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Interdisciplinary circular economy design education through local and regional partnerships

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Abstract

A review of Educational Sustainable Development (ESD) strategies has found that participatory and collaborative partnerships are the most effective for engaging students with sustainability. To enable students from Higher Education to experience and understand the relevance of the Circular Economy, as opposed to the linear economy, a series of 'real-life' collaborative projects have been created for Design students from Product Design, Fashion Design, Commercial Interior Design and Landscape Architecture, bridging the schools of IT Computing and Business with Art and Design. These 'real life' projects have been created in collaboration with local and regional charities, local Government and companies. The focus of these 'real-life' projects is based upon facets of the Circular Economy, such as 'Design for Longevity', 'Reuse', 'Repair' and 'Recycling', with the intention of engaging staff and students with the Circular Economy within each unit of assessment. This work is evaluated using an educational framework based upon the ESD principles, which is embedded throughout the Applied Design degree programmes, with the aim of creating engaging partnerships to improve the quality and impact of the student learning experience. This paper will describe some of the 'real-life' case studies, focusing upon first year Design degree students, the outcome of these projects will be discussed and reflections made. Fundamentally it is found these collaborative partnerships have the ability to empower students to become active partners in the Circular Economy and the Sustainability agenda.

Introduction

The Circular Economy is recognised in Higher Education (HE) as the alternative to the linear design process. In contrast to the linear economy, the Circular Economy (2017) requires applied design disciplines to think systemically, according to Lovins (2013), and to engage with regional and local communities and businesses. Design students need to consider product longevity, repair, reuse, remanufacture and recovery of waste streams, while considering the impact upon the environment, society and economy. In an international review of national and regional Education for Sustainable Development (ESD) strategies, Tilbury (2011) concluded that participatory and active learning approaches are perceived as being the most appropriate to learning for sustainable development.

The University of Gloucestershire (2017) applied design disciplines, i.e. Product Design, Fashion Design, Commercial Interior Design and Landscape Architecture, have thus created partnerships with local and regional organisations to create 'Live' participatory site-based projects to create an educational framework, shown in Figure 1. This engages undergraduate students with the Circular Economy and ESD principles throughout the whole of their undergraduate programme, (Ryan and Tilbury 2013), (Tilbury and Cooke, 2005) as described by

Williams and Ryan (2016). Students exchange discipline specific design skills to respond collaboratively with these organisations to solve real-world sustainable challenges. This longitudinal study initiated in 2015, has evaluated the quality and impact of the student experience through a framework of five components of assessment, reflected in the IUCN publication prepared by Tilbury (2011). These components are: Futures Thinking, Critical and Creative
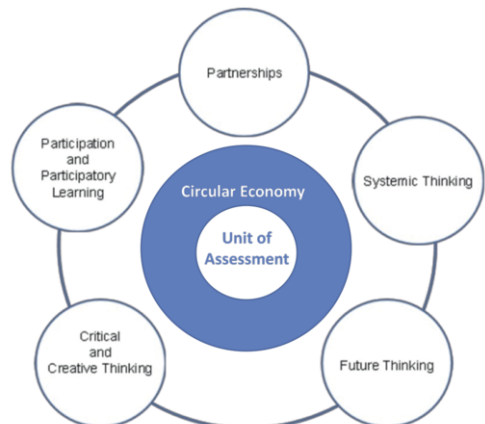

Figure 1. Educational framework.

Thinking, Systemic Thinking with particular focus upon Participation and Participatory learning and Partnerships as described by Williams and Ryan (2016).

Partnerships

The focus of each collaborative project is based upon learning outcomes of the unit of assessment, for each individual design discipline (as shown in Figure 1). Simultaneously each project focuses upon the loops of the Circular Economy through partnerships with local and regional organisations (RCE7 2017). The Circular Economy and it's relationship to the 'live' project is introduced at the beginning of each project, to all design students involved in the collaboration. This paper will focus upon the projects undertaken within the first year of the degree programme only.

Product Longevity

The concept of product longevity, as described by Chapman (2005) and Bakker (2014) was initially introduced during the first collaboration, with Product and Fashion Design students and the clothing company SuperDry (2017), in 2015. The aim of this project was to design a Spring/Summer collection of clothes, bags and shoes, to raise awareness of the waste streams created by 'fast fashion' and to design good quality products for SuperDry.

Design students were assigned to mixed groups and provided with an exchange of discipline specific skills. The unit of assessment for each design discipline was Human Factors and Sustainable and Ethical Design for Product and Fashion students, respectively. The intention was to extend the product life by improving the suitability and usability of clothes, shoes and bags, through an exchange of human factors lectures to all design students. Product Design lecturers taught Human Factors' user centered design tools: personas, scenarios, The Four Pleasures (Jordan, 2002), Maslow's hierarchy of needs and the concept of Emotional attachment by Chapman (2005), and the notion of the 'Classic Long Life model' by Bakker (2014).

Conversely, a range lectures on textile choice, shoe and bag design and manufacturing processes were taught to Product and Fashion Design students by Fashion lecturers, technicians; and designers from SuperDry. This included the durability and emotional attachment to denuim by SuperDry designers. The aim was to employ durable 'fit for purpose' materials, suitable for the intended user groups and their everyday needs.

Initially, observations of SuperDry consumers in two retail outlets, in depth interviews with the retail managers in their flagship store in London and SuperDry designers, were carried out to create personas and scenarios to understand the needs of the users. One group of students identified that SuperDry's main target consumers were 'festival goer's'. Through the development of the scenarios, they chose to design a 'two-in-one' robustly designed

bag to comfortably carry heavy clothes and personal goods, to a festival camping place. The smaller bag could be detached to carry expensive personal belongings, to prevent stolen possessions and later used as a personal bag for outdoor or travelling activities. Through the support of a Fashion Technician the Product Design students were able to design and make well-made bags, employing durable fabrics suitable for the function intended. The students also carried out user testing techniques (taught in the Human Factors module) and tested the bag for functionality and suitability.

The advantages of interdisciplinary knowledge exchange and participatory learning through partnerships was evident with this project. Product and Fashion Design students gained in-depth knowledge of SuperDry's consumers, designing, purchasing and manufacturing choices. Product and Fashion students also experienced opposing design processes. Fashion students, for the first time, were required to question who were the users and understand their emotional and physical needs before attempting to design. They unexpectedly found that the purchasers were the parents and grandparents of the users and needed to use more robust textiles to carry the weight of the items identified. Product Design students were able to learn how to make robust working prototypes using textiles, that they tested and refined for durability.

The suitability of the products created for the functionality and usability identified, resulted in solutions that were designed for the customer's needs, rather than solely focusing upon a style or season, resulting in fast fashion.

Reuse and redistribute

The notion of reuse with regard to the Circular Economy, was introduced to first year Product Design students through a '3D Modelling and Computing' unit of assessment in 2015, in collaboration with the British charity 'IT Schools Africa' (2017). IT Schools Africa follow the 'Gap Exploiter Model' described by Bakker (2014). They 'exploit' the 'leftover value and lifespan' of an existing product (Bakker, 2014) by exporting used computers, donated from schools and companies throughout the United Kingdom, and set up IT classrooms throughout Africa. The aim of this project was to raise awareness of the circular, added value, of reusing a product. Product Design students were required to design an IT classroom in Malawi, using local materials, to enable the school children to reuse used donated computers. The classroom design solutions were required to accommodate older larger sized computers through the use of 'Solidworks' (a 3D parametric computational software) that they were being taught for this unit of assessment.

Interviews were undertaken of the secondary school children, teachers and Head of School from three schools in Malawi, a local school in Cheltenham, and the employees of IT Schools Africa. This was to establish the environmental and spatial requirements of the larger secondhand computers and their users

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Product Design students benefited from engagement with 'IT Schools Africa', who participated in fortnightly meetings with the Product Design students, providing them with pragmatic feedback upon their computational concept development. Reuse, as not a difficult concept for students to understand with the advent of 'Ebay' (2017). Through visits to IT Schools Africa, the students learnt about the social and economic benefits of being a 'gap exploiter' (Bakker, 2014), as well as learning about the processes required to reuse second hand computers. They simultaneously learnt how to design ergonomic classroom furniture and layout for different cultural expectations using newly acquired 3D computational skills. The students were able to meet out of work volunteers who benefited from gaining work experience with the charity. They were also able to question how the computers were transported throughout Africa and learn about the benefit of the secondary school students being taught IT skills to support them in gaining professional employment. The Design students also learnt that African schools were required to make a donation for the computers to recognise their worth and thus be treated with the care.

This research is now concerned with bridging the gap between repair and Hackerspaces (2017), as discussed by Charter and Keiller (2014). To create solutions for the end-of-life electronics, for the flow of materials and components to become circular.

Repair and maintain

The notion of repair was introduced through a monthly 'Regeneration' Repair Café based in the local community, launched in May 2016, as described by Repair Café (2017) and Parker et al (2016). This collaboration of Product Design students with the Local Council Waste Team (2017), and a local sustainable charity Vision 21 (2017), is described by Williams and Ryan (2016). This was based upon the unit of assessment 'Materials and Manufacturing' for first year Product Design students and 'Design for Sustainability' for second year Product Design students. During the launch of this project students carried out qualitative primary research of the community's attitudes and behaviours towards repair, and learnt how to deconstruct, repair and re-assemble goods with the community's products, alongside qualified volunteer

Figure 2 Branding created by final year graphics students

engineers and electricians, (Rosner, 2012), (Salvia, 2015), (Scott and Weaver, 2014). Final year Graphics students created the Regeneration branding, as shown in Figure 2, and an upcycling exhibition of denim jeans was created by first year Fashion Design students for their Ethical and Sustainable Design unit of assessment.

Product Design students benefited from gaining knowledge of a vast array of products spanning approximately 50 years of design, which were brought into to the Repair Café. They gained first-hand experience of the emotional attachment of people to their products (shown on BBC Hugh's War on Waste 2016), together with the typical faults of components and materials. They were also required, as part of their 'Materials and Manufacture' unit of assessment, to choose one product from the Repair Café, record and evaluate the ease of disassembly/assembly, the materials and manufacturing methods, establish the fault and redesign to overcome the fault.

The Product Design students over the past two academic years, through anecdotal feedback, have commented that they did not initially believe that repair would be interesting, until they participated in the Repair Café. The Fashion students felt empowered to 'make a difference' through the experience of being involved with the local community. The Product Design student involvement in the Repair Café is now annually employed as part of the 'Materials and Manufacturing' unit of assessment and is an evolving project based in partnership with the Gloucestershire County Council Waste Team, Vision 21 and the community.

Recycling

Waste streams from the textile industry have recently been addressed to support the 'I love my Clothes' WRAP campaign (2017). This recent partnership included the local Gloucestershire County Council Waste Team, Bristol Textile Recyclers (2017) and first year Fashion, Product and Interior Design students. The project has focused upon the notion of creating future scenarios for clothes, luminaires and furniture, using reclaimed textiles from the regional Bristol Textile Recycling Centre (2017). The Interior and Product Design students focused upon the design of 'a space within a space', luminaire and seating for the local Cheltenham Minster (2017) and the Wilson International Art Gallery (2017), as part of a product design Human Factors unit of assessment. Whereas, the Fashion Design students responded as part of their Ethical and Sustainable Design module. The expectation for each discipline's assignment was to creatively include the use of textile waste streams within their design solutions. The best designs of the three disciplines were given the opportunity to exhibit these designs as part of the launch of a newly established sustainable forum for textiles 'Thread Counts' on the 22nd April 2017: A fashion and textiles forum for sustainable and creative futures. Aiming to increase awareness of slow ethical textiles and sustainable fashion, while promoting it to a wider public audience regionally and contribute to developing a

pedagogic framework for e-learning, research as practice and impact specifically around ESD (supported by LIFT, 2017). A new 'Makerspace' (2017) was also introduced to the community during this week-long exhibition, to teach how to repurpose textiles.

The textile 'recycling' project did not involve the 'making' support from the fashion department to teach the Product Design students the skills required to make their products, due to time constraints, even though textile machinery was available. The Product Design students, majority being incidentally male, did not have the experience to make well finished textile products, but alternatively engaged through hand sewing. Some male students also experienced difficulty in creating solutions using textiles without the support of Fashion Design. However, the outcome for the Thread Counts exhibition was extremely creative, with luminaires that were made from various sized jumpers named 'a hug from above' and a modular chair design that was aptly threaded together.

Renewable energy

Renewable energy has been introduced through the collaboration of Commercial Interior, Product Design and Landscape Architecture students, University gallery curator and the Estates department. Through the exchange of discipline specific knowledge of solar gain, energy efficiency, as well as bio philia and rainwater harvesting to create designs for the University art gallery and surroundings.

Results

This longitudinal study has evaluated the quality and impact of each student's experience at the beginning and the end of each academic year, through the five units of ESD assessment, as described by Tilbury (2011). Feedback from the students reported positive feelings of empowerment due to the tools and 'real life' experiences they gained, feeling that they are 'making a positive change for the future'. Sustainability has become a natural part of their approach to design problems.

Some students experienced difficulties in group working due to a minority of students not participating equally, which is generally common in group projects. However, this is outweighed by the first-hand experience the students have gained of the Circular Economy. The confidence and knowledge gained through these collaborations has enabled students in subsequent years of study to independently engage with external local organisations e.g. 'When in Rome' (2017) (a local wine import company) and the Director of Hewlett-Packard (2017) to carryout Life Cycle Analysis and further learn about the Circular Economy, in the second year of their degree.

The Product Design students that collaborated in the SuperDry project in 2015, have further successfully employed the interdisciplinary knowledge and skills learnt, in subsequent projects using textiles.

Conclusions

The launch of the now established monthly Regeneration' Repair Café (2017) has become a successful strategy for teaching Design students about the restoration of products and more recently Film media students to regularly engage with the local community and learn about repair and reuse.

The comparison of the projects over the last two years has shown that lecturers and technicians must support the teaching of interdisciplinary skills and knowledge exchange. This is required to enable the students to experience the advantage of these collaborative projects.

The timely organisation and agreement of the aims and objectives of the project are paramount to prevent student dissatisfaction. Timetabling differences, bridging two different schools of IT Computing & Business and Art & Design has been challenging. This has been overcome with collaborative making-workshops and exchange of lecture time.

These interdisciplinary industry-relevant experiences have contributed to the students' professional portfolio and skills which have been recognised as a UNU Flagship Project, Finalist in 2016 Green Gown Awards (2017) and 'Highly Commended' in the Furniture Reuse Award, UK.

The prime aim of this framework has shown that design disciplines can collaboratively explore sustainable practices, with particular reference to the Circular Economy, through the engagement of embedded pedagogical principles of Education for Sustainable Development, in regard to individual unit of assessments. Where students are active partners in the sustainable agenda.

Acknowledgments

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References

Chapman, J, 2005. Emotionally Durable Design, Objects Experiences and Empathy. pp. 96, *ISBN:9781844071814.*

Cheltenham Minster [last accessed] 9th June 2017 [online] available: http://stmstm.org.uk/

Bakker C (2014), Products That Last, TUDelft.Library.

BBC Hugh's War on Waste 2016, [last accessed] 9th June 2017 [online] available: www.bbc.co.uk/programmes/b07m8qwz

Bristol Recycling Textile Centre [last accessed] 9th June 2017 [online] available: http://btr-ltd.co.uk/

Charter, M. and Keiller, S. (2014) Grassroots Innovation and the Circular Economy: a global survey of repair cafés and hackerspaces, July 2014, Farnham: The Centre for Sustainable Design/University for the Creative Arts. - [last accessed] 9th June 2017 [online] available: www.research.ucreative.ac.uk/2722/1/Survey-of-Repair-Cafes-and-Hackerspaces.pdf

Circular Economy - [last accessed] 9th June 2017 [online] available: https://www.ellenmacarthurfoundation.org/circular-economy/interactive-diagram

Ebay [last accessed] 9th June 2017 [online] available: https://www.ebay.co.uk/

Gloucestershire County Council Waste Team - [last accessed] 9th June 2017 [online] available: www.recycleforgloucestershire.com/article/118305/Joint-Waste-Team

Green Gown Awards [last accessed] 9th June 2017 [online] available: www.greengownawards.org/2016-finalists

Hackerspaces.org – [last accessed] 9th June 2017 [online] available hackerspaces.org

Hewlett-Packard - [last accessed] 9th June 2017 [online] available: http://www.sustainablebrands.com/news_and_views/business_models/coro_strandberg/circular_economy_action_hp_leading_way

IT Schools Africa - [last accessed] 9th June 2017 [online] available: www.itschoolsafrica.org/

Jordan P. (2002) Pleasure with Products : Beyond Usability, Edited by Patrick W. Jordan

LIFT (2016) – last accessed] 9th June 2017 [online] available: sustainability.glos.ac.uk

Love your Cloths – [last accesses] 9th June 2017 [online] available loveyourclothes.org.uk/about

Lovins, A.B., Braungart, M., Stahel, W.R., Birkland, J., Goerner, S., Spicer, D., Tuppen, C., Voller, R., Webster, K., Hopkinson, P., Mulhall, D. and Sempels, C. (2013) A New Dynamic, Effective Business in a Circular Economy, Ellen MacArthur Foundation Publishing, p.p. 26-27

MakerSpace – [last accessed] 9th June 2017 [online] available: makerspace.com

Parker, D., Morley, N., Eatherley, D., Sprong, N., Arendorf, J., Derbyshire, P., Fryer, A., Giorgi, S., King, G. and Cooper, T. (2012) Understanding the Opportunities to Increase Re-use and Repair, Report by Oakdene Hollins, Brook Lyndhurst and Nottingham Trent University for WRAP, Banbury: WRAP Platform21 (2016b) 'About us'. - [last accessed] 9th June 2017 [online] available: www.platform21.nl/page/133/en

RCE Severn - [last accessed] 9th June 2017 [online] available: sustainability.glos.ac.uk/partnerships/partners/

Repair Café – [Last accessed] 9th June 2017 [online] available: repaircafe.org/en/

Rosner, D. K. (2012) 'Devices: On Gender and the Development of Contemporary Public Sites of Repair in Northern California', Public Culture, Vol. 26(1): p.p.51-77

Ryan, A. and Tilbury, D. (2013) Uncharted waters: voyages for Education for Sustainable Development in the higher education curriculum, International Research Institute in Sustainability (IRIS), University of Gloucestershire, Cheltenham, UK. Publisher: Routledge, London, UK [last accessed] 9th June 2017 [online] available: sustainbility.glos.ac.uk

Salvia, G., Cooper, T., Fisher, T., Harmer L. and Barr, C. (2015) What is broken? Expected lifetime, perception of brokenness and attitude towards maintenance and repair, PLATE (Product Lifetimes and the Environment) Conference proceedings, 17-19 June 2015, Nottingham, UK. - [last accessed] 9th June 2017 [online] available: www.ntu.ac.uk/plate_conference/proceedings/index.html

Scott, K. A. and Weaver, S. T. (2014) 'To repair or not to repair: What is the motivation?', Journal of Research for Consumers, 26, - [last accessed] 9th June 2017 [online] available: http://jrconsumers.com/Academic_Articles/issue_26/Issue26-AcademicArticle-Scott1-31.pdf

SuperDry [last accessed] 9th June 2017 [online] available: https://www.superdry.com/

Tilbury, D. and Cooke, K. (2005) 'A National Review of Environmental Education and its Contribution to Sustainability in Australia: Frameworks in Sustainability'. Canberra: Australian Government Department of the Environment and Heritage and Australian Research Institute in Education for Sustainability. Vol 1 ISBN: 1 74138 078 2

Tilbury, D. (2011) 'Education for Sustainable Development': An Expert Review of Processes and Learning' Paris UNESCO. Available in Spanish, French and English ED- 2010/WS/46

University of Gloucestershire [last accessed] 9th June 2017 [online] available: http://sustainability.glos.ac.uk/

Vision 21 - [last accessed] 9th June 2017 [online] available: http://www.vision21.org.uk/

When in Rome [last accessed] 9th June 2017 [online] available: https://wheninromewine.co.uk/

Wilson Gallery [last accessed] 9th June 2017 [online] available: http://www.cheltenhammuseum.org.uk/

WRAP [last accessed] 9th June 2017 [online] available: http://www.wrap.org.uk/