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GROWING SPACES: DEVELOPING A SUSTAINABILITY–LITERATE GRADUATE

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ABSTRACT
Knowledge of the principles of sustainability is of paramount importance to designers because they make a significant contribution to the majority of designed products, systems and society in general. Sustainability is directly connected to ongoing research however and what might be seen as the best path today could be proved unsustainable tomorrow. Therefore, we need to create curricula and pedagogy that enable students to develop appropriate sustainable knowledge, values and skills in order to become sustainability literate graduates. We also need a holistic sustainable thinking strategy, so students can engage with different stakeholders and develop skills to contextualise appropriate choices.
The 'Growing Spaces' project introduces sustainability and sustainable design principles to first year Product Design students who are asked to redesign and improve a particular space within the university estate. University students, staff and local communities should be able to use the space and students have to interview and identify the needs of a wide range of users. Together with building a sense of community, the space should promote biodiversity and could be used for a variety of purposes such as growing food, decorative and/or sensory plants.
This collaborative project was launched with the members of the university Estates and Academic Environment team and offers students the opportunity to develop transferable professional skills. The project specifically encourages students to embody environmental, social and economic values in their design proposals and the paper includes several such examples of design proposals that contribute to the development of a reflective sustainability–literate graduate.

Keywords: Sustainability literacy, user research, design empathy, Analyst Triangulation.

1 INTRODUCTION

1.1 Sustainability and unsustainability

Although many human inventions including buildings, products, technologies and services have contributed to the development of and benefited humankind over thousands of years, they have also had a detrimental impact on the planet. For example, if the global population lived as we do in the UK and the USA we would need the equivalent of three and four planets of resources respectively to support us [1]. In addition to the production of objects all human activity – and especially the combustion of fossil fuels – has made a harmful impact on the quality of air, water, soil and complete ecosystems as well as initiating climate change. The creators of artefacts (designers, engineers, manufacturers) and more recently marketing and advertising executives, have contributed directly and indirectly to these positive and negative phenomena although when some practices were initiated, the negative impacts were unknown. For example, planned obsolescence was introduced in 1932 as a means of ending the Great Depression by stimulating the market and creating employment [2]. Consequently, many designers believed that their output should initiate 'the desire to own something a little newer and a little better, a little sooner than necessary' [3] to support this model. These practices boosted economic growth and employment but as early as 1960 it was recognised that they also created 'wasteful, debt-ridden, permanently discontented individuals' [4]. Nevertheless, many designers continued to design in a way that directly and indirectly supported conspicuous consumption and the growth of a throwaway society because products were designed for a linear (take-make-use-dispose) economy.

Between the 1940s and 1970s however several leading design thinkers acknowledged the need for alternative practice and restrained consumption and while Victor Papanek criticized designers for their irresponsibility [5] for example, Richard Buckminster Fuller proposed that we should look after resources by 'doing more with less' [6]. More recently other designers and engineers have begun to develop and implement strategies (such as Eco Design) to reduce the impact of products and 21st century lifestyles; sustainable design is the main business of some consultancies (e.g. Sprout Design in the UK) and a service in others (e.g. IDC, SeymourPowell, IDEO). However sustainable design practice remains a matter of choice for many designers and consequently the contribution of designers to the development of our current unsustainable circumstances and lifestyles is still prevalent. This emphasizes the need for Sustainability Literate design graduates.

1.2 Sustainability Literacy

The need for change from an unsustainable to a sustainable society has been widely acknowledged at local, national and international levels and various individuals and organisations have proposed ways to propagate and support this change. For example, in the UK the Higher Education Academy (HEA) requires that Universities embed sustainability principles in their curricula and start by educating individuals about and developing skills for sustainable development [7] to ensure that they are *sustainability literate* i.e. they are expected to

- understand the need for change to a sustainable way of doing things, individually and collectively
- have sufficient knowledge and skills to decide and act in a way that favours sustainable development
- be able to recognise and reward other people's decisions and actions that favour sustainable development [8]

This third attribute includes 'having sufficient knowledge and understanding to talk to others in a positive and engaging way about matters relating to sustainable development' and the intent is that sustainability literate individuals will transfer knowledge and skills to other individual and create a sustainability literate society [8].

As stated above designers and their design output have immense power to influence unsustainable practice in manufacture, business models, behaviour and lifestyles; conversely designers and their design output also have immense potential to bring about sustainable environmental, social and economic practices. It is therefore, vitally important to develop sustainability literate design graduates. Like graduates from other disciplines, they can contribute to the development of a sustainability literate society but they will also create more sustainable designs with lower environmental impact and more social value as well as products, services and systems that encourages sustainable behaviour.

The subject of sustainability has been embedded in the design and engineering design curricula at London South Bank University for twenty years and has gradually evolved to include design *for* as well as design *about* sustainability. This is key to developing sustainability literate graduates who are prepared 'to cope with, manage and shape social, economic and ecological conditions characterised by change, uncertainty, risk and complexity' [9]. Educating sustainability literate graduates begins in the first year and we now discuss Growing Spaces, an archetypal first year product design project and explain why it is a foundation for sustainability literacy.

2 GROWING SPACES

2.1 Sustainable design at London South Bank University

Students on the Engineering Product Design and Product Design courses at LSBU have been engaging with low and intermediate technology, renewable energy and other eco-design projects for at least 25 years. Examples include a water pump based on Stirling Engine principles for use in deserts and domestic lanterns made from local 'waste' materials in and for use in Africa. While students were educated *about* sustainable design and engineering however, education *for* sustainability was incidental. This was addressed by changes to the curriculum and assignment briefs including the introduction in 2008 of live design projects with the university Estates and Academic Environment team to promote sustainable behaviour around the campus, the impact and outcomes of which were very positive [10]. Design students have collaborated with members of this support team since then but project content has shifted from communication design to better address the requirements of

sustainability literacy. Consequently, in 2013 we launched the Growing Spaces project in conjunction with the Sustainability Projects Lead as part of the programme to improve the university campus.

2.2 The Project Brief

The project is part of the Design for a Sustainable Society module; there are six hours contact per week and the project runs for six weeks concurrently with assignments in two other modules. The brief asks students to design an ideal sustainable garden that encourages biodiversity and could be used to grow food as well as decorative and/or sensory plants. The space is part of the university so they must consider how it could best be used by students and staff and include features to meet both groups' requirements. They also consider how the space could be used by surrounding communities (nurseries, primary schools, home care facilities, etc.) in the future and whether their requirements will be the same as those of students and staff. They have to assess the potential and limitations of the site as well as all practicalities: for example, how, what, in what will be planted? How can biodiversity be increased? How and who will care for and maintain all aspects of the garden? Finally, the design proposal must embody the three key values of sustainability, namely environmental, social and economic factors (planet, people and profit).

The fourth iteration of the project is running in 2017 on a third site. The first was a roof space in between two buildings but it was only accessible to staff and students and therefore excluded the local community. There were also structural issues because the roof was not designed to accommodate heavy planters. The second site was a courtyard surrounded by halls of residence and although the students' designs have not been fully implemented (due to lack of funding) some planters have now been installed. Although this site was accessible to members of the local community it is relatively hidden which does not encourage community engagement. The third site is also a courtyard adjacent to the university Research Enterprise and Innovation centre. This site is already used by local visitors and is accessible by the community; it can also be cultivated and maintained more easily so staff and students are hoping that selected designs will either be built in part or in full. Group and individual research visits to diverse sites including The Museum of Garden History, The Sky Garden, Hackney City Farm and Siemens Crystal are also key to the project.

2.3 The project structure, teaching and learning strategies

The project is complex and, in addition to laying the foundations sustainability literacy introduces students to different practical skills and intellectual concepts. These include:

Group work and collaboration: the students need to collect a lot of information about different subjects very efficiently and quickly in order to complete the brief and so this task is shared. The class is divided into groups, each of which collects information about a different theme including food and plants, biodiversity, materials reuse/remanufacture/upcycling/recycling, different people's physical and intellectual abilities, inclusive environments, and urban gardening. Each group formally presents their research findings to the class after which presentations are added to the VLE so that all students can access and use the material as and when required. This process helps them to develop general group work skills such as identifying and allocating tasks, writing a work plan and related contract.

Peer assessment: this encourages students to be objective, constructively critical and reflective about other people's work; it is also a stepping-stone to self-reflection and evaluation of their own work

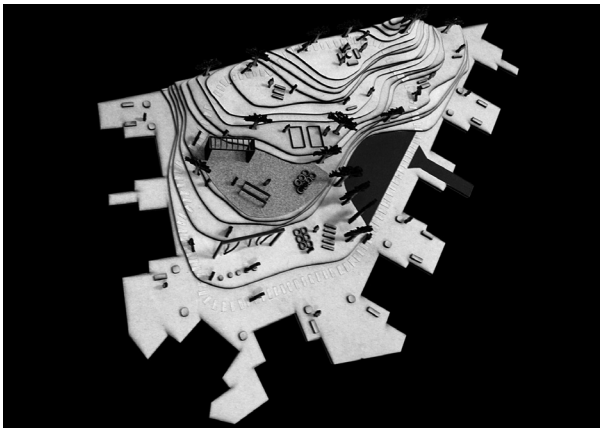
Accuracy and scale: students have to measure the space accurately with a surveyors tape, produce scale drawings and make a 1:110 scale model of the site and their design proposal as well as 1:20 scale models of features such as furniture or planters. Some students find this very challenging because they usually build full size 1:1 models but what they learn makes them more aware of attention to detail and is useful for exhibition and installation design work.

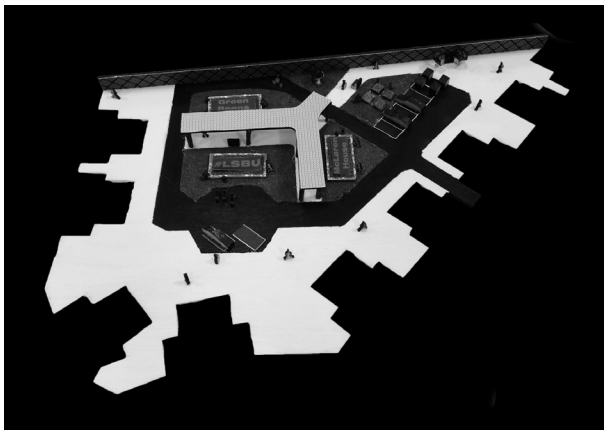
Visual and verbal communication: the submission includes a diagram/infographic that explains their scheme, its benefits and how this meets three key criteria of sustainability. Page space is limited so students have to select and structure pictorial and written information carefully and clearly. As described above they also have to present research to their peers in a group (which requires organisation and planning of visual and verbal material) and finally to present to the client (Sustainability Projects Lead). As the first presentation to an external party this is a challenging but useful experience that helps to prepare students for application for third year placements and develops employability skills.

Design empathy: students develop ability to empathise in the design context because 'without the understanding of what others see, feel, and experience, design is a pointless task' [11]. As a university and community resource they need to identify potential users of the sustainable garden and the needs and wishes of people outside their peer group. They learn about different types of data collection, interview techniques, what type of questions to ask, and how to structure and deliver questionnaires. The data collection process also helps to develop social and communication skills as above; moreover, an appreciation of need to collect and collection of real world and real time data ensure that students develop skills to contextualise appropriate choices and shape change, uncertainty, risk and complexity.

2.4 Learning outcomes

In addition to evidence of general skills-based and intellectual learning outcomes the project includes specific learning outcomes that foster the development of sustainability literacy: if the design proposals demonstrate a balanced understanding of environmental, social and economic values and their inter-relationship then these learning outcomes have been met. All Growing Spaces design proposals embody some of these values and many embody all of these values. Some proposals have been of an exceptionally high standard that has exceeded the norm for the first year project work. For example, the proposals in figures 1 and 2 show high quality model making, which was supported by dynamic graphic presentation sheets. Moreover, the design proposals illustrate inventive and holistic approach to the brief in that the students have designed inclusive spaces that are accessible to different user groups, encourage social interaction and opportunities to improve health and wellbeing through exercise and gardening. Choice of decorative and edible plants was appropriate to the climate and location; similarly, consideration of cost and environmental impact were demonstrated through (re)use of recycled and recyclable materials (for example the 'hills' in figure 1 are made from hard core and spoil from surrounding building sites).





Figures 1. and 2. 'Growing Spaces' student models

The high standard of work is a positive affirmation that the brief is interesting, challenging and appropriate for the level of the course. From the Module Evaluation Questionnaires, we have also learnt that the majority of students really enjoy the project and that they value working for an external client because it brings the real world into the classroom. Throughout the project they develop transferable skills (as described above) and knowledge of sustainable design, sustainability in general which they can then apply to second and final year projects. The fact that a number of students decide to investigate aspects of sustainability through their dissertations and/or to design sustainable products for major final year projects is also confirmation of the positive impact and success of this project. It is however much more difficult to determine whether students become sustainability literate graduates because this really requires longitudinal research which has not been possible because the first group of students to undertake the Growing Spaces project have not yet graduated.

3 PROJECT VALIDATION

In order to validate the project as being appropriate for developing sustainability literate graduates we have adapted a method that is used in social sciences research, namely Analyst Triangulation [12]. In

this case the aims, objective and project methodology are cross-referenced with guidelines and protocols for developing sustainability literacy. For example, in their report 'Sustainable Development in Higher Education' Dawe et al (2005) outline a framework which includes 'problem solving using systemic approaches, making critical judgements on authentic issues and working collaboratively and in interdisciplinary teams', all of which are inherent to the project in part or in full. This same report describes a sustainably literate graduate as being able to:

- appreciate the importance of environmental, social and political contexts to their studies
- solve or ameliorate real life problems through employing holistic as well as reductionist approaches, as appropriate to the issue
- think creatively, holistically, and systemically and make critical judgements on issues
- develop a high level of self-reflection at a personal and professional level
- understand, critically evaluate and adopt thoughtfully sustainability values
- apply theory to practice and vice versa
- work collaboratively and work in interdisciplinary teams
- initiate and manage change that supports sustainable development in personal, institutional and social contexts develop and apply a broad and balanced knowledge of sustainable development [13]

These competencies are a slightly more detailed version of those identified by Parkin at al (2004) and listed in the Introduction. The brief, project structure, and teaching and learning methods described above present students with opportunities to develop all of these competencies although as first years, the project is introduction to these competencies. Students are presented with further opportunities to develop and consolidate their learning as they engage with more challenging and complex sustainable design projects during the second and final years of the course.

The third set of guidelines used in this validation exercise is a framework for university staff from all subject areas to help them to embed sustainability into student learning. In this case seven steps are proposed as follows:

1. Understand the principles of sustainability and education for sustainability
2. Identify key sustainability issues
3. Develop sustainability literacy and competencies
4. Enhance teaching through sustainability pedagogies
5. Use the campus as a learning resource
6. Link the curriculum and informal learning
7. Become part of University's sustainability community [14].

Step 4 is based on 'A review of sustainability pedagogies and their potential for use in Higher Education' [14] and is a very useful addition to the above points for validation. In this case 'student-centred and interactive enquiry-based approaches …. participatory and inclusive learning processes, trans-disciplinary collaborations, experiential learning and the use of local environment and community as learning resources' are all endorsed as pertinent teaching and learning methods to facilitate education for sustainable development. Moreover, being typical of design education these are inherent within this project. The review also promotes 'role play, simulations, stimulus activities, debates, reflexive accounts, personal development planning and problem-based learning' as sustainability pedagogies [15]. While some of these methods are employed in Growing Spaces they are all employed throughout the second and final years of the course.

In addition to Step 4 Steps 1, 2, 3, and 5 are already addressed by academic staff and students within the project. Step 6 suggests that students become 'informed active citizens who engage with the university and local communities' while Step 7 encourages students and staff to become part of the sustainability network. These wider issues are discussed by academic and support staff with students who are encouraged to volunteer and be ambassadors in local schools for example and to join the student union Sustainability Society. Consequently, the above criteria are also fulfilled by the project and other course content.

4 CONCLUSION

This paper began by briefly describing some of the reasons how and why current lifestyles in the UK have become unsustainable and the contribution of designers to this phenomenon. It then defined sustainability literacy and potential role of sustainability literate design graduates in addressing the problem of unsustainability. The paper subsequently describes Growing Spaces, a first year project

that involves the design of a sustainable garden for use by members of the university and wider local communities. It also describes the teaching and learning methods, various transferable skills and knowledge and learning outcomes of the project. The high quality of design output is a good measure of the short term impact and success of the project; in order to validate its long term impact however it was necessary to cross reference the project content and teaching and learning methodology with respected and proven frameworks and guidelines for Education for Sustainable Development. The results of the triangulation exercise positively validated the project content, sustainable thinking strategy and pedagogy and confirmed that the project is a relevant and beneficial component of the course that helps students to develop skills to contextualise appropriate choices and become sustainability-literate graduates.

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