LP2: Exploring Alternative Solutions for Sustainable Textile Production

Target Audience

Vet Trainers

Goal (50-60 words)

The goal of this lesson plan is to equip trainees with knowledge and practical skills in sustainable textile production, focusing on eco-friendly materials, methods, and innovative solutions to minimise environmental impact. VET trainers will help trainees gain expertise in sustainable textiles, enhancing their problem-solving abilities, innovation, and industry readiness for a greener future.

Objectives (1-3 Objectives)

Upon completing the module, your trainees should be able to:

1. Identify and evaluate sustainable materials and production techniques in textile manufacturing: Trainees will gain the ability to critically evaluate the environmental benefits and drawbacks of different techniques, helping them make informed decisions in textile production.

2.Design and implement sustainable practices in textile production: Trainees will develop the ability to create and apply sustainable production strategies, ensuring environmentally friendly practices are integrated into the textile manufacturing process.

When this lesson plan is applied, VET trainer's trainees will gain practical skills to **apply** sustainable production techniques and **create** prototypes using eco-friendly materials. They will develop analytical abilities to **analyse** and **evaluate** the environmental impacts of different production methods, fostering critical thinking. Trainees will **design** and **recommend** innovative solutions and best practices, enhancing their problem-solving skills. Additionally, by **assessing** market demand and **explaining** the

benefits of sustainable textiles, trainees will be well-prepared to meet industry needs and advocate for sustainability.

Optional
Theoretical Background

Sustainable Alternatives

Eco-friendly Materials: Using organic cotton, recycled fibres, and other sustainable materials can reduce the environmental footprint of textiles. (Rauturier, 2024)

1. Organic Cotton:

- **Definition:** Organic cotton is grown without synthetic pesticides, herbicides, and fertilisers, relying on natural processes.
- **Benefits:** Reduced chemical usage leads to lower environmental contamination, enhanced soil fertility, and improved health for farm workers. Organic cotton also typically uses less water compared to conventional cotton.
- **Lifecycle Impact:** From cultivation to disposal, organic cotton generates fewer greenhouse gases and reduces water pollution. (Soil Association)

2. Recycled Fibres:

- **Definition**: Recycled fibres are made from repurposed materials such as plastic bottles or post-consumer textile waste.
- **Benefits**: Using recycled fibres helps reduce waste in landfills and decreases the need for virgin raw materials, thus saving energy and resources.
- **Lifecycle Impact**: Recycling reduces the environmental footprint associated with raw material extraction, processing, and waste management. It also diminishes carbon emissions. (Recycling Fibres)

3. Other Sustainable Materials:

- **Bamboo**: Known for its rapid growth and minimal need for pesticides, bamboo can be processed into soft and durable fabric. (Performance of Home Textiles, 2010)
- **Hemp:** A highly renewable resource that grows quickly and requires minimal chemical inputs. Hemp fabric is strong, durable, and biodegradable. (Textile Exchange)
- **Tencel (Lyocell):** Made from sustainably sourced wood pulp, Tencel fibres are produced using a closed-loop process that recycles solvents, reducing environmental impact. (Tencel)

Environmental Footprint Reduction

The environmental footprint of textiles encompasses several factors, including water usage, chemical pollution, carbon emissions, and waste generation. Eco-friendly materials significantly mitigate these impacts through the following mechanisms:

1. Water Conservation: Organic cotton and certain sustainable fibres, like hemp, require less water for cultivation compared to conventional cotton. Recycled fibres also save water by repurposing existing materials.

2. Reduced Chemical Use: Organic and sustainable materials often avoid or minimise synthetic chemicals, reducing soil and water contamination and promoting biodiversity.

3. Lower Carbon Emissions: The production and processing of eco-friendly materials typically generate fewer greenhouse gases. Recycled fibres, in particular, save energy compared to the production of virgin materials.

4. Waste Reduction: Recycling fibres and using biodegradable materials help decrease textile waste, promoting a circular economy.

Incorporating eco-friendly materials like organic cotton, recycled fibres, bamboo, hemp, and Tencel in textile production is essential for creating a more sustainable industry. These materials not only reduce the environmental footprint but also support the well-being of ecosystems and communities involved in the textile supply chain. Emphasising the use of sustainable materials can drive innovation and lead to a more responsible and eco-conscious textile sector. (Rauturier, 2024)

Useful links:

https://goodonyou.eco/most-sustainable-fabrics/

https://stateofmatterapparel.com/blogs/som-blog/35-sustainable-materials-for-eco-friendly-fashion

Eco-friendly Dyeing and Printing Techniques: Techniques like natural dyeing, low-water dyeing, digital printing, and their environmental benefits.

1. **Natural Dyeing**:
    - **Definition**: Uses dyes from natural sources like plants, minerals, and insects.
    - **Benefits**: Biodegradable, non-toxic, and requires less water and energy.
    - **Challenges**: Colour consistency and fastness can be variable.
2. **Low-water Dyeing**:
    - **Definition**: Techniques that significantly reduce water usage.
    - **Methods**: Air dyeing, foam dyeing, high-density dye baths.
    - **Benefits**: Conserves water and reduces wastewater and energy consumption.

Eco-friendly Printing Techniques

1. **Digital Printing**:
    - **Definition**: Applies patterns directly onto fabric using inkjet technology.
    - **Benefits**: Reduces water and ink waste, allows precise application, and lowers energy consumption.

Environmental Benefits

1. **Water Conservation**:
    - Significantly reduces water usage compared to traditional methods.
2. **Reduction in Toxic Chemicals**:
    - Uses natural dyes and less harmful chemicals, reducing toxic effluents.
3. **Energy Efficiency**:
    - Requires lower temperatures and less processing time, saving energy.
4. **Waste Reduction**:
    - Produces less waste, and any waste generated is less harmful and often biodegradable. (Vibe Fabriclore, 2023)

Useful links:
https://www.colorashram.com/blog-3/ufrngn7kovxoci0x6myvv7ydby13xu#:~:text=Eco%20printing%2C%20also%20known%20as,boiled%20to%20extract%20the%20dye.
https://fabriclore.com/blogs/textiles/sustainable-dyeing-and-finishing-methods-in-textile-industry
https://www.fibre2fashion.com/industry-article/7250/eco-textile-dyeing-and-finishing

Circular Fashion: Designing for Longevity and Reuse: Principles of designing durable clothing, modular design, repairability, and fashion longevity.

Principles of Designing Durable Clothing

1. **Material Selection**:
    - **Durability**: Choosing high-quality, long-lasting materials that withstand wear and tear.
    - **Sustainability**: Opting for eco-friendly materials like organic cotton, hemp, and recycled fibres which are robust and environmentally friendly.
2. **Quality Construction**:
    - **Techniques**: Using strong stitching, reinforced seams, and high-quality fastenings to ensure garments can endure prolonged use.
    - **Standards**: Adhering to high manufacturing standards to produce resilient and durable clothing.

Principles of Modular Design

1. **Interchangeable Components**:

- **Definition**: Designing garments with interchangeable parts that can be easily replaced or updated, such as buttons, zippers, and panels.
- **Benefits**: Facilitates repair and customization, extending the garment's usable life.

2. **Adaptability**:
   - **Versatility**: Creating designs that can be adapted for different uses or styles, such as reversible clothing or pieces that can be worn in multiple ways.
   - **Functionality**: Ensuring garments can be adjusted for size or style, accommodating changing preferences and body shapes.

Principles of Repairability

1. **Ease of Repair**:
   - **Design Features**: Incorporating features that make repairs straightforward, such as accessible seams and modular components.
   - **Instruction and Tools**: Providing guidance and tools for customers to repair their garments themselves.
2. **Service Models**:
   - **Support Systems**: Establishing repair services or partnerships with repair shops to assist consumers in maintaining their clothing.
   - **Warranty and Guarantees**: Offering warranties and guarantees that encourage repair over replacement.

Principles of Fashion Longevity

1. **Timeless Design**:
   - **Aesthetic**: Focusing on classic, timeless styles that do not go out of fashion quickly, reducing the need for frequent replacement.
   - **Simplicity**: Emphasising simple, elegant designs that appeal to a broad audience and can be easily matched with other garments.
2. **Emotional Durability**:
   - **Connection**: Designing clothing that consumers form emotional attachments to, which encourages longer use.
   - **Personalization**: Offering customization options to make garments unique to the wearer, fostering a deeper connection.

Environmental and Economic Benefits

1. **Resource Efficiency**:
   - Reduces the demand for raw materials and the environmental impact associated with production.
   - Minimises waste through reuse, repair, and recycling.

2. **Cost Savings**:
    - Lowers costs for consumers by reducing the frequency of new purchases.
    - Generates economic opportunities in repair and recycling sectors.
3. **Reduced Waste**:
    - Significantly cuts down on textile waste sent to landfills, promoting a more sustainable consumption pattern. (WRAP, 2024)

    Useful links:
    https://www.wrap.ngo/taking-action/textiles/actions/circular-design-fashion-and-textiles#:~:text=It%20requires%20businesses%20to%20look,or%20recycled%20at%20the%20end
    https://circular.fashion/downloads/2021_circular.fashion_circular_design_kit.pdf
    https://refashion.fr/eco-design/sites/default/files/fichiers/Circular%20Design%20Toolbox.pdf

Upcycling and Recycling Techniques: Creative upcycling methods, recycling processes for different textiles, and designing with post-consumer waste.

Creative Upcycling Methods

1. **Definition**:
    - Upcycling involves repurposing discarded materials or products into new items that retain or increase their value.
    - Techniques focus on creativity and innovation to give new life to textile waste.
2. **Examples**:
    - **Patchwork**: Combining small pieces of fabric to create new garments or accessories.
    - **Remodelling**: Altering existing garments to fit new styles or purposes.
    - **Accessory Creation**: Using textile remnants to craft bags, jewellery, or home decor items.

Recycling Processes for Different Textiles

1. **Mechanical Recycling**:
    - **Definition**: Involves shredding and processing textile waste to create new fibres or products.
    - **Process**: Textile waste is sorted, cleaned, shredded, and then spun into new yarns or materials.
2. **Chemical Recycling**:
    - **Definition**: Uses chemical processes to break down textile fibres into their molecular components, which can be used to create new textiles or materials.
    - **Methods**: Includes techniques like depolymerization or solvent-based processes to dissolve and regenerate fibres.

Designing with Post-consumer Waste

1. **Materials**:

- **Sources**: Post-consumer waste includes discarded garments, textiles, and other materials.
- **Selection**: Designers choose materials based on their suitability for upcycling or recycling processes.

2. **Design Principles**:
   - **Integration**: Incorporating recycled or upcycled materials seamlessly into new designs.
   - **Innovation**: Experimenting with textures, colours, and patterns to highlight the unique characteristics of recycled textiles.

Environmental and Economic Benefits

1. **Resource Conservation**:
   - Reduces the demand for virgin materials and conserves natural resources like water and energy.
2. **Waste Reduction**:
   - Diverts textile waste from landfills, mitigating environmental impact and promoting a circular economy.
3. **Cost Efficiency**:
   - Often more cost-effective than producing new materials from scratch, particularly when using local or readily available waste streams. (Fibre 2 Fashion)

Useful links:
https://www.fibre2fashion.com/industry-article/7279/recycling-and-upcycling-in-the-apparel-industry
https://blog.anuprerna.com/blog-details/upcycling-fabrics-using-different-craft-techniques/81260
https://www.hilarispublisher.com/open-access/sustainable-fashion-through-recycling-and-upcycling-93917.html

Lesson Plan Details

Lesson Plan title	Exploring Alternative Solutions for Sustainable Textile Production

21st Century Skills	● Collaboration ● Communication ● Creativity ● Critical Thinking ● Problem-solving ● Decision making
Duration	Total: 120 minutes. **Introduction and Objectives Setting: 10 minutes** Briefly introduce the lesson's goals and objectives. **Scenario 1: 40 minutes** Scenario Presentation: 10 minutes Group Activity: 20 minutes Presentation and Discussion: 10 minutes **Scenario 2: 40 minutes** Scenario Presentation: 10 minutes Group Activity: 20 minutes Presentation and Discussion: 10 minutes **Activity 1: 20 minutes** Introduce the Exercise: 3 minutes Brainstorming Session: 12 minutes Discuss and Vote on the Best Ideas: 5 minutes
Classroom setting	Work either in groups or individually, to ensure all participants feel comfortable.
Required material/resources	**Scenario 1: Select Eco-Friendly Materials for a New Collection** - Presentation slides or a whiteboard for Scenario Presentation - Paper and pens for note-taking **Scenario 2: Implementing Sustainable Practices in VET Centers** - Presentation slides or a whiteboard for Scenario Presentation. - Handout spreadsheets with the template. - Flipchart or whiteboard markers for facilitation during group activity. **Activity 1: Upcycling and Recycling Old Textiles** - Collection of old textiles (a pair of jeans, linen shirt, silk dress) for each

	group. - MentiMeter or similar online platform for brainstorming and voting. - Projector or screen to display MentiMeter results. Useful link for upcycling ideas: https://www.ashinyday.com/post/diy-%CE%BA%CE%B1%CF%80%CE%B9%CF%84%CE%BF%CE%BD%CE%AD%CE%BD%CE%B5%CF%83%CE%B5%CF%83%CE%AD%CF%81-a-shiny-day-x-singer-dot-skai-tv https://www.ashinyday.com/post/diy-%CE%B8%CE%AE%CE%BA%CE%B7-%CE%BA%CE%B9%CE%BD%CE%B7%CF%84%CE%BF%CF%8D-a-shiny-day-x-singer-dot-skai-tv https://www.ashinyday.com/post/diy-patchwork-%CE%BC%CE%B1%CE%BE%CE%B9%CE%BB%CE%B1%CF%81%CE%BF%CE%B8%CE%AE%CE%BA%CE%B7-a-shiny-day-x-singer-dot-skai-tv For more check **Annex OERs** **Additional General Materials:** - Presentation setup (projector or screen) for group presentations. - Whiteboard and whiteboard markers. - Paper and pens for note-taking and sketching ideas. - Access to the internet for online research.
Prerequisites	Experience working collaboratively in group settings could be useful.
Final Assessment (if applicable)	The trainees will be assessed after the lesson. Multiple-Choice Quiz Platform: Google Forms Questions: 1. Which of the following materials is considered eco-friendly for textile production? a) Polyester b) Organic Cotton c) Nylon d) Acrylic

	2. What is the main principle of circular fashion? a) Use disposable materials b) Design for single use c) Minimise waste by recycling and upcycling d) Prioritise synthetic fibres 3. Which of the following is a benefit of upcycling old textiles? a) It increases waste production b) It reduces the need for new raw materials c) It is more expensive than buying new clothes d) It requires complex machinery
Additional resources	For more check OERs Annex.
References	# References Performance of Home Textiles. (2010). *Bamboo Fiber.* Retrieved from Bamboo Fiber: https://www.sciencedirect.com/topics/engineering/bamboo-fiber#:~:text=of%20bamboo%20fibre-,Bamboo%20fibre%20is%20a%20regenerated%20cellulosic%20fibre%20produced%20from%20bamboo,chemical%20processes%20produce%20bamboo%20fibre. Fibre 2 Fashion. (n.d.). *Recycling and Upcycling in the Apparel Industry.* Retrieved from Fibre 2 Fashion: https://www.fibre2fashion.com/industry-article/7279/recycling-and-upcycling-in-the-apparel-industry Rauturier, S. (2024). *What Are the Best Lower-Impact Fabrics and Fibres on the Market Right Now?* Retrieved from Good on you Eco: https://goodonyou.eco/most-sustainable-fabrics/ Recycling Fibers. (n.d.). *Recycling Fibers.* Retrieved from Recycling Fibers: https://recyclingfibers.com/en/inicio-english/

	Soil Association . (n.d.). *Organic cotton.* Retrieved from Soil Association : https://www.soilassociation.org/take-action/organic-living/fashion-textiles/organic-cotton/ Tencel. (n.d.). *Tencel.* Retrieved from Tencel: https://www.tencel.com/about Textile Exchange. (n.d.). *Hemp is one of the strongest fibers around.* Retrieved from Textile Exchange: https://textileexchange.org/hemp/ Vibe Fabriclore. (2023). *Sustainable dyeing and finishing methods in textile industry.* Retrieved from Fabriclore: https://fabriclore.com/blogs/textiles/sustainable-dyeing-and-finishing-methods-in-textile-industry WRAP. (2024). *Circular design for fashion and textiles.* Retrieved from WRAP: https://www.wrap.ngo/taking-action/textiles/actions/circular-design-fashion-and-textiles#:~:text=It%20requires%20businesses%20to%20look,or%20recycled%20at%20the%20end

Lesson Plan for Activities & Scenarios #1 (include 1-3 activities & 1-2 scenarios)

Scenario 1: Select Eco-Friendly Materials for a New Collection

Step 1. Scenario Presentation: A fashion brand is launching a new collection and wants to select materials that are sustainable. Their goals are to reduce their carbon footprint and attract environmentally conscious consumers. They ask your expertise as a VET Trainer teaching about sustainable textiles and fashion on how to do it. What would you propose to them?

Step 2. Group Activity: Divide in groups and choose a type of clothing item (e.g., t-shirt, dress, jacket). Your task is to think and present three eco-friendly materials suitable for your assigned item. You should consider factors like durability, cost, and availability of the material when making your selections.

Step 3. Presentation and Discussion: Present to the other groups your ideas. Then, with the help from your trainer, discuss the advantages and disadvantages of each material.

Scenario 2: Implementing Sustainable Practices in VET Centers

Step 1. Scenario Presentation: The municipality of your city has launched a competition aimed at promoting sustainable practices related to the textile industry across Vocational Education and Training (VET) campuses. The objective is to **reduce** the environmental impact of these educational institutions and set an example for **sustainability** in education and familiarise the learners with **green practices**, and enhance their **green skills**. As engaged VET trainers, passionate about environmental issues, representing your institution, you want to develop innovative ideas to win the competition, based on the training you participated in and the knowledge you gained. You need to propose actionable and impactful initiatives that can be implemented within the VET centre to enhance its sustainability. Proposed thematic areas for the competition are: waste management, water conservation, and the 3 Rs (Reuse, Reduce, Recycle).

Step 2. Group Activity: Divide into groups and select one thematic area to enter the competition. Use the template below as your guide. Feel free to customise.

Title	Objectives	Resources	Impact	Sustainability of the practice
	1. 2. 3.			

Step 3. Presentation and Discussion: Present your idea to the other groups. Discuss the advantages and disadvantages of each initiative. Make sure to factor in durability, cost and feasibility. Try to answer the questions below:

- Which initiatives offer the greatest potential for reducing the environmental impact of the VET centre?
- How can these initiatives be integrated into the existing curriculum to educate students about sustainability?
- What and who could support the implementation of these initiatives? (policy makers, community, partnerships, other funding opportunities, EU)

Activity 1: Upcycling and Recycling Old Textiles

Step 1. Introduce the exercise: You have been given a collection of old textiles, including a pair of jeans, a linen shirt, and a silk dress. Your task is to come up with creative ideas to upcycle or recycle these materials into new garments or fashion items.

Step 2. Brainstorming: You access a MentiMeter session to share and brainstorm ideas for upcycling and recycling the materials. Try to think creatively and consider various factors such as:

- Functionality: How can the new item be practical and functional?
- Aesthetics: How can the new item be visually appealing?
- Sustainability: How can the process and final product promote sustainability?

Step 3. Discussion, (optionally, vote for the best ideas): See the shared ideas on a screen. If you want, you may vote on your favourite ideas and leave comments or suggestions for improvement.