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**Subject: Creative and Critical Thinking in the Classroom**

**Part I: Introduction**

**Responsible Design for Product and Apparel Industries**

Product development begins with a concept or idea; The beginning stages in design starts as a creative process. The process needs specific motivations to allow intuitive thought, brainstorming, conceptual visualization, and critical thinking of the product while maintaining acceptable levels of economic feasibility. In order for the entire process to remain cohesive, challenges are set to create a variety of paths as problem solving evolves. Problem solving for responsible design needs to be integrated in all parts of the creative process and continued throughout the product development stages of manufacture as well as distribution and disuse of the product. In order to develop responsibly designed products each of the following four categories needs to be researched and then critically examined during each step of the products lifecycle.

The term “Cradle to Cradle” is how a product is problem solved with “Bio- Mimicry”. By mimicking nature, a product can be designed and built with regenerative elements for no waste and no destruction to the planet. This will include sourcing raw materials, versatility of the product, supply chain management, ethics and reducing the carbon footprint.

<https://epea.com/en/about-us/cradle-to-cradle>

<https://link.springer.com/referenceworkentry/10.1007%2F978-3-642-28036-8_165>

**Four Categories for Responsible Design in Product Development**

Responsible sourcing of fibers without impact to the environment/worker/ animal. Material sourcing that includes “ Green” labeling standards; bio-degradable

<https://www.global-standard.org/>

<http://www.ecolabelindex.com/ecolabels/?st=category,textiles>

<https://www.oeko-tex.com/en/our-standards/made-in-green-by-oeko-tex>

<http://www.welspunindia.com/environment_management/Welspun%20Sustainability%20Report_2015-16%20(1).pdf>

<https://www.onlineclothingstudy.com/2018/01/wel-track-rfid-based-fibre-tracking.html>

<https://www.peopletree.co.uk/about-us>

**1.Raw Materials for Fabrics**

**Certified Organic Cotton**- Plant fiber- Certification tracks the identity and use from farming, production, finishing, sewing , retail. There are 2 Certifications: OCS- Organic Content Standards and GOTS Global Organic Cotton Standards. Research why cotton must be certified organic for responsible design/development

<https://www.global-standard.org/>

<http://aboutorganiccotton.org/organic-certification/>

<https://ota.com/advocacy/fiber-and-textiles/get-facts-about-organic-cotton>

<https://organiccotton.org/oc/Cotton-general/Impact-of-cotton/Risk-of-cotton-farming.php>

<https://www.commonobjective.co/article/made-by-environmental-benchmark-for-fibres>

[www.cottonworks.com](http://www.cottonworks.com) , [www.cotton.inc](http://www.cotton.inc)

**Hemp-** Plant fiber **-**Ban on growing hemp due to its associative plant with the illicit drug ;the Marijuana Act was passed in 1937, it fell out of favor due to its association with the illicit drug. It is considered a “Green Fabric” back in favor due to its being part of the sustainable fibers and non-polluting lifer cycle. Little is still grown in the US. Non-toxic, non-polluting, renewable, produces oxygen, controls topsoil erosion. (Under this category of plant based fibers is **Linen, Ramie and Jute**- All have little to no need for pesticides and can be organically grown and processed)

<https://recreator.org/blogs/hemp-101/hemp-101-a-traditional-method-of-hemp-textile-production>

<https://cfda.com/resources/materials/detail/hemp>

**Wool-**Protein fiber- can be 100% sustainable. Eco-wool includes healthy livestock practices, grazing rotation to eliminate field erosion, organic grazing (food). Fiber is biodegradable, can be recycled, and produced organically.

<https://textileexchange.org/responsible-wool/>

<https://www.theguardian.com/sustainable-business/sustainability-performance-textiles-wool-environment>

<https://www.woolmark.com/about-wool/wool-fibre/>

**Wild / Cultivated Silk-** Protein Fiber- considered fully sustainable ; but due to ethical considerations due to the destruction of the lifecycle of the silkworm there is much controversy on whether this is a responsible fiber. **Wild or Ahimsa( Peace silk)** allows the completion of the lifecycle, but the end product fibers are broken; they can be used but the quality is not as consistent as luxurious as cultivated silk.

<https://qz.com/quartzy/1309227/asos-is-banning-silk-but-is-it-really-unethical-to-wear/>

<https://goodonyou.eco/is-silk-sustainable/>

<https://goodonyou.eco/ethical-silk-alternatives/>

**Synthetics and Semi-Synthetics**

**Eco friendly Rayon** ( semi synthetics) -Conventional production releases carbon disulfide into the atmosphere and salt into water supplies. Known to destroy rainforests due to the destruction of trees,. Ecofriendly alternatives: Lyocell, Modal and some Bamboo rayon they use organic solvent and rapidly renewable tree regeneration.

<https://ecocult.com/greenwashing-alert-that-natural-fabric-made-from-plants-might-be-toxic/>

<http://ecosalon.com/fiber-watch-tencel-the-tenable/>

<https://www.biopreferred.gov/BioPreferred/>

**Biotechnology- Biopolymers -** Integration of biology, microbiology and chemical engineering to create fibers/fabrics  **Bolt Threads-** The study of spider silk DNA is replicated to mimic the properties and characteristics of silk without harming living organism. Invest in new technology for better effects on the environment.

<https://goodonyou.eco/ethical-silk-alternatives/>

<https://madebylandandsea.blogspot.com/2017/09/the-itsy-bitsy-spiber.html>

<https://boltthreads.com/technology/microsilk>

<https://www.spiber.jp/en/about/>

**Recycled Polyester-** Polyester is one of the largest polluting fibers and non- responsible fibers in production and end use. Over the last few years organizations such as Parley for the Oceans and Plastic soup have been recovering plastic bottles for recycling. Many have been recycled to make fiber for fabric. This has also been an issue due to the fact that it is still polluting in the process of recycling it into a fiber and the end result of it not being bio-degradable. However, many strides in developing more responsible recycled polyester have been entering into the production side to eliminate some of the issues.

<https://www.parley.tv/#fortheoceans>

<https://www.plasticsoupfoundation.org/en/>

<https://www.youtube.com/watch?v=BlInCFUQtuU>

<https://www.bionicyarn.com/>

<https://en.guppyfriend.com/>

**2.Versatility of Product**

Quality in manufacture /reducing waste/ new technologies**,** efficiency of design, a longer life span to the product, adapting better or fuller use of the product, products built to last a long time. Reestablishing value guidelines: Encourage product care, “cradle to cradle”-(recycled/upcycled), basics that can function in more ways than one. Slow down excessive waste of ( overproduction) by creating better quality products.

<https://buymeonce.com/>

<https://gabrielfariasiribarren.com/en/global-versatile-textile-industry/>

<https://remake.world/stories/style/how-to-outsmart-fast-fashion-buy-buying-fewer-better-things/?gclid=EAIaIQobChMI66n4vtS96AIVibWzCh2xfQHcEAAYASAAEgJYIfD_BwE>

<https://www.mckinsey.com/business-functions/sustainability/our-insights/style-thats-sustainable-a-new-fast-fashion-formula>

<https://www.thewellessentials.com/blog/why-quality-is-important-for-sustainability>

**3.Supply Chain Management**

Mainstreaming the supply chain process through cost efficiency, risk and waste management. Minimalize long distance shipping with strategic distribution centers and factories, new technology, computer software programs for “real time” PLM (Product Lifecycle Management) decision making and design prototypes.

<https://www.mckinsey.com/business-functions/sustainability/our-insights/starting-at-the-source-sustainability-in-supply-chains>

<https://hbr.org/2010/10/the-sustainable-supply-chain>

<https://www.unglobalcompact.org/what-is-gc/our-work/supply-chain>

**4. Ethics and Reducing the Carbon Footprint**

Compliance: Rules /regulations to uphold responsible standards for humans/animals in workplace. Support safe working conditions, appropriate pay, anti- corruption, end child labor and environmental awareness. Safety from toxic chemicals in printing and dyeing. Manufacturing- Reduction of supply chain emissions, renewable electricity, responsibility towards restoring forests, shrubbery, wetlands, harvesting lakes. Transport of finished goods through bio sourced energy. Bio-degradable packaging and compostable containers- bags, cut down on water usage , CO2 emissions,. Solar panels in stores and factories, **tracing the environmental footprint of different fabrics, cutdown on landfill dumping,** upcycling.

<https://www.achilles.com/industry-insights/need-know-supply-chain-ethics/>

<https://www.scientificamerican.com/article/green-chemistry-benign-by-design/>

<https://www.scmr.com/article/the_ethical_supply_chain>

<https://youtu.be/XcqoKIBH960>

<https://www.welspunindia.com/environment_management/BusinessResponsibiliyReport_2018-19.pdf>

<https://www.qualitylogoproducts.com/blog/how-big-brands-are-going-green/>

<https://www.theguardian.com/sustainable-business/2017/jul/10/100-fossil-fuel-companies-investors-responsible-71-global-emissions-cdp-study-climate-change>

<https://anthropocenemagazine.org/launch-team-2/>

**Part II**

**Assignment: Creating a Responsible Product and Development Proposal**

**Objective:**

Designing and developing a “Responsible” product will encounter many roadblocks. Along the chain of responsible design, traditional models of manufacture must be critically reviewed, and alternative paths may need to be researched when an encounter of non-sustainable measures occur. Critical thinking occurs when a procedure along the traditional manufacturing chain would need to be evaluated and replaced with a more responsible one. Researching alternative paths will result in the redirection of the creative design process. Some materials or procedures along the chain may start out responsible but further along the supply chain they may no longer achieve responsible outcomes. Rather than discarding a plan, brainstorming alternative short term solutions that counteract the non-sustainable part of the process may allow the continuation of the development of the product. The goal is for all 4 areas to be an integral part of a responsibly designed product.

**Part A: Preparation and Research for “Responsible Product Development” 100pts**

**Part B: Presenting a Logical and Ethical “ New Responsible Product Idea 100pts**

**100pts Part A: Preparation and Research for “ Responsible Product Development”**

Students will be teamed in groups of 4 (with one industry /mentor) to conduct research and gather investigative information in four specific areas of a product development from cradle to cradle. The team will choose a current tangible product and each student is responsible for including the following information that will be presented as a research paper:

**20pts 1.** Choose a product to research. Determine if this product is currently considered responsible from cradle to cradle by researching the product’s raw materials, versatility, supply chain management , ethics during manufacture and carbon footprint.

**20pts 2.** Raw materials: Review 5 sustainable raw materials that could be used or substituted for the product. Discuss any “Green” labeling you come across

**20 pts 3.** Versatility of Product**.** Review and discuss the lifecycle of the product from purchase to disuse.

**20 pts 4.** Supply Chain Management: Research and discuss each step needed in the supply chain for the product chosen.

**20 pts 5.** Ethics and Reducing the Carbon Footprint; Research rules /regulations to uphold responsible standards for humans/animals in workplace. Safety from toxic chemicals in printing and dyeing. Manufacturing- Reduction of supply chain emissions, renewable electricity, responsibility towards restoring forests, shrubbery, wetlands, harvesting lakes. Transport of finished goods through bio sourced energy. Bio-degradable packaging and compostable containers- bags, cut down on water usage , CO2 emissions,. Solar panels in stores and factories, **tracing the environmental footprint of different fabrics, cutdown on landfill dumping,** upcycling.

**Part A Rubric Responsible Product Development**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Categories** | **20-16pts** | **15-11points** | **10-6 points** | **5-0 points** | **20 Points** | |
| **1. Research Similar Product** | Research provided complete development of the product from cradle to cradle | Research provided majority development of the product from cradle to cradle | Research provided some development of the product from cradle to cradle | Research provided little to no development of the product from cradle to cradle | | **20pts** |
| **2.Raw Materials** | Research explains 5 sustainable materials in relation to product | Research explains only 3-4 sustainable materials in relation to product | Research explains only 2 sustainable materials in relation to product | Research explains only 1-0 sustainable materials in relation to product | **20pts** | |
| **3.Versatility of Product** | Research demonstrated complete efficiency of the lifecycle of product | Research demonstrated the majority of efficiency of the lifecycle of product | Research provided some efficiency of the lifecycle of the product | Research provided little to no efficiency of the lifecycle of the product | **20pts** | |
| **4.Supply Chain Management** | Explanation of supply chain management offers complete information | Explanation of supply chain management offers most of the information | Research of supply chain management offers incomplete information | Research of supply chain management offers little no information | **20pts** | |
| **5.Ethics/Carbon Footprint** | Details of regulations are complete | Details of regulations are missing some information | Details of regulations are missing the majority of information | Details of regulations have little to no information | **20pts** | |

**Part B: Presenting Logical and Ethical Product Development Decisions**

Students will orally present and pitch a new “Responsible” product idea from cradle to cradle. Research from Part A will be analyzed and provide support to the team as they creatively and critically develop a product that demonstrates integral paths towards responsible design development.

20pts 1. Student/team will propose a plan for a new responsible product that includes features of product and sustainable materials

20pts 2. Student/team will present problem solving and critical thinking in the versatility of the product

20pts 3. Student/team will demonstrate a responsible supply chain management plan of the product

20pts 4. Student/team will discuss development improved ethics and carbon footprint within production and end use of the product

20pts 5. Students will summarize their success and evaluate their roadblocks along with alternative solutions to complete their goal of a responsibly developed product.

**Part B Rubric A New Responsible Product Idea**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Categories** | **20-16pts** | **15-11points** | **10-6 points** | **5-0 points** | **20 Points** | |
| **1. New Product Plan /Features and Sustainable Materials** | Presentation provided detailed tangible features and materials relating to sustainability | Presentation provided moderate detailed tangible features and materials relating to sustainability | Presentation provided some detailed tangible features and materials relating to sustainability | Presentation provided little to no detailed tangible features and materials relating to sustainability | | **20pts** |
| **2.Critical Analysis of Versatility of New Product** | Excellent critical analysis of the versatility of product | Good critical analysis of the versatility of product | Moderate critical analysis of the versatility of product | Little to no critical analysis of the versatility of product | **20pts** | |
| **3. Responsible Supply Chain Plan** | Excellent decision-making for organization skills for a responsible supply chain | Good decision-making and organization skills for a responsible supply chain | Moderate  decision-making and organization skills for a responsible supply chain | Little to no  decision-making and organization skills for a responsible supply chain | **20pts** | |
| **4. Development of Improved Ethics and Carbon Footprint** | Demonstrates an excellent plan for improved ethics and carbon footprint | Demonstrates a good plan for improved ethics and carbon footprint | Demonstrates a moderate plan for improved ethics and carbon footprint | Demonstrates little to no plan for improved ethics and carbon footprint | **20pts** | |
| **5.Evaluation of Success/**  **Roadblocks and Solutions from cradle to Cradle** | Excellent evaluation of product success/ roadblocks from cradle to cradle | Good evaluation of product success/ roadblocks from cradle to cradle | Moderate evaluation of product success/ roadblocks from cradle to cradle | Little to no evaluation of product success/  roadblocks from cradle to cradle | **20pts** | |

**NSF GRANT APPLICATION LIBRARY LESSON ASSESSMENT PLAN**

**Lesson Title:**  Creating a Responsible Product and Development Proposal

**Author:** Professor Lisa Steinberg

**LESSON OUTCOMES**

Students should be able to:

1. Work as a team while conducting research

2.Provide critical analysis in areas of responsible product development

3.Conceptually design a product with sustainable features

4.Research ethics in product manufacturing

**ASSESSMENT**

**The Plan – Means of Assessment & Criteria for Success**

A. Means of assessment:

**First assignment:** Working in a team of four, conduct research and gather investigative information for the “Responsible Product Development” assignment in four specific areas of a product development from cradle to cradle.

**Second assignment**: Create an oral presentation using research from previous assignment to present and pitch a new “Responsible” product idea from cradle to cradle.

B. To whom: All students enrolled and participating in [course]

C. By whom: All faculty of students enrolled and participating in course

D. When: semester

E. Criteria for Success:

Criteria for Success:

First assignment: 80 percent of students will score at least 70 out of 100 possible points on the “Responsible Product Development” rubric.

Second assignment: 80 percent of students will score at least 70 out of 100 possible points on the “A New Responsible Product Idea” rubric.

**RESULTS**

**Summary of Assessment Data Collected**

Data Results:

**STEP 5: Use of Results to Improve Instructional Program**

Criterion for success was met or not met:

Reflective Summary: