Transforming Mind-sets of Product Design Students Towards Sustainable Product Service Systems: The Case of the University Of Botswana

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Structure:

1. Introduction
2. Theoretical framework
3. Methodology
4. Results
5. Discussion
6. Conclusion
Introduction:

Current Business Models

Increased Consumption

Energy, Water & Materials

Sustainable Product-Service Systems (S.PSS)

Applied Meaningful

Distributed Renewable Energy systems (DRE)

Institutions of Higher Learning

Must produce students

Responsive & Proactive Global Sustainability Crisis
Research explored

S.PSS applied to DRE

Taught & Learned by Design students

Enrolled Traditional Product Design Programs

Results/Findings inform Pedagogy & Context

Interactive Resource informing Teaching & Learning

WHERE?

Non-Conventional Learning Spaces
Design Students

Design Challenges

Product Service Systems

approach

Positive Transition

Towards

Service-Oriented Solutions

leading to

Sustainable Culture
Countries striving to attain sustainable societies

New Systematic Approach

Radical Redefinition

Production & Consumption

Energy and materials

Re-orientate Current Standards

Production & Consumption

Biggest Concerns

Global catastrophe

"To combat the current global challenges, a sustainable PSS is a promising alternative"

(Manzini & Vezzoli, 2003; Valencia et al., 2015; Ceshin, 2013; Baines et al., 2007; Beuren, 2013)
University of Botswana seeks to contribute to Sustainable Industrial Development of their country by Equip design students with S.P.SS knowledge & Skills. New Generation designer will Assist Botswana leapfrog and Avoid mistakes committed by other countries. The aim is to inculcate the values of S.P.SS in design students to mitigate economic, environmental and socio-ethical. Anticipated that new crop of designers will contribute towards a sustainable future and construct service-oriented strategies.
**PSS:**

- An *innovation strategy that shifts the business focus* from only designing and selling physical products.

- To *designing and selling* a competitive system of products and services which are jointly capable of fulfilling specific *client demands* with lower *environmental impacts*.

- *Selling the use* is more emphasised than *selling the product itself* (Pergande, 2012).

- A *mix of tangible products and intangible services* designed and combined so that they are both capable of fulfilling *customer needs* (Tischner, Verkuiji & Tukker, 2002; Baines et al., 2007).

- *Designed to be more competitive, satisfy customers and social demands by reducing consumption of material products through product service solutions over products ownership.*
Theoretical framework


PSS categorised into three areas:

1. Product oriented PSS:
   • Ownership rights of the product are transferred to customer & a service arrangement is provided to ensure utility of the product over a given period of time. Examples: warranties & maintenance contracts;

2. Use oriented PSS:
   • Ownership rights of the product are retained by the service provider
   • Customer purchases use of the product over a given period of time or units of service

3. Results oriented PSS:
   • Ownership rights of the product are retained by the service provider, similar to use oriented PSS,
   • Customer purchases the utility as an outcome and not the use of a product over a given period of time
   • Example: Instead of purchasing a washing machine, the customer purchases the service of clean clothes delivered through a washing service.
• Qiu (2010) posited that sustainability concerns have an impact on teaching approaches.

• What people learn, how they learn, and where they learn will radically change in future

• There is a need to make the transition towards a service economy and sustainable culture,

• It’s imperative to inculcating the same values in the students because they are future leaders.

• Require Cultural shift to redefine customer needs away from product ownership (Manzini & Vezzoli, 2003).

• Ceschin (2013) advances that there is need to move from focus on product improvements only, towards a wider systematic approach (considerations new potential ways of satisfying the social demand of well-being)
Advantages gained by implementing S.PSS and applying S.PSS to DRE

Benefits relate to service providers, consumers, governments, the environment, and society at large since they are drivers of PSS in their different capacities (Boehm & Thomas, 2013; Emili et al, 2016).

Major benefits of the PSS are focused on the continuous improvement of the business, innovation in quality, and the satisfaction of consumer demand.

Results in building long lasting relationships and fostering loyalty among consumers.
Methodology:

UB students → Loose opportunity to learn → strategic design for sustainability

Since design for sustainability → Offered as optional courses

Reporting case study → Conducted with Design students at UB
## Source of Ideas about Behaviour

<table>
<thead>
<tr>
<th>Offers opportunities for Innovation</th>
<th>Resulting from New Service Development</th>
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<tr>
<td>Challenges theoretical assumptions</td>
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<td>Understanding /Explaining Links &amp; pathways</td>
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(Yin, 2009; Crowe et al., 2011).
Evidence for case study

Collected mainly

- 2-week workshop involving User research,
- Brainstorming Sessions
- Exploring Possible solutions
- Structured Presentation to share outcomes
Research question was in part addressing aim number three of the LeNSes project;

“Delivering these curricula through an innovative teaching approach...” (Vezzoli, et al, 2015: 135).

Workshop participants consisted of 41 fourth year students from the Bachelor of Design (D & Technology Education)

Experts from research institutions on renewable energy, energy companies, government departments and academic experts on DRE & S.PSS contributed

Sample was also on the verge of undertaking their Major Design Project course the following semester.
Understanding user needs and problems with teachers at a primary school in Old Naledi Community
Workshop came at the right time to equip participants with sustainable PSS & DRE knowledge to further apply into their major Design Project.

Workshop was structured to include lectures, practical activities and field visits.

Students were given lectures on sustainable development, sustainable design, sustainable product service systems and distributed renewable energy systems.

Followed by a field trip to facilitate user research on the launched design exercise.

With a pre-requisite knowledge about sustainability, PSS and distributed renewable energy systems, the students were now able to undertake the design exercise.
### 2 briefs for the design exercise.

**Design exercise and final Expected Outcome**

<table>
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<tr>
<th>Briefs</th>
<th>Final expected outcome</th>
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<tr>
<td>1. Design a <strong>Product-Service System</strong> to improve safety of townships by providing light and security to public, passages and open spaces which are not lit at night</td>
<td>- Summary of <em>problem and user analysis</em>&lt;br&gt;- Offering diagram&lt;br&gt;- Concept description&lt;br&gt;- Interaction storyboard&lt;br&gt;- Details on the energy system and ‘energy using products’&lt;br&gt;- Details on services&lt;br&gt;- Details on the payment structure&lt;br&gt;- Stakeholder system map&lt;br&gt;- Sustainability potential</td>
</tr>
<tr>
<td>2. Design a <strong>Product-Service System</strong> to assist students from low-income and rural areas to study at night</td>
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Ability to develop Sustainable Product Service system solutions for distributed renewable energy systems formed the foundation provided by lectures

**Summary of the Workshop Structure**

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<th>Phase</th>
<th>Workshop activity</th>
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<tr>
<td>1</td>
<td>• Introduction of the workshop aim&lt;br&gt;</td>
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<td></td>
<td>• Launch of the design exercise&lt;br&gt;</td>
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<td></td>
<td>• Lectures</td>
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<td>2</td>
<td>• Lectures&lt;br&gt;</td>
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<td></td>
<td>• Field visit&lt;br&gt;</td>
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<tr>
<td></td>
<td>• User research and problem framing</td>
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<tr>
<td>3</td>
<td>• Lectures&lt;br&gt;</td>
</tr>
<tr>
<td></td>
<td>• Brainstorming - solution seeking</td>
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<tr>
<td>4</td>
<td>• Solution detailing and presentations</td>
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Qualitative data generated was handled using thematic analysis (Miles and Huberman, 1994).

Analytical question was:

How did students absorb new S.PSS & DRE knowledge & reflect it in their outcomes?
Experimentation with teaching and learning of S.PSS applied to DRE was conducted in a workshop setting.

Practical component of the teaching and learning was the design exercise.

Context as Interactive Resource

Understanding of the local context elicited important information on users and their energy needs.

Groups demonstrated themes by profiling of users as described personas or a visual representation.

Provided useful insights through the emphatic approach adopted during the field trip to the Old Naledi community.
Interaction with the environment and the people, who live and work there, uncovered and shaped what should be investigated, how it should be investigated and possible configuration of the outcomes.

Different approach when compared to the classroom-based approach.

Classroom scenario, context is not explicitly planned into the learning activities to be a resource.
Non-Conventional New Learning Spaces

Facilitating the acquisition and assimilation of new knowledge meant that the new learning space had to be defined.

Framework was developed.

Treating both energy issues (DRE) and business model issues (S.PSS) at the same time were evident in the students’ work.

New concept in a non-conventional learning way prescribed new learning spaces for learning S.PSS and DRE.

Dynamic learning environment were evident where students constantly consulted various experts.

Defining parameters of this new learning space was the flexibility to consult academics, industry experts and members of the community within a manageable space of time.
Expert consultation going on at the same time
Integrated Use Of Enabling Tools

Socio-Technical rigour of S.PSS and the Technical Perspective of DRE required that students use tools to effectively communicate both Qualitative and Quantitative data.

Qualitative tools often allowed for exploring holistic systemic issues, defining actors and their roles, products and possible services.

what a DRE-S.PSS offer could look like in various models, customers and their roles as well as payment modalities and system benefits.
Idea generation map allowed students to build narratives and express situations in the local context.

Quantitative tools such as the system information tool provided technical rigour in student solutions.
Learning & Problem Solving through Networking

Diversity of human capital involved in the workshop provided students with opportunities for networking and having access to new knowledge from various people.

Experts from research institutions, energy companies, government departments and members of the Old Naledi community.

Between PSS and DRE was linked through bringing experts on PSS and DRE and energy systems together under one roof.

Created a platform for cross-pollination of ideas, thus defining how PSS can be practically applied to DRE in Botswana.
Participants networking with stakeholders in Old Naledi Community
Process Reflective Outcomes

Outcomes from all the **ten groups** were a reflection of the **integration of principles** explored through the **design exercise** and **lecture structures of the workshop**

**Offering diagrams** from the students reflected **local community structures** such as the **Village Development Committee**, local manufacturers/providers and **payment modalities** that are applicable in the **local context**

**Understanding of who the stakeholders are and what their roles will be**, a **stakeholder system map**

**How they will relate** to each in a **system win-win scenario**,

**Customer meets their needs** and the **providers make profits at no or minimal cost** to the environment.
Sample **Offering Diagram** from one of the groups
Sample Stakeholder System Map

1. Village Development Committee pays to purchase charging station
2. Installation of Charging Station
3. Training
4. Offers
5. User pay per energy consumed
6. Training

- Bulbs & lights
- Power bank

Parents & Children
Discussion:

For students to develop these solutions, they had to overcome a dominant and established cultural barrier of designing products for ownership as opposed to designing solutions based on sharing and access.

Knowledge imparted through a series of lectures and the design exercise regarding S.PSS and DRE assisted students to overcome that cultural barrier and facilitated the design of solutions based on S.PSS in a systemic landscape.

Could be argued to be an innovative teaching approach given that it took place outside the conventional lecture room environment, but directly informed the students’ design skills base.

Conducting user research and building familiarity with the context during S.PSS and DRE teaching and learning could help develop valuable solutions which are systemic in nature and appropriate for the users in the given context.
To build awareness on resources available in the physical environment and how fragile they are, so that social and economic development issues are cautious of a rebound effect.

Constant interaction with the community, experts and knowledge of the energy situation in Botswana by students who participated in the workshop is an example of this measure.

What people learn, how they learn, and where they learn will radically change in future.

Need to make the transition towards a service economy and sustainable culture,

It’s imperative to start inculcating the same values in the students because they are the future leaders. This requires a cultural shift to redefine customer needs away from product ownership.
Students projects show a transition from a product-orientated solution to a S.PSS approach.

UB sees S.PSS knowledge and skills vital to their design students so that they can contribute to addressing issues of national concern in their country.

Dynamic teaching and learning environment could also promote self-directed learning especially where students see the practical value of acquiring new knowledge and skills.

Through constant networking and direct interaction with real people, real needs and the real environment, values of transfer of academic concepts into the real world are made simpler.

The S.PSS approach advances the strategic position of design in sustainability, which requires a retrofit of the teaching and learning environment in universities such that communication of the service component to student designers in a product design undergraduate programme is not an alien abstraction.
Conclusion:

Case study approach offered an opportunity to explore two issues

Firstly,

- To conduct teaching and learning of sustainable product service systems in a localised context where systemic problems were identified

After identifying the problem, students used a system thinking approach to develop the solutions.

That is, using a set of synergistic analytic skills used to improve the capability of identifying common elements and understanding their interconnection, predicting their behaviours, and devising modifications to them in order to produce the desired effects and viewing systems as a whole rather than as parts.

Secondly,

These activities took place in the usual environment of teaching and learning for these students.
Conclude that learning sustainable product service systems in existing structures of product design require a change in pedagogy over a period of time.

This process should be supported by local and social settings in terms of learning resources and examples that can demonstrate the practicability of PSS.

The findings indicate that there was a trajectory through which student designers developed a mind-set change after being introduced to product service systems and DRE.

Though S.PSS is still a new business concept in new emerging economies, it has proved to have the potential to address economic, socio-ethical and environmental challenges facing the society such as exploitation of renewable energy systems in developing contexts.

A recommendation for future scaling up of this initiative could be to work closely with education ministries so that the concept is trickled down to lower levels in the education system, as opposed to end of pipe approaches currently being implemented only at university and corporate levels.