not add to the demands of either students or teachers [1]. The scheme provided opportunities for students to learn about sustainable design by undertaking sustainable design briefs set within both southern and northern hemisphere contexts, and created a support structure including a website and email service in order to sustain the student's efforts. The initiative soon got backing from a number of actors including the Centre of Alternative Technology, Loughborough University, Twente University, the Construction Industry Training Board, Dyson and Edwin Datschefski. Teachers who were interested in becoming involved were invited to a teacher training day where the scheme was explained and their role in it was discussed [1]. Schools who opted to take part in the award scheme were each provided with a 'sustainability pack' that contained the information needed to engage with the scheme. The SDA scheme also provided additional support through optional study weekends and school visits, and by providing contact details for all brief providers (for more detail see [1]). More recently the authors and the department's teacher trainees, alongside a number of other partners, and co-ordinated by Practical Action, developed *The Sustainability Handbook for D&T Teachers* [18], which has been sent to a large number of design and technology teachers in England and Wales. The current cohort of 26 PGCE students are trialling ideas in the Handbook with every class that they are teaching during their school experiences. Data from this trial will inform additions and improvements to future editions on the Handbook. Early indications are that the Handbook, distributed to over 2000 schools, has had a positive impact on National Curriculum requirements for Education for Sustainable Development in secondary education.

Figure 1The Sustainability handbook [20].

4 PEDAGOGY

The success of the initiatives discussed above can be attributed to the methodologies by which they were developed. Since the development of these initiatives two of the authors, Bhamra and Lofthouse, have developed the *toolbox for sustainable design*

education [21] which clarifies the educational approach and learning objectives used in many of the above approaches. Firstly, they highlighted that the learning experience for students should include; working on actual, real-world problems, and working in groups. Secondly they suggest 10 key learning objectives, these can be seen in Figure 2.

	Learning Objective
1	Understand the historical context of sustainable development.
2	Understand different definitions of Sustainability (e.g. Brundtland, Natural Step, Triple Bottom Line)
3	Understand key concepts of sustainable development (e.g. Limits to Growth, Carrying capacity, Ecological footprints, Sustainable Consumption, Needs and Rights, Diversity).
4	Understand the idea of systems thinking in relation to Sustainability.
5	Have an appreciation of the commercial, institutional, legislative and social motivations for implementing Sustainable Development.
6	Demonstrate knowledge and understanding of the concept of Sustainable Design and how it exists within an industrial context.
7	Have a practical understanding of the pressures facing industry in terms of integrating Sustainable Design into an established product development process (e.g. internal drivers, legislation…).
8	Have an appreciation of the current range of tools and resources available for Sustainable Design and understand how to use some of the most common (e.g. LCA, MET Matrix, Environmental checklists).
9	Understand future directions for Sustainable Design (e.g. system innovation and function fulfilment)
10	Understand how to analyse the environmental profile of a product, and generate appropriate improvement options

Figure 2 10 key learning objectives [21].

The level of adaptation required by designers to enable them to produce sustainable outcomes is large, therefore people need to be made more aware of the issues and given the skills with which to deal with such change [21]. All of the educational initiatives described above begin by introducing the concepts of sustainability and building sustainable design knowledge, they then move to supporting learners who are expected to be working on live design projects. This approach also promotes learning that 'emphasises independence of mind and the ability to make sense of, rather than reproduce, information' [22] Interestingly, best practice design education shares some key characteristics with a transformative education approach. It involves creative, solutions-focused learning; self-directed team work; learning by doing (commonly 'live' projects); iterative refinement and reflection; and drawing from a range of disciplines: e.g. mechanics; electronics; manufacturing; marketing; sociology; ergonomics; and history, to inform the outputs that emerge as a result of design-based activity. To date (within proactive design education) sustainability has been viewed as an 'additional subject' to be addressed in the design process to inform a range of outcomes. To reach conceptually different solutions towards sustainability one has to begin to see design thinking in a context of sustainability [23].

The sustainable design elements of the design courses at Loughborough University have evolved as a result of the authors' continued research in sustainable design, taking its lead initially from emerging industrial practice in sustainable design to the point where now its approaches and methods are more advanced than the majority of professional practice. Whilst initially the teaching of sustainable design was as part of an optional module for the students in Year Two of the course this has now evolved to the point where design practice and design context modules across all years of the course have integrated many aspects of sustainability into their teaching and assessment. In addition to this the optional module is year two is still available to enable a more in-depth understanding of the issues of sustainability to be examined.

5 CONCLUSIONS

It is becoming essential for all design graduates to have a good understanding of sustainable design so they can apply these skills within professional practice. However, one of the major problems in getting to grips with sustainable design is the diversity of the issues that impinge on it: from technical issues such as the impact of a product on human health or biodiversity, to the importance of values in human decision-making. By developing a number of resources, alongside a number of partners, for sustainable design education from ages 11 up to those used at a professional level, Loughborough University has begun to establish an integrated approach to developing a clear map in an otherwise disorientating agenda, within which sustainable design solutions can be produced. By developing resources for different audiences the building of knowledge and skills as a student's education continues is promoted. The approaches used to teach sustainable design within these resources also develops student's problem solving abilities, by focussing on understanding and engaging with issues and working on live projects, often with industry backing.

In opening peoples' minds to the scope of the connection between sustainable development and design it is important that they have the opportunity to translate these abstract concepts (e.g. precautionary principle; limits to growth; scale) into language and action that has resonance for them. The main idea behind linking a traditional knowledge transfer to practical design briefs was to provide design students with a familiar 'zone' (the act of thinking in a designerly way) to explore an unfamiliar area - in this instance the core concepts of sustainability.

Loughborough University's Department of Design and Technology is at the beginning of a journey and through continual reflection on teaching, project questions and outcomes and learning experiences we hope to advance our understanding of how we can cultivate sustainable design, in education and in professional practice.

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