



Fashion DIET

Teaching and Learning Materials

Implementing ESD in Textile and Fashion Education

Best Practice Examples for Secondary
and Vocational Education

Editor: Anne-Marie Grundmeier
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Editor:

Prof. Dr. Anne-Marie Grundmeier
Pädagogische Hochschule Freiburg
Institut für Alltagskultur, Bewegung und Gesundheit Mode und Textil
Freiburg, Germany

Teaching and Learning Materials

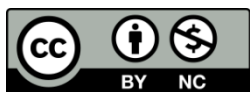
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Implementing ESD in Textile and Fashion General and Vocational Education

Pädagogische Hochschule Freiburg – University of Education Freiburg

Freiburg im Breisgau, 2024

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PARTNER UNIVERSITIES

P1 University of Education Freiburg, Germany (Coordinator)

P2 Reutlingen University, Germany

P3 Gheorghe Asachi Technical University of Iași, Romania

P4 Trakia University of Stara Zagora, Bulgaria



Hochschule Reutlingen
Reutlingen University



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1 Preface

Fashion DIET (Sustainable Fashion Curriculum at Textile Universities in Europe – Development, Implementation and Evaluation of a Teaching Module for Educators) was an EU funded project under the Key Action “Strategic Partnerships” of the Erasmus+ Programme. From September 2020 until August 2023, within the international project teaching and learning arrangements were developed under the lead of the University of Education Freiburg. Partner universities were Reutlingen University in Germany, Gheorghe Asachi Iași University of Technology in Romania and Trakia University Stara Zagora in Bulgaria.

The devastating environmental and social implications of the fast fashion and textile industry which prevailed throughout the last decades make it of high relevance to integrate the targets of the sustainable development goals (SDGs) of the UN into the entire textile value chain, i.e. production, consumption and disposal sites, to make it fully sustainable and positive for people and the ecosystems. The upcoming transformation of the textile and fashion industry towards sustainability therefore requires nothing less than a continuous implementation of the guiding principle Education for Sustainability Development (ESD) in education and training.

The Fashion DIET project aimed to foster the process of ESD implementation in national educational systems. The project’s major goal was to develop an ESD further education module in the context of fashion and textiles for universities since teachers and learners will have to cooperate more internationally in the future to establish the guiding principle of ESD permanently on an international level. Furthermore, teaching and learning materials for vocational schools and secondary education derived from this were developed and made available as Open Educational Resources (OER) via the database Glocal Campus.

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1.1 Introduction to Teaching and Learning Materials

Anne-Marie Grundmeier

In the face of climate change, species extinction and inequality of opportunity, the premise of sustainability has taken hold in all areas of society. In everyday life, this is expressed in diverse actions such as waste avoidance, upcycling and the use of renewable energies. In politics, it manifests itself in sustainability strategies, whereas the economy establishes sustainability through sustainability-oriented processes as well as ecological and fair products. Within the framework of a sustainable transformation, a reorientation of established production techniques and products, consumption patterns and lifestyles is demanded (United Nations, 2015).

The promotion of the necessary skills of knowledge acquisition, critical reflection, autonomous decision-making and action (Getzin & Singer-Brodowski, 2016) is a task of teacher education (Rieß et al., 2022). To implement ESD, teachers need sustainability-oriented design competence (de Haan, 2008), which is based on subject knowledge, skills as well as sustainability knowledge, motivation and reflection of their own convictions. For teachers in the context of fashion and textiles, the question arises of how complex problem areas in subject theory and subject practice can be developed in the sense of ESD to promote emancipatory design competence (Pettig, 2021).

To support students in classifying the relevance of their actions for the environment and society, targeted educational offers in the sense of Education for Sustainable Development (ESD) are needed. ESD represents a pedagogical action concept that is intended to enable pupils to make judgements and take action in everyday life and at work, and to make a contribution to shaping sustainable development. The didactic educational approach considers the three pillars of sustainability – ecology, economy and social issues – and is intended to bring about sustainable change.

These teaching and learning materials aim at the integration of Education for Sustainable Development (ESD) in fashion and textile education at secondary schools and vocational colleges. They have been created within the Fashion DIET project and are part of the intellectual outputs (Grundmeier & Höfer, 2023). These selected teaching and learning materials have been developed by the fashion and textile department of the University of Education Freiburg.

In general education, the focus is on patterns of consumption in the sense of a creative and skillful approach to textile material culture. ESD empowers teachers and students as consumers and professionals to contribute to sustainable development through civil society engagement and political action (Nachreiner et al., 2020). Besides the acquisition

of knowledge, it is about the willingness to engage and to take responsibility, to manage risks and uncertainty, and the empathy for other people's circumstances and solid judgement on questions about the future.

Vocational education and training are seen as the key to the sustainable transformation of the professional world (de Haan et al., 2021). The aim of vocational education and training for sustainable development is to promote competences with which the working and living environment can be shaped in the sense of sustainability. In doing so, orienting professional action toward its ecological, social, and economic consequences is important (Hemkes et al., 2013).

Learning is an active process that builds on previous knowledge, draws on a variety of sources, is a social process and requires motivation. Therefore, ESD learning situations should be designed that enable learners to learn actively in authentic, real-life environments (Schneider, 2013). Another important quality criterion is the selection of a key theme, such as consumption and lifestyle, global learning or global environmental risks (Brundiers & Wiek, 2013). ESD-relevant topics should concern a central local and/or global problem situation, be of long-term significance, be based on broad and differentiated knowledge about the topic and offer the greatest possible potential for action. Thus, generalisable knowledge should be gained by dealing with the topic. The preliminary compilation of the teaching units includes topics such as sustainable fibres and textile raw materials, circular fashion, microfibres, repairing and upcycling, and craftivism.

The teaching and learning materials developed in the Fashion DIET project are linked to selected teaching units of the ESD module with 42 lectures for higher education. They are suitable for the secondary level of the general education system and/or for the vocational education and training. Both theoretical and practical teaching sequences are presented. Due to the diversity of international curricula, there is no assignment to the educational systems. Teachers and trainers are encouraged to adapt the teaching units to the requirements of the learning group according to their own ideas.

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2 Teaching and Learning Materials

2.1 Sustainable Raw Materials

Anne-Marie Grundmeier

2.1.1 Introduction

Students will engage in an insightful exploration of raw materials that serve as fundamental building blocks in the textile chain. Materials covered include cotton, wool, lyocell, polyester and more. Through this unit, students will gain a deeper understanding of each material's unique characteristics and versatile applications within the textile chain and fashion industry.

Competences and Learning Objectives

- Identify and describe different raw materials used in textile production.
- Recognize the properties and characteristics of various textile materials.
- Differentiate between natural and chemical fibres.
- Understand the environmental impact of different raw materials in the textile chain and fashion industry.
- Compare and contrast the advantages and disadvantages of using specific textile materials also regarding sustainability aspects.

2.1.2 Overview of Working Materials

Worksheet 1: Group Work: What do the pictures have in common?

Worksheet 2: Plant Fibre: Cotton

Worksheet 3: True or False (Cotton)

Worksheet 4: Natural Fibre: Flax / Linen

Worksheet 5: True or False (Flax / Linen)

Worksheet 6: Animal Fibre: Wool

Worksheet 7: True or False (Wool)

Worksheet 8: Animal Fibre: Silk

Worksheet 9: True or False (Silk)

Worksheet 10: Cellulosic Chemical Fibre: Viscose / Modal

Worksheet 11: True or False (Viscose / Modal)

Worksheet 12: Cellulosic Chemical Fibre: Lyocell

Worksheet 13: True or False (Lyocell)

Worksheet 14: Synthetic Chemical Fibre: Polyester

Worksheet 15: True or False (Polyester)

Worksheet 16: Synthetic Chemical Fibre: Elastane

Worksheet 17: True or False (Elastane)

Worksheet 18: Systematic Overview of Fibres

Worksheet 19: World Fibre Market

Worksheet 20: Future Fashion Walk – Planning a Sustainable Fashion Tour

2.1.3 Materials

2.1.3.1 Worksheet 1

Teacher Material

Introduction into the topic: Guessing the topic and activating pre-knowledge!



Group Formation:

Divide the class into small groups of 4 to 5 students each.



Picture Analysis:

Distribute the four pictures of the silkworm, wood, sheep, and cotton to each group. Instruct them to carefully study the images and take notes of any elements or connections they can think of.



Group Discussion:

Give the groups time to discuss and share their ideas, pre-knowledge, and related knowledge they might have. Encourage the students to write down questions they may have regarding the topic as well.



Presenting:

Each group presents their findings, ideas, pre-knowledge, and their questions to the class.

After all groups have presented, reveal the correct answer that ties the pictures together.

Answer: The common factor is that all the pictures represent raw materials or sources used in the textile chain to produce textiles and fabrics. Textiles and fabrics can be made from plant or animal fibres or are manufactured from resources such as wood.

Suggested solutions to the worksheet tasks are in light grey font.

Worksheet

Group Work: What do the pictures have in common?



Work on the following tasks within your group:

1. Get together with your group and talk about what the pictures have in common.
2. Do some brainstorming and gather everything you already know about the topic and write it down. Are there any related processes or related facts / information you already heard of? Collect your ideas.
3. Create a short and informative presentation about the topic using the information you already have.
4. Write down any questions you have about the topic and incorporate them at the end of your presentation.

2.1.3.2 Worksheet 2

Plant Fibre: Cotton

Cotton is a plant fibre and the most widely produced natural fibre on the planet. It consists of seed fibres in the fruit capsules of cotton bushes. Today, cotton accounts for less than a third of all fibrous materials in the global market. It is by far the most important natural fibre. The cotton plant needs a hot **climate**, which is why it is mainly grown in China, India, Brazil, Pakistan and the Southern United States of America, the so-called Cotton Belt. These main producing countries supply about 80% of the world's cotton.



The cotton plant needs a lot of **water** to grow, and dryness is important during the ripening period and harvest. The Aral Sea between Kazakhstan and Uzbekistan has been deprived of 80% of its water to water the cotton plants. To protect the plants from pests such as the boll weevil, **pesticides** are used, which are very dangerous to both health and the environment. Only the planting of **organic** cotton avoids the use of chemical fertilisers, pesticides, and genetic engineering. Genetically modified cotton plants are grown on about 75% of the fields. However, organic cotton accounts for only about 1% of the cotton grown worldwide.

Before cotton fibres can be spun into yarns they need to be separated from the seeds. Each cotton fibre is a single cell and reaches a length up to 5 cm. To make **yarns** for fabrics the fibres are overlapped and twisted around each other in a spinning process. Longer fibres are more valuable than short ones, because they require less overlap and can therefore be spun into finer yarns.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
climate, organic, pesticides, water, yarns.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on cotton.
3. Have a look at your wardrobe and household textiles and see which of them are made of cotton. Give at least four examples:

1. _____ t-shirt
2. _____ jeans
3. _____ underwear
4. _____ bath towel

Did you know that the Mayans in Mexico and the Incas in Peru grew cotton over 7,000 years ago?

2.1.3.3 Worksheet 3

True or False (Cotton)

4. Do some research to identify the European countries that hold importance in the cotton production. After conducting your research, which three countries emerged as the most important in cotton production?

1. _____ Greece
 2. _____ Spain
 3. _____ Bulgaria

5. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Cotton cultivation is a highly water-intensive process. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: Cotton is a renewable resource, as it can be harvested year after year. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: Cotton fibres are spun into yarns, which are then woven into fabric. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: Cotton is known for its softness, breathability, and moisture absorption properties. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Cotton cultivation requires careful fertilisation and irrigation to ensure a successful yield. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: Cotton is used to make products such as t-shirts, jeans, bed sheets, and towels. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: Cotton is a synthetic fibre made from chemical processes. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: Cotton cultivation has a low environmental impact compared to other natural fibres. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: Cotton is commonly used in various art and craft projects due to its versatility. (True) |

2.1.3.4 Worksheet 4

Natural Fibre: Flax / Linen

Flax is a plant that was already processed by humans into so-called linen fibres, yarns and strings more than 35,000 years ago. Today, it is largely cultivated in France, Belgium and Russia, but also in the Netherlands and England. Compared to cotton cultivation, the flax plant only needs about a quarter of the water. It is also rather undemanding in terms of soil quality. The plant needs only a small amount of fertiliser.



Before the fibres are extracted from the plant, the capsules must be separated from the stalks. The capsules contain the linseeds, from which linseed oil, for example, is made. To produce linen fibres, however, the fibre bundles are needed, which have to be removed from the stalks.

For the harvesting and fibre extraction, the stalks are stacked in bundles in the field to dry out. During the retting process, moisture and heat cause fungi to develop, which degrade the woody part of the stems, so that the fibre bundles can be released in further steps. First, the flax straw is broken, coarse wood residues and the fibre bundles are loosened and separated from each other. The remaining plant and woody parts as well as very short fibres are removed by scutching, followed by a combing process. These processes result in longer and shorter fibres. The latter can be converted into very fine fibres in chemical mechanical processes.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
capsules, fertiliser, fibre bundles, linen, stalks.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on flax/linen.
3. Have a look at your wardrobe and household textiles and see which of them are made of linen. Give at least four examples:

1. _____ shirt
2. _____ dress
3. _____ kitchen towel
4. _____ tablecloth

Did you know that several thousand years ago the Egyptians called flax “woven moonlight” and used flax to make the clothes of priests, pharaohs and as the shrouds of mummies?

2.1.3.5 Worksheet 5

True or False (Flax / Linen)

4. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Flax is also known as linen due to its historical use in making linen yarns. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: Flax requires the same amount of water as cotton cultivation. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: To extract fibres from the flax plant, the capsules containing linseeds are left intact during the process. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: Flax was processed by humans into linen yarns and strings more than 35,000 years ago. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Flax is undemanding in terms of soil quality and requires only a small amount of fertiliser. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: The spinning process involves the scutching and combing of the processed flax stalks, resulting in linen fibres. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: Flax is also known as linen due to its historical use in making linen yarns. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: As part of the harvesting and fibre extraction, the stalks must be dried out before further processing. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: Moisture and heat prevent the development of fungi that dissolve the glue between plant layers, making it challenging to release the fibre bundles. (False) |

2.1.3.6 Worksheet 6

Animal Fibre: Wool

A sheep's hair is called wool. Wool is a protein fibre that is very similar to human hair, known as *keratin*. On the outer layer of the wool fibre there is a structure of scales arranged like roof tiles. The outer layer of scales, which is covered with wool grease (lanolin), protects against external moisture. Water drops roll off the surface. Water vapour, on the other hand, passes through the scaly layer. The wool fibres can absorb up to a third of their own weight in moisture and release it back into the environment without becoming damp to the touch.



To preserve the wool fleece, the sheep are sheared with electric shears at least once a year. If done carefully, this does not hurt the animals and the *sheepskin* grows back again. First, the wool has to be washed, because the valuable wool grease, but also plant residues and dirt cling to the fibres. The *wool grease* is used for ointments. Once the wool has been washed, the wool fibres are spun into yarns.

The wool fibres can become permanently interlocked with their scaly layer under the influence of heat, moisture and mechanics; this process is called *felting*.

Wool is produced in about 100 countries worldwide. Today, most wool comes from Australia, followed by China, New Zealand, and Turkey. Australia is also known for producing the best merino wool, which is used for fine clothing. Further popular animal fibres (hairs) are alpaca, camel, cashmere and mohair from angora goats. Angora hair from rabbits is mainly used for thermal underwear.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
felting, keratin, sheep, sheepskin, wool grease.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on wool.
3. Have a look at your wardrobe and household textiles and see which of them are made of wool. Give at least four examples:

1. _____ scarf
2. _____ knitted jumper
3. _____ carpet
4. _____ blanket

Did you know that wool is used as insulation and as a low-flammability material in car seats or aeroplanes?

2.1.3.7 Worksheet 7

True or False (Wool)

4. Do some research to identify the European countries that hold importance in the wool production. After conducting your research, which three countries emerged as the most important in wool production?

1. _____ United Kingdom

2. _____ Spain

3. _____ Romania

5. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Wool is a synthetic fibre made from chemical processes. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: The outer layer of wool fibres cannot protect from external moisture. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: Merino wool is known for its softness, breathability, and moisture absorption properties. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: Wool is commonly used in various art and craft projects due to its versatility. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Wool is a renewable resource, as it can be harvested year after year. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: Wool fibres are typically spun into yarns and used to make various clothing items. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: Wool is naturally insulating and helps to keep the body warm. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: Wool can felt and shrink when exposed to washing and heat. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: Wool is biodegradable, making it environmentally friendly. (True) |

2.1.3.8 Worksheet 8

Animal Fibre: Silk

Silk is an animal fibre obtained from the cocoons of the silkworm. With the help of a spinneret at their heads, which is fed by two glands, they spin a very long double thread, which they wrap around themselves in rollercoaster-like movements (up to 300,000 times). This process is called “pupation”. The silkworms produce a tangle of loose silk fibre to secure the position of the cocoons in the straw. In 14 days, they undergo a complete metamorphosis from pupa to moth.



The silk thread consists of the protein fibroin and the silk glue (sericin) surrounding it. The fibres can have a length of up to 3,000 metres. Since the filament of a cocoon is very, very fine, usually 8 to 10 are processed into a silk thread. It takes about 3,000 cocoons to make 250 g of silk thread.

The best-known silk is obtained from the cocoons of the larvae of the mulberry silkworm *Bombyx mori*, which is reared in captivity. Silk is produced by various insects, but only the filament of the moth caterpillar has been used for textile manufacturing for about 5,000 years.

Silk originally comes from China and even today China is the main producer. Brazil, India and Japan are also important producer countries. Beside the mulberry silkworm, there are further wild species of which the Tussah is the most important.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
caterpillar, cocoons, producer, protein, silkworms.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on silk.
3. Have a look at your wardrobe and household textiles and see which of them are made of silk. Give at least four examples:

1. _____ blouse
2. _____ lingerie
3. _____ wedding dress
4. _____ bed linen

Did you know that the so-called Silk Road – a trade route from China to Europe – got its name from the export of silk?

2.1.3.9 Worksheet 9

True or False (Silk)

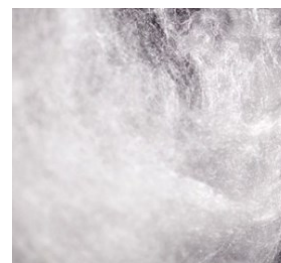
4. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Silk is an animal fibre obtained from the cocoons of the silkworm. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: Silkworms spin a very long double thread around themselves during the pupation process. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: Silk originally comes from India, and even today India is the main producer. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: The silk thread consists of the protein fibroin and the silk glue (sericin) surrounding it. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Usually, 30 to 80 cocoons are processed to create a silk thread. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: It takes about 1,000 cocoons to make 500 g of silk thread. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: A single cocoon's fibre can have a length of up to 5,000 metres. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: Silk is the only naturally occurring continuous fibre that people use in large quantities for textiles and clothing. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: Silk is one of the most precious fibres we know. (True) |

2.1.3.10 Worksheet 10

Cellulosic Chemical Fibre: Viscose / Modal

Viscose and modal are cellulosic chemical fibres. That means that the fibre consists of the plant material cellulose, but it is produced chemically. They are mainly made from wood types such as beech, spruce, eucalyptus, pine and bamboo, the trees which are grown in large plantations. After removing the bark, the wood is chipped into fragments with the length of matches.



To obtain the viscose or modal fibre, a very complex chemical process is necessary. A large amount of chemicals is used, most of which contain sulphur, so that elaborate wastewater and exhaust air purification is necessary to avoid polluting the water and air. In addition, a lot of water and energy are needed for the process.

The cellulose is scarcely altered by the spinning process, but the cellulose molecules are much shorter than those of cotton, and their organisation in the fibres is different. The spinning process of modal is more advanced than the one of viscose fibres. On the one hand, it results in longer cellulose molecules, and, on the other hand, the structure and the orientation of the crystalline areas are improved which yields a higher strength.

Viscose is mainly produced in China, India and Indonesia, but there is also production of cellulosic man-made fibres in Europe. One of the world's leading companies is Lenzing AG in Austria.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
beech, cellulose molecules, plantations, polluting, sulphur.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on viscose and modal.
3. Have a look at your wardrobe and household textiles and see which of them are made of viscose and modal. Give at least four examples:

1. _____ blouse
2. _____ top
3. _____ handkerchiefs
4. _____ hygiene textiles

Did you know that cellulose-based fibres are also called artificial silk because they have a silky shine, are very soft and have a flowing drape.

2.1.3.11 Worksheet 11

True or False (Viscose / Modal)

4. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Viscose is a natural fibre obtained directly from plant materials. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: Viscose is produced through a chemical process using cellulose from wood. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: The pulp for cellulose used in viscose is mainly obtained from animal sources. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: Modal is a cellulosic man-made fibre made from beech wood. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Viscose is mainly made from wood types such as beech, spruce, eucalyptus, pine, and bamboo. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: Viscose is primarily produced in China, India, and Indonesia. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: Elaborate wastewater and exhaust air purification are not necessary during the production of viscose. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: Viscose production does not require a significant amount of water and energy. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: Lenzing AG in Austria is one of the world's leading companies producing viscose. (True) |

2.1.3.12 Worksheet 12

Cellulosic Chemical Fibre: Lyocell

Lyocell is a cellulosic man-made fibre. The brand name of Lenzing AG, which produces this fibre, is Tencel™. The cellulose is mainly extracted from **beech wood**, sourced from certified sustainable forestry. Cellulose sheets are broken into squares measuring approximately one inch across. They are placed in pressurised and heated vats of amine oxide, which is the direct solvent used to make lyocell fibres.



Once the cellulose has dissolved into a clear **liquid**, it is filtered and pumped through spinnerets. As the cellulose is forced through spinnerets, it is turned into long, thin fibres. The resulting filaments are immersed in a vat of diluted amine oxide to set, and they are then washed with water.

Unlike modal and **viscose**, no sulphur-containing chemicals or others are used in this closed loop production process, and the water required can be released back into the **water cycle**. The solvent, which is not harmful to health or the environment, can also be recycled at a rate of over 99%. Therefore, the spinning process of lyocell transforms wood pulp into cellulosic fibres with high resource efficiency and low **ecological** impact.

Lyocell can be produced in various thicknesses and can therefore be used in a wide variety of textiles, ranging from durable woven fabrics to knitwear.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
beech wood, ecological, liquid, viscose, water cycle.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on lyocell.
3. Have a look at your wardrobe and household textiles and see which of them are made of viscose and modal. Give at least four examples:

1. _____ shirt
2. _____ functional underwear
3. _____ sportswear
4. _____ bed linen

Did you know that lyocell is biodegradable with the help of microorganisms? The company Lenzing AG itself states a decomposition time of 100% in 16 weeks.

2.1.3.13 Worksheet 13True or False (Lyocell)

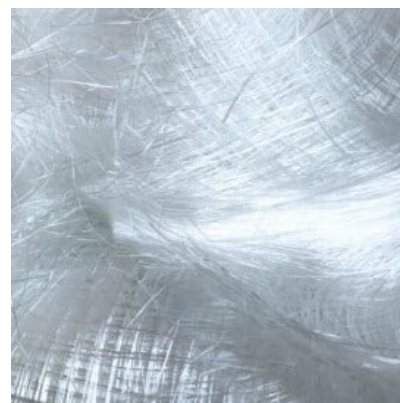
4. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Lyocell is a synthetic fibre made from crude oil by means of chemical processes. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: Lyocell is a cellulosic man-made fibre derived from plants. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: Lyocell is biodegradable and environmentally friendly. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: Lyocell is commonly used in the production of fire-resistant clothing. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Lyocell is known for its high elasticity and wrinkle resistance. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: Lyocell is made from wood pulp, usually sourced from eucalyptus, beech or bamboo. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: Lyocell production requires the use of harmful chemicals that pollute the environment. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: Lyocell is a non-absorbent fibre, making it unsuitable for clothing. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: Lyocell is also known as “Tencel™”, both terms referring to the same fibre. (True) |

2.1.3.14 Worksheet 14

Synthetic Chemical Fibre: Polyester

Polyester is the most important chemical fibre in terms of quantity and versatility. It is made of the synthetic polymer polyethylene terephthalate, more commonly known by the abbreviation PET. The so-called PET bottles (plastic bottles) are made from the same raw material. The basic building materials of PET are mainly petroleum, chalk, hard coal and natural gas.



PET is cast and cut into chips, which are melted and extruded in the spinning process. Based on the shape of holes in the spinneret, polyester can imitate other fibres. The filaments are often textured and cut into staple fibres to blend them with cotton, wool and other fibres.

Due to its versatile use, polyester has become increasingly popular since the 1950s. Textiles made of polyester are hard-wearing, easy to care for, and dry quickly. Polyester fibres have a high tensile strength, what makes them suitable for sewing threads. They hardly absorb any moisture, can be made water-repellent and are therefore used for everything from functional underwear to weatherproof clothing.

The major ecological disadvantage of polyester and other synthetic fibres is their high resistance to microorganisms; unlike natural fibres and cellulosic man-made fibres, they do not biodegrade.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
absorb, biodegrade, chips, petroleum, water-repellent.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on polyester.
3. Have a look at your wardrobe and household textiles and see which of them are made of polyester. Give at least four examples:

1. _____ sportswear
2. _____ outdoor clothing
3. _____ backpack
4. _____ tent

Did you know that polyester fibres are spun as hollow fibres so that they provide optimal thermal insulating properties just like the polar bear's fur?

2.1.3.15 Worksheet 15True or False (Polyester)

4. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Polyester is a natural fibre derived from plants. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: Polyester is made from a combination of materials, mainly petroleum, but also including coal, limestone, and natural gas. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: Polyester is popular in the textile industry due to its versatility, stability, and low cost. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: Polyester is hardly used in blends with other fibres, especially cotton and wool. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Polyester fibres are produced through a spinning process involving melting chips. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: Polyester can imitate various other fibres based on the shape of the holes in the spinneret. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: Polyester is biodegradable and can decompose naturally over time. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: Polyester fabric is known for its excellent wrinkle resistance and quick-drying properties. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: Polyester fibres are commonly used for sewing threads in clothing. (True) |

2.1.3.16 Worksheet 16

Synthetic Chemical Fibre: Elastane

Elastane is a synthetic fibre, which is known for its exceptional stretchiness and only produced as filament yarn. According to the Textile Labelling Act, a fibre is called **elastane** as soon as it consists of at least 85% polyurethane (this substance provides the strength of the fibres) and polyethylene glycol, which gives the fibre its high stretchability.



The **molecular structure** is that of a block copolymer with alternating hard and soft segments. The fibres are produced by several spinning technologies. Typically, a concentrated solution of the polymer is drawn through spinnerets at temperatures where the solvent evaporates.

They are added to other fibres (in percentages of 2 to 30%) to increase the elasticity of fabrics. Elastane can be **stretched** to eight times its original length and then reverts to its former shape. The higher the proportion of elastane, the better the stretch.

Elastane is similar to **rubber** in its qualities but unlike rubber it has greater **strength** and is also more durable. The filaments can be used as such or are covered by other fibres. The bare fibre is used in larger amounts up to 45% in stockings, hosiery, sportswear, and swimwear. Covered yarns are used in e.g., cotton textiles at a level of 2 to 5% for a shape-holding elasticity.

Tasks:

1. Read the text and fill in the gaps in the text by using the word list:
elastane, molecular structure, rubber, strength, stretched.
2. If you have difficulties or want to gather more information, inform yourself with the help of websites on elastane.
3. Have a look at your wardrobe and textiles at home and see which of them are made of elastane. Give at least four examples:

1. _____ socks
2. _____ shorts shirt
3. _____ leggings
4. _____ swimsuit

Did you know that a bathing suit, for example, needs up to 30% elastane? With jeans, on the other hand, 2% is enough to ensure a skin-tight fit.

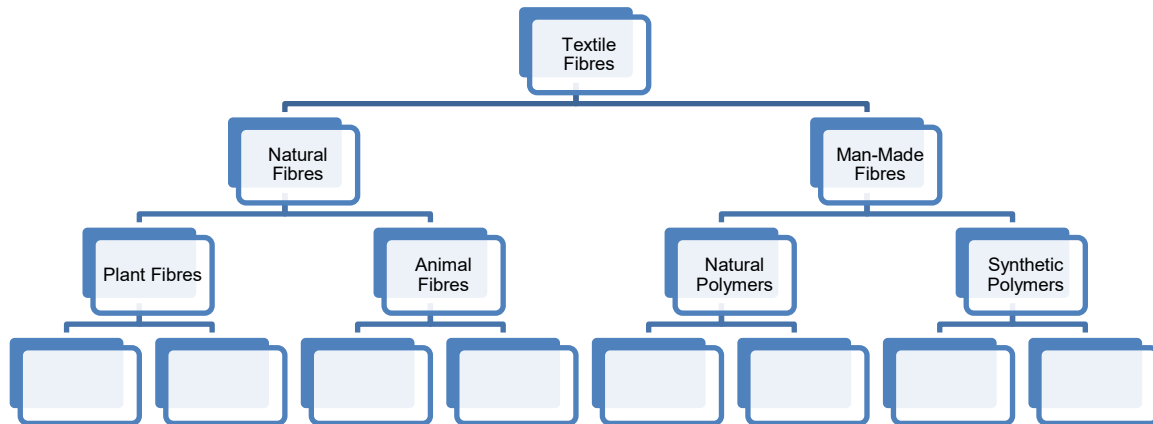
2.1.3.17 Worksheet 17True or False (Elastane)

4. Answer these true or false questions by ticking the right answer.

| TRUE | FALSE | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. True or false: Elastane is a natural fibre. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. True or false: Elastane is added to other fibres to increase the elasticity of fabrics. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. True or false: Elastane can only be stretched twice its original length. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. True or false: Elastane has similar qualities to rubber but is less durable. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. True or false: Elastane is suitable for stockings, hosiery, sportswear, and swimwear. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. True or false: The higher the proportion of elastane, the better the shape-holding elasticity. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. True or false: According to the Textile Labelling Act, a fibre is called elastane if it consists of at least 65% polyurethane. (False) |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. True or false: Elastane is a block copolymer with hard and soft segments. (True) |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. True or false: In stretch jeans cotton is blended with elastane. (True) |

2.1.3.18 Worksheet 18

Systematic Overview of Fibres



Overview of Textile Fibres, CC-BY-SA-NC Grundmeier

Tasks:

- Complete the systematic overview table with the appropriate fibres:
cotton, elastane, flax, polyester, silk, wool, and viscose/modal
into the systematic overview.
- Fill in the gaps:

Solar energy is the basis of life and of all fibres. Fibres are constructed from large polymer molecules, which lie alongside and are bonded to each other.

Fibres from plants and animals are constructed from natural polymers such as cellulose, which is the basic scaffolding substance of all plants and is formed through photosynthesis.

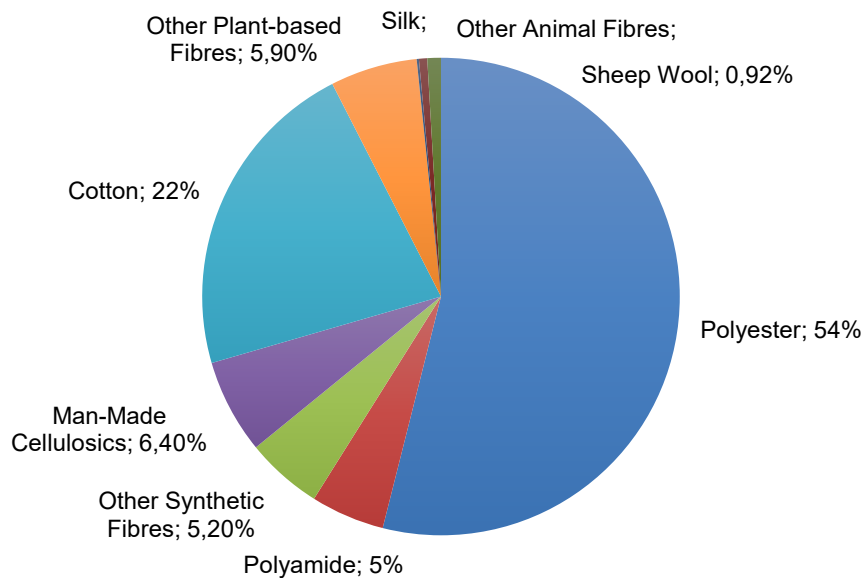
The food taken-in by animals is transformed into fibre-forming proteins.

Cellulosic man-made fibres are formed from cellulose, which is mainly extracted from wood, dissolved, and then forced through spinnerets.

Synthetic fibres are derived from petroleum and other non-renewable energy resources.

2.1.3.19 Worksheet 19

World Fibre Market



Source of rounded percentage values: Textile Exchange, 2022
Pie Chart of World Fibre Market, CC-BY-SA-NC Grundmeier

In 2021, around 113 million tonnes of fibres were produced. The pie chart shows what percentage of total fibre production each fibre accounts for.

Tasks:

- Sort the fibres according to their percentage of the total fibre production. Start with the highest share.
- What can you observe when comparing the share of natural fibres with that of synthetic fibres? Try to find reasons for the different shares.
- Have a look at the pie chart and fill in the gaps:

Synthetic fibres account for more than half of the total fibre production. In contrast, natural fibres are very underrepresented, except for cotton. Cotton nearly accounts for a quarter of the total fibre production, which is very high for a natural fibre. The cellulosic chemical fibres have a share of only more than 6%, which is very little in comparison.

- Discuss the different shares of fibres in the world in regard to a sustainable future of the textile and fashion market.

2.1.3.20 Worksheet 20

Exercise: Future Fashion Walk – Planning a Sustainable Fashion Event

In this exercise, you will collaborate with your classmates to plan an exciting event called the “Future Fashion Walk”, a sustainable fashion event focused on promoting eco-friendly fashion choices. You will create a route through your city and identify locations offering future fashion options, such as eco-friendly fashion stores, second-hand shops, and clothing lending places, supporting the future of fashion in your city!

Through this event, you’ll encourage sustainable consumption, raise awareness about eco-friendly fashion, and support local businesses making a positive impact.



Future Fashion Walk,
CC-BY-SA-NC-ND Kim Frank

Instructions:



Research and Mapping:

Form small groups and delve into researching specific areas of your city. Identify and map locations that offer future fashion options, such as eco-friendly stores, second-hand shops, and clothing lending stores. Your keen exploration will unearth the wonderful places aligned with your sustainable fashion vision.



Planning the Route:

Collaboratively, share your findings with the team to craft an engaging route connecting the best eco-friendly fashion spots.



Event Activities:

Envision captivating activities that will add charm to the event. Consider sustainable fashion workshops, discussions on eco-friendly materials, and demonstrations of upcycling or clothing repair techniques. Your imaginative ideas will elevate the event’s appeal!



Promote the Event:

A dedicated group will be tasked with promoting the Future Fashion Walk. Utilise your creativity to design eye-catching posters and implement impactful social media campaigns to spread the word throughout the city.

**Event Logistics:**

Another responsible team will manage the event's logistics. They will ensure to liaise with the locations on the route and ensure a seamless flow on the event day.

**Present and Improve:**

Each group will present their well-prepared plans to the class. Feedback and suggestions will be provided to enhance the event and make it an extraordinary experience.

**Event Day:**

The much-awaited day has arrived! Hosting the Future Fashion Walk, you will explore the remarkable eco-friendly fashion spots with your peers. Extend invitations to friends, family, and fellow advocates of sustainable fashion to partake in this meaningful event.

**Reflection:**

Following the event, engage in a reflective session to assess the impact achieved. Evaluate how the Future Fashion Walk inspired others to embrace eco-friendly fashion choices. Celebrate the success of your event in promoting sustainable fashion!

This exercise offers valuable insights into event planning, research, marketing, and the significance of environmentally conscious fashion choices.

As you lead the Future Fashion Walk, you will emerge as fashion leaders and influential change-makers in your city.

Together, let's make a difference with the Future Fashion Walk, fostering a brighter and sustainable future for fashion!

2.1.4 References

Text

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Images

Worksheet 1:

Sheep: No title, Judith Prins, <https://unsplash.com/license>, <https://unsplash.com/photos/AJa7S1fjy-l>

Wood: No title, Sonia Rose, <https://unsplash.com/license>, <https://unsplash.com/photos/azdKdNj3YRU>

Cotton: No title, Marianne Krohn, <https://unsplash.com/license>, <https://unsplash.com/photos/RNqZbnBnMQk>

Silkworm: https://unsplash.com/photos/RNqZbnBnMQkBombyx_mori1.jpg:

Zivyaderivative work: Linksfuss, CC BY-SA 3.0

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Worksheet 2:

Cotton Fibres, CC-BY-SA-NC Grundmeier

Worksheet 4:
Flax Fibres, CC-BY-SA-NC Grundmeier

Worksheet 6:
Wool Fibres, CC-BY-SA-NC Grundmeier

Worksheet 8:
Silk Cocoons, CC-BY-SA-NC Grundmeier

Worksheet 10:
Viscose Fibres, CC-BY-SA-NC Grundmeier

Worksheet 12:
Lyocell Fibres, CC-BY-SA-NC Grundmeier

Worksheet 14:
Polyester Fibres, CC-BY-SA-NC Grundmeier

Worksheet 16:
Elastane Fibres, CC-BY-SA-NC Grundmeier

Worksheet 20:
Illustration Future Fashion Walk, composed by Kim Frank, CC-BY-SA-NC-ND,
with reference to:
Landscape of a city, Mahij16902
<https://www.canva.com/policies/content-license-agreement/>
People Protesting with Sign Half Body, sketchify
<https://www.canva.com/policies/content-license-agreement/>
Space Earth Planet Flat Style Icon, iconsy
<https://www.canva.com/policies/content-license-agreement/>
Dynamic Lined Shopping Bag, Lemuel Taytay
<https://www.canva.com/policies/content-license-agreement/>

2.2 Circular Fashion

Maleika Schmidbleicher & Anne-Marie Grundmeier

2.2.1 Introduction

At the beginning of this unit, the pupils learn the difference between a linear and a circular fashion system. Therefore, half of the class get a worksheet that explains the linear fashion system (No. 1) while the other half receive a worksheet that explains the circular fashion system (No. 3). They also get a worksheet with a diagram that either shows the linear (No. 2) or the circular (No. 4) fashion system and some cut out symbols as well as terms.

The pupils are asked to read the text in the speech bubbles and to fill out the diagram individually. As some might need more micro-scaffolding than others the diagram can be adjusted to the learners' individual needs by adding or removing symbols and terms in the worksheets (No. 2 and No. 4). Then the pupils should form groups of three with other pupils who all had the same fashion system, discuss their findings in the group and define the term linear/circular fashion system.

The worksheets (No. 1 and No. 3) ask the pupils to go back to their neighbours, explain their fashion system to one another and compare both systems.

In the next step the pupils learn more about the different sustainable design strategies. Therefore, the class needs to be divided into four groups. Each group gets a worksheet about a sustainable design strategy (No. 5, 6, 7 and 8). The pupils should read the text individually, take notes and compare them to their group members' notes. The groups create a glossary for their classmates with all the important words from the text. Afterwards, the groups create a poster and prepare a short presentation in which they focus on the challenges and aims of their design strategies. For support teachers can hand out tip cards (No. 9) to their pupils. These tip cards can be adjusted to the learners' individual needs by removing or adding sentences.

In the unit's last sequence, the pupils create pieces out of old garments they no longer wear. To enable the pupils to work creatively with textiles the teacher needs to provide some virgin materials and sewing instructions. After creating their own pieces, the learners present their garments and justify their design decisions in front of the class. In these presentations the pupils should say which sustainable design strategies they have implemented.

Competences and Learning Objectives

- Understand the difference between a linear and a circular fashion system.
- Compare the linear and the circular fashion system.
- Describe different sustainable design strategies.
- Create and present a poster about sustainable design strategies.
- Design and justify a self-made garment based on sustainable design strategies.

- Reflect sustainable design strategies on a theoretical and practical basis.

2.2.2 Overview of Working Materials

Lesson module 1:

Topic: Linear fashion system

Worksheet 1: Linear fashion system

Worksheet 2: Linear fashion system (diagram)

Lesson module 2:

Topic: Circular fashion system

Worksheet 3: Circular fashion system

Worksheet 4: Circular fashion system (diagram)

Lesson module 3:

Topic: Design strategies for low waste

Worksheet 5: Design strategies for low waste

Lesson module 4:

Topic: Design strategies for low-impact materials and processes

Worksheet 6: Design strategies for low-impact materials and processes

Lesson module 5:

Topic: Design strategies for recyclability and disassembly

Worksheet 7: Design strategies for recyclability and disassembly

Lesson module 6:

Topic: Design strategies for longevity and durability

Worksheet 8: Design strategies for longevity and durability,

Lesson module 7:

Topic: Presenting and justifying own design decisions

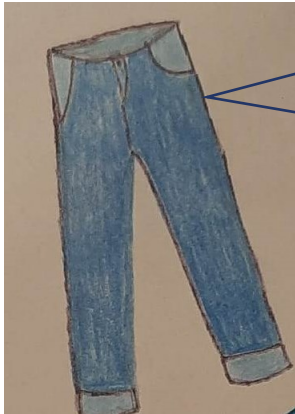
Worksheet 9: Tip cards for the presentation

2.2.3 Materials

2.2.3.1 Worksheet 1

Linear fashion system

Read the text in the speech bubbles to learn more about the linear fashion system.



We were created in a linear fashion system. Do you know how it works?
Let us explain it to you.



First, raw materials were produced and extracted because they are needed to create textiles like fabrics and yarns – they did not look much like we do.



In the third step we were designed. In this very important step, designers decided how we should look, what we should be able to do, and which materials should be used to create us.

Then we got produced in a factory according to the designers' ideas.



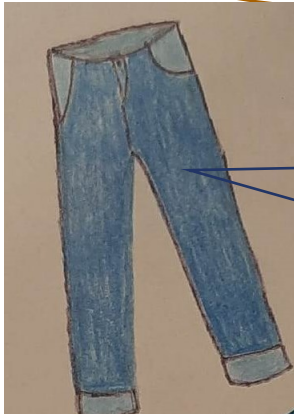


After we looked as fashionable as we do now, we travelled a very long way to finally arrive in this shop. Here we are waiting for you to buy us.

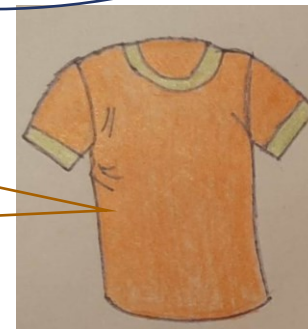
When you bought us, you will use us, and we hope that you will like us and take good care of us.



But what happens to us after we are worn out? What happens when you don't want to wear us any more because we are out of fashion or damaged?



In a linear fashion system, you will then dispose us. Most likely, we will end in a landfill.



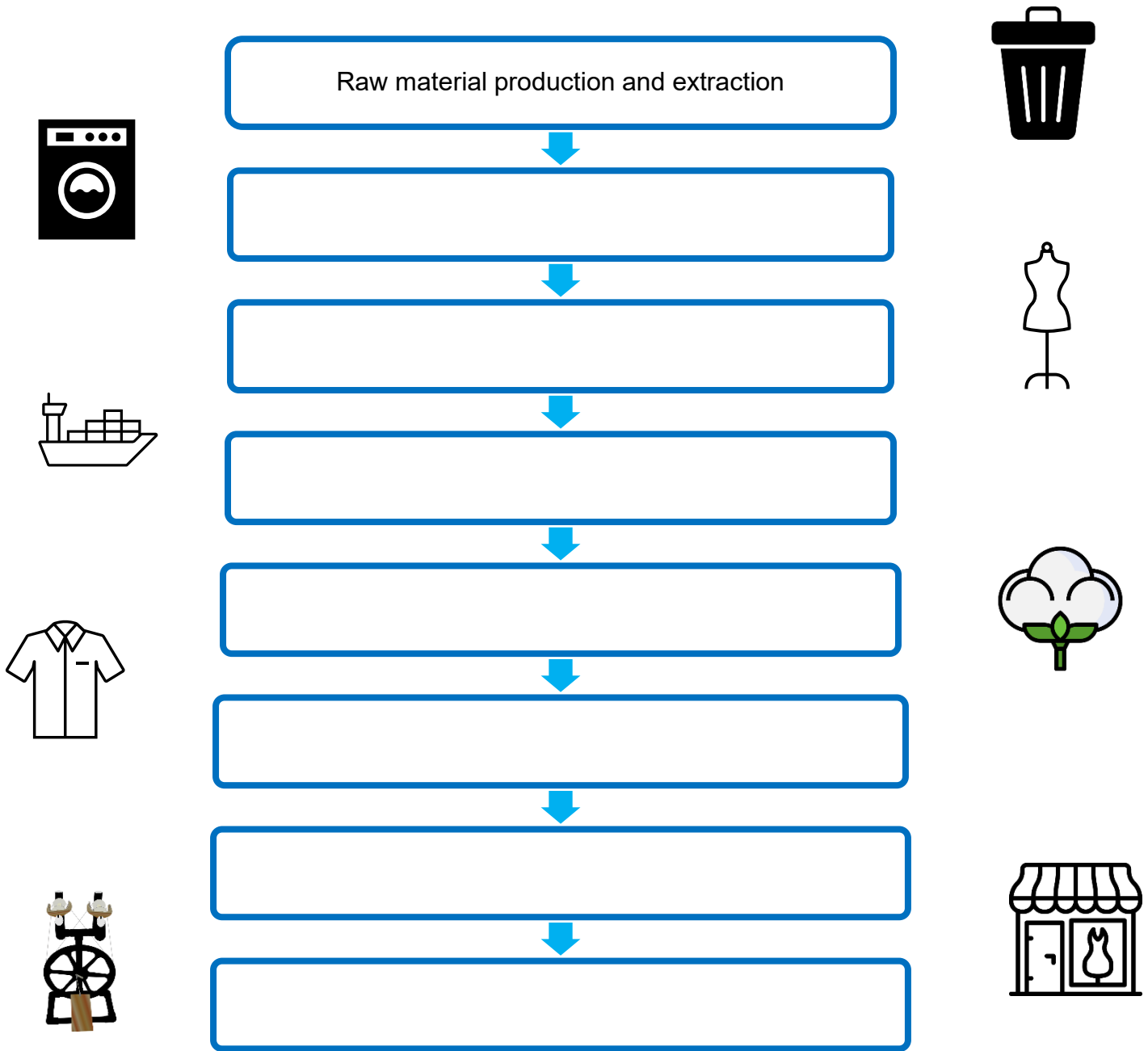
Illustrations: CC BY-SA-ND Schmidbleicher

Task: Discuss the following questions in the plenary.

1. What are the different steps of the linear fashion system?
2. What happens after the use phase?
3. Which alternatives do you see for the jeans and the T-shirt after they are worn out?

2.2.3.2 Worksheet 2

Linear fashion system



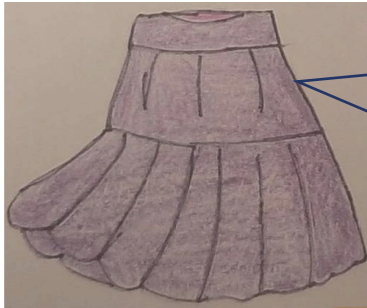
Tasks:

1. Bring the words into the right order and write them into the diagram:
Consumer use, Disposal, Shop, Garment production, Fashion design, Transportation, Textile production.
2. Draw a line between the suitable symbols and words in the diagram.
Use a pencil so that you can correct them.

2.2.3.3 Worksheet 3

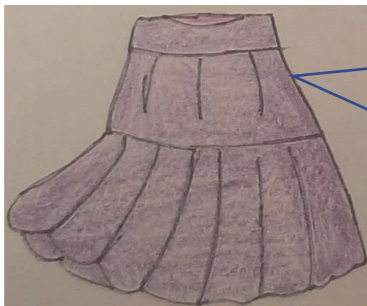
Circular fashion system

Read the text in the speech bubbles to learn more about the circular fashion system.



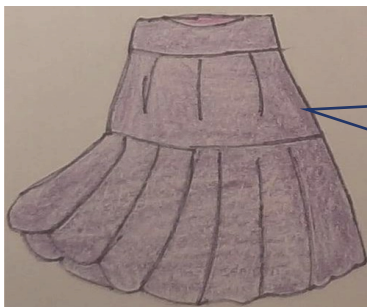
We are created for a circular fashion system. Do you know how it works? Let us explain it to you.

First, materials were recycled, and raw materials were produced and extracted because they are needed to create textiles like fabrics and yarns – they did not look much like we do.



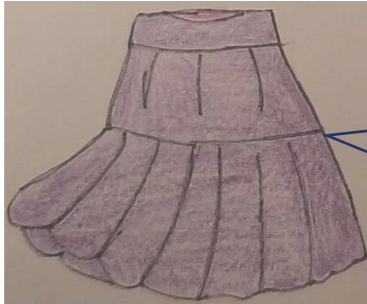
In the third step we were designed. Designers decided how we should look, what we should be able to do, and which materials should be used to create us.

Then we got produced in a factory according to the designers' ideas.



After we looked as fashionable as we do now, we travelled a very long way to finally arrive in this shop. Here we wait for you to buy us.

When you bought us, you will use us, and we hope that you will like us and take good care of us.



But what happens to us after we are worn out? What happens when you don't want to wear us anymore because we are out of fashion or damaged?

In a circular fashion system, the goal is to extract the maximum value from us. When we are no longer needed, the aim is to recover and regenerate the used materials into something else that is useful. So, we are not being wasted.



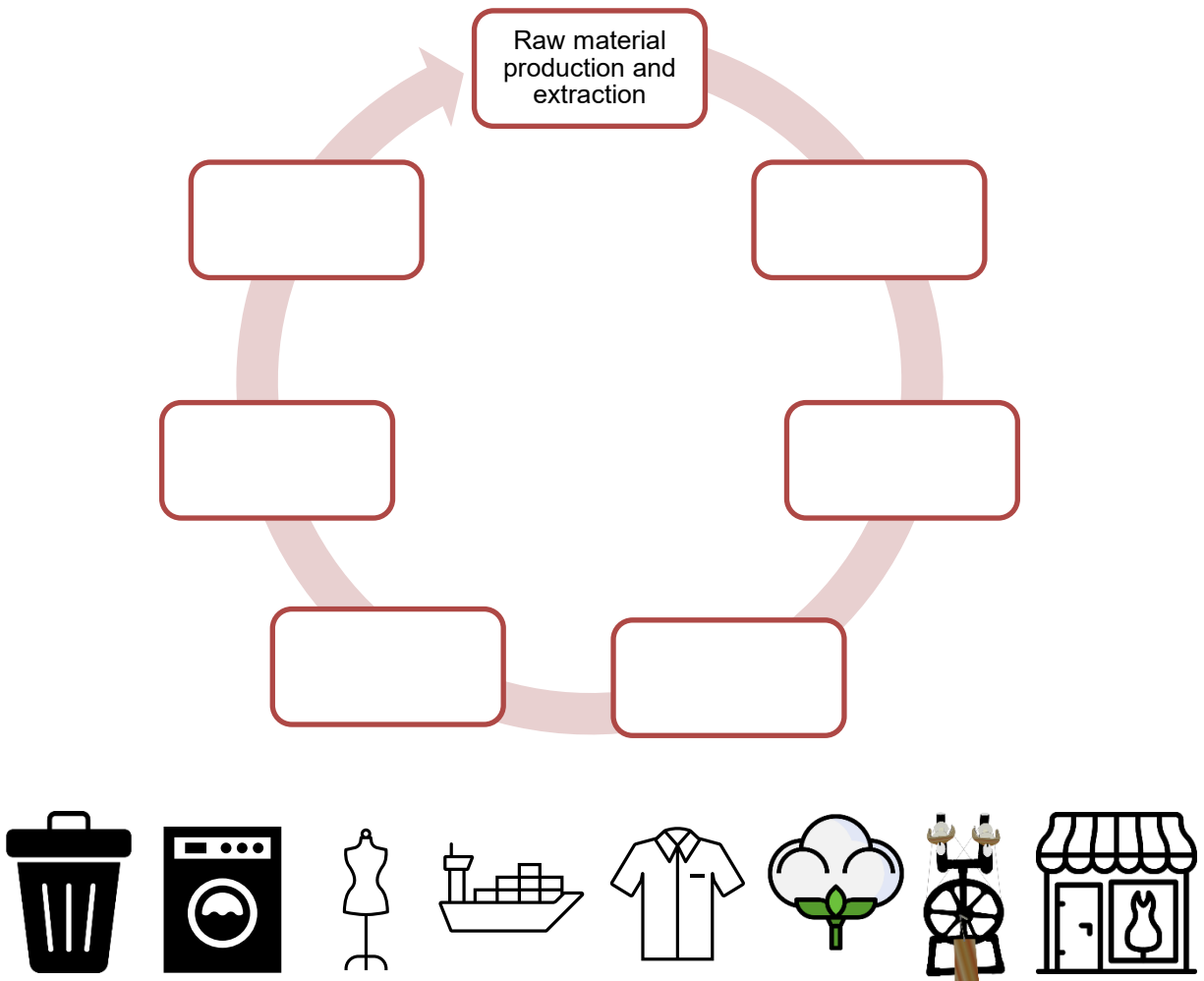
Illustrations: CC BY-SA-ND Schmidbleicher

Task: Discuss the following questions in the plenary.

1. What are the different steps of the circular fashion system?
2. What happens after the use phase?
3. Which alternatives do you see for the skirt and the shirt after they are worn out?
4. Form a group with classmates that had the linear fashion system. Explain the fashion systems to each other and compare both systems. How do they differ?

2.2.3.4 Worksheet 4

Circular fashion system



Tasks:

1. Bring the words into the right order and write them into the diagram:
Consumer use, Disposal, Shop, Garment production, Fashion design, Transportation, Textile production.
2. Draw a line between the suitable symbols and words in the diagram.
Use a pencil so that you can correct them.
3. Explain a circular fashion system in your own words and write it down:

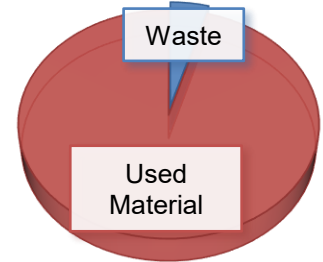
A circular fashion system is ...

2.2.3.5 Worksheet 5

Design strategies for low waste

Read the text and take notes.

The most common method of making clothes involves cutting fabrics and assembling the pieces into clothes. During this process up to 15% of the fabric is being wasted.



This waste can be reduced through the zero-waste pattern design approach. The approach aims to create clothes without generating fabric waste. To achieve this aim, the length of the fabric must be calculated. Then all cutting pieces are placed next to each other like a puzzle. To use all the fabric, they need to interlock perfectly.

A second approach to reduce pre-consumer waste is 3D design. Due to 3D design, physical prototypes and samples are unnecessary since designers can see garments instantly. This reduces pre-consumer waste and makes communication between designers, brands and manufacturers easier.



Another solution to reduce waste within a circular fashion system is the mass customisation. It enables personalised, tailored and made-to-measure services for mass production. Data about consumer preferences, behaviour and demand is being collected. Then the products can be adjusted to better fit the consumer tastes and wants. This strategy leads to less unsold clothes.

Tasks:

1. Form a group with your classmates that also had “design strategies for low waste”. Talk about your notes with your group members.
2. Create a glossary for your classmates with words from the text. Your glossary should include the term and a description of the word.
3. Create a poster about the design strategies for low waste. Do not write whole sentences on posters.
4. Prepare a short presentation in which you present and explain these design strategies to the class. For support, you can have a look at the tip cards on the table.

2.2.3.6 Worksheet 6

Design strategies for low-impact materials and processes

Read the text and take notes.

It is estimated that more than half of the environmental footprint of the textile industry is created in the state in which fabric, yarns and fibres are produced. Therefore, there is the need for alternative, lower impact materials and improved manufacturing processes.

When a designer chooses the materials for garments, the materials' attributes and how they suit the wearing practices must be considered carefully. Thereby it is also important to evaluate the materials' aging processes so that the materials do not look old too fast. Recycled materials such as PET from bottles are available for textile production. But even with an increased use of recycled materials, some virgin material input will likely always be required.

Choosing materials for garments is considered one of the most problematic phases in the sustainable fashion design process because each fibre has its own environmental burden. It is impossible to decide whether natural fibres or manufactured fibres are environmentally friendly.



During the processing stage, the yarns, fibres and fabrics or garments must go through multiple steps to achieve the desired performance and aesthetics. These steps can broadly be categorised into pre-treatment, dyeing, printing and finishing treatments. All of them have much potential to have a negative health and environmental impact. To combat these impacts, a growing number of innovative environmentally friendly technologies are emerging in the market. These innovations can have a significant impact in reducing water, dyes, chemical consumption and energy requirements.

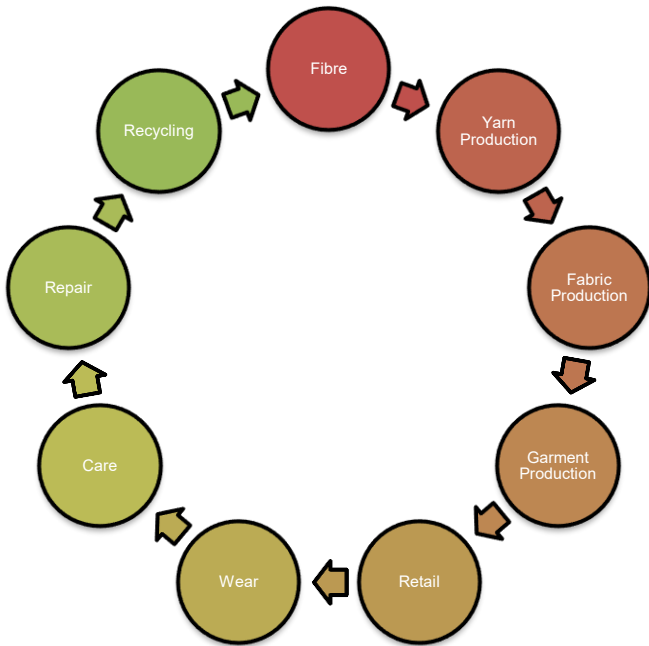
Tasks:

1. Form a group with your classmates that also had “design strategies for low-impact material and processes”. Talk about your notes with your group members.
2. Create a glossary for your classmates with words from the text. Your glossary should include the term and a description of the word.
3. Create a poster about the design strategies for low-impact materials and processes. Do not write whole sentences on posters.
4. Prepare a short presentation in which you present and explain these design strategies to the class. For support, you can have a look at the tip cards on the table.

2.2.3.7 Worksheet 7

Design strategies for recyclability and disassembly

Read the text and take notes.



All clothes should first be cycled through the technical loop of reusing, repairing and remaking. Recycling is the last option in a circular economy since the materials are recovered but their product functionality is lost. Nevertheless, the recyclability is also a prerequisite for products when the extension of their usefulness is no longer possible. A major concern for chemical and mechanical recycling methods is the complexity of textile products, due to the use of material blends, the layering of different materials, the presence of prints, elastane and trims which include chemicals, colours and dyes as well as other harmful substances.

The circularity of materials is enabled by keeping different technical materials separate or easily separable since not doing so can hinder recycling. This is described by the term design for disassembly, which is a design strategy that

enables the product to be taken apart in a way that allows to reuse, remake, or recycle the materials and components. This includes the use of fewer parts and fasteners, as well as the avoidance of glues. Using recycled materials rather than virgin ones offers an opportunity to drastically reduce non-renewable resource inputs and the negative impacts of the industry.

Tasks:

1. Form a group with your classmates that also had “design strategies for recyclability and disassembly”. Talk about your notes with your group members.
2. Create a glossary for your classmates with words from the text. Your glossary should include the term and a description of the word.
3. Create a poster about the design strategies for recyclability and disassembly. Do not write whole sentences on posters.
4. Prepare a short presentation in which you present and explain these design strategies to the class. For support, you can have a look at the tip cards on the table.

2.2.3.8 Worksheet 8

Design strategies for longevity and durability

Read the text and take notes.

Good quality and durability of fabrics and fibres means that they can be used over a longer period of time. Longevity can be considered from either the product or the material perspective. The material longevity focuses on enabling the repeated use of material resources through efficient recycling. The product longevity, on the other hand, focuses on extending the useful lifetime of products through physical and emotional durability.



The physical durability considers the garment's design and construction. It might be enhanced by blending different fibres, which improves the durability of the fabrics and the comfort of the final product. A high yarn twist generally improves the strength of the fabric and reduces the pilling.

Finishing processes improve the look, performance and feeling of clothing. They therefore affect the performance and durability or help extend the active use of a garment. Dyes, prints, as well as the selection of dyeing methods, have a huge impact on the colour fastness, colour fading and consequently on the durability of a garment. Each manufacturing technique is best suited to a particular fabric or garment type and can help to achieve greater durability.

A very important design factor in extending a garment's life expectancy is its cut. An option to maximise the longevity of garments is designing garments that can be adapted over time such as adjusting the size to an individual's various shapes. Oversized shapes that can be worn with a belt could potentially be worn for a longer period of time. Garments that are adaptable and upgradeable allow one piece to match several outfits.

Tasks:

1. Form a group with your classmates that also had "design strategies for longevity and durability". Talk about your notes with your group members.
2. Create a glossary for your classmates with words from the text. Your glossary should include the term and a description of the word.
3. Create a poster about the design strategies for longevity and durability. Do not write whole sentences on posters.
4. Prepare a short presentation in which you present and explain these design strategies to the class. For support, you can have a look at the tip cards on the table.

2.2.3.9 Worksheet 9

Tip cards for the presentation

Introduction and goals:

Today we are going to talk about ...
I/we want to give a presentation about ...
The purpose/goal of this presentation is ...

Structure:

Our presentation is divided into ... parts.
In our presentation we will focus on ...

We will start with ...
Then we will look at ...

Starting point:

Let's start with ...
Let's start by explaining why/how ...
I/we would like to give you some background information about ...

Transition:

I would like to give the word to ...
Now I will pass you over to ...
This leads me over to ...

The purpose of this presentation is ...
The goal of this presentation is ...

Graphs and images:

Let me use a graphic to explain this ...
The graph/picture shows how/that...
If you look at this chart/picture, you can see that ...

Summary and conclusion:

I/We would like to conclude by ...
That brings us to the end of our presentation.
Thank you for your attention/listening.

2.2.4 References

Text

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Khanna, P., Kanayala, J., Parker, G., Borst, C., Van den Bergen, J., & Lönnqvist, J. (2020). *The State of Circular Innovations in the Indian Fashion and Textile Industries*. <https://reports.fashionforgood.com/report/state-of-the-circular-innovations-in-the-indian-fashion-and-textile-industry/>

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Tutorials

Waste & Resources Action Programme (WRAP) (2017). *Introducing durability*. <https://youtu.be/G879BnWGOUY>

Images

Worksheet No. 2, No. 4. and No. 6:

Cotton, surang, CC0, https://www.flaticon.com/free-icon/cotton_5742001

Disposal, Flipper, CC0, https://www.flaticon.com/free-icon/garbage-bin_5681314?term=disposal&page=1&position=29&origin=search

Fashion shop, Prettycons, CC0, https://www.flaticon.com/free-icon/shop_1563400?term=fashion+shop&page=1&position=6&origin=search&related_id=1563400

Spinning Wheel Spinning Yarn, OpenClipart-Vectors, <https://pixabay.com/service/license>, <https://pixabay.com/vectors/spinning-wheel-spinning-yarn-154120/>

Worksheet No. 5:

Male Character - Clothes and Hair, sapenton8821, Creative Commons, CC BY 4.0, <https://search.openverse.engineering/image/62f41901-ccdf-444d-9267-bd1d3c1d04c2>

Worksheet No. 7:

Circular Economy CC BY-SA-ND Grundmeier

Worksheet No. 9:

Notizen, TBIT, <https://pixabay.com/de/service/terms/>, <https://pixabay.com/de/vectors/notizen-klebenotiz-erinnerung-memo-1014547/>

2.3 Visible Mending

Dorit Köhler

2.3.1 Introduction

The focus is on the concept of mending clothes as a way of consciously consuming clothes, which preserves their value, raises awareness of their worth and prevents new purchases. This appears in the context of the lack of raw materials and finished goods with different cultural references and in connection with the abundance of fast fashion, whose downsides are becoming increasingly apparent.

Competences and Learning Objectives

- describe the process of repairing as a cultural phenomenon.
- recognise that repairing and recycling can have scarcity and sustainability aspirations in abundance as a starting point.
- recognise that repairing and thus avoiding the consumption of textiles is a way of acting in the sense of sustainability.
- recognise that a (necessary) repair technique can become a decorative element.
- apply different textile techniques (sewing, embroidery, felting) for repair and as decoration from different cultural areas.

2.3.2 Overview of Working Materials

Lesson module 1:

Topic: "Make-Do and Mend"

Worksheets: A1 Lack of raw materials in and after World War II

Lesson module 2:

Topic: Abundance! - The dark side of fast fashion

Worksheets: A2/1, A 2/2

Lesson module 3:

Topic: I'll make something out of it – Upcycling

Worksheets: A3/1, A3/2

Working materials: Trouser leg, sewing machine, possibly leftover cotton fabric for lining, thread

Lesson module 4:

Topic: Stuffing and visual mending

Worksheets: A4 Oh, a hole in my jumper!

Working materials: Worksheets, textiles with damage, yarn, darning needle, possibly felting needle and unspun wool

Lesson module 5:

Topic: And what does it look like somewhere else? - Boro and Sashiko from Japan

Worksheets:

A5 Information text: And what does it look like somewhere else? - Boro and Sashiko from Japan

A6 Cushion in Boro style

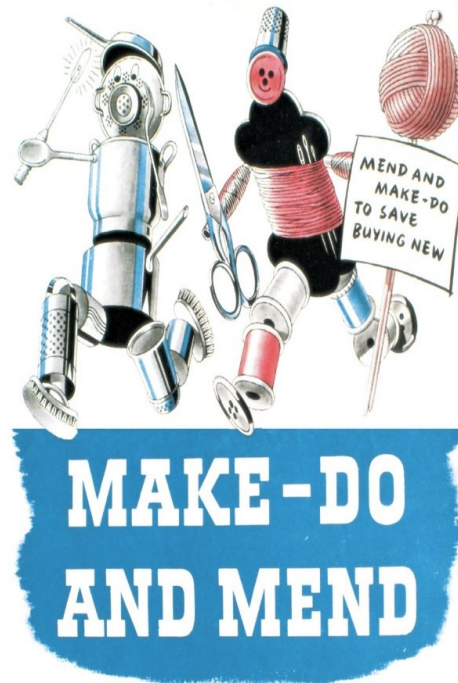
A7 Sashiko from Japan - postcards with sashiko motifs

Working materials: Worksheets, fabric, embroidery thread, needle, marking pen, ruler

2.3.3 Materials

2.3.3.1 Worksheet 1

Lack of raw materials in and after World War II



<http://vitiworks.blogspot.com/2012/12/make-do-and-mend.html>

“Make-Do and Mend” was a pamphlet issued by the British Ministry of Information in the midst of WWII. It was intended to provide housewives with useful tips on how to be both frugal and stylish in times of harsh rationing. With its thrifty design ideas and advice on reusing old clothing, the pamphlet was an indispensable guide for households. Readers were advised to create pretty ‘decorative patches’, to cover holes in worn garments; unpick old jumpers to re-knit chic alternatives; turn men’s clothes into women’s; as well as darn, alter and protect against the ‘moth menace’. An updated version of the book was recently released to coincide with the economic recession, offering similar frugal advice for 21st century families.

Tasks:

1. Describe the intention of the British Ministry's "Make-Do and Mend" initiative during World War 2.
2. Do you see parallels to the current situation in dealing with textiles? Make references and formulate them in writing.

2.3.3.2 Worksheet 2

The dark side of fast fashion – too much of everything (1/2)

Picture 1: Atacama Desert in Chile



Status: 26th of November 2021 02:38 o'clock
<https://www.tagesschau.de/ausland/amerika/muellhalde-atacama-wueste-101.html>

Task 1: Describe what is in the picture and make guesses about what it is.

The dark side of fast fashion – too much of everything (2/2)

Task 2: Read the text and then answer the questions:

The unique Desierto de Atacama in Chile is degenerating into a dumping ground for fast fashion clothing. The regional secretary of the Ministry of Environment is quoted: “No doubt, these landfills and textile waste are a big problem for the environment. They often cause fires, which pollutes the air. And this affects local residents as well because the dumps are very close to populated areas.”

The textiles are as toxic as plastic or tyres. They contain many pollutants, for example through dyeing, bleaching, or printing. According to a recent study by Greenpeace, the textile industry uses more than 70 chemicals that are hazardous to health and the environment. The polyester contained needs up to 200 years to degrade, and even then, so-called microplastic particles remain.

Normal landfills do not even accept this kind of hazardous waste, says Franklin Zepeda. He has founded a company that processes the discarded clothing. “The textile waste is generated by importing the used clothes. In the free trade zone, it is sorted into high-value and secondary garments and waste. It all used to go to the desert, we now use it as raw material for our thermal insulation panels.”

The founder of Ecocitex, Rosario Hevia from Santiago, also recycles the weathered textiles and makes yarn from them. But these remain isolated initiatives in the fight against a global problem: the overproduction of the textile industry. According to a UN report published in 2019, between 2000 and 2014, global textile production doubled. Meanwhile, the industry is responsible for around 20 per cent of water consumption worldwide.

Environmental organisations like Greenpeace are calling for more pressure on the textile industry: “There should be an obligation to recycle properly. People need to rethink,” says entrepreneur Hevia, “and question their own consumption behaviour.” (Herberg, 2021)

Questions:

1. Why are these mountains of clothing considered as trash and who are the culprits behind them?
2. What problems arise from this dumping of textiles?
3. What solutions are there to avoid this problem?
(Please also name those that are not mentioned in the text).

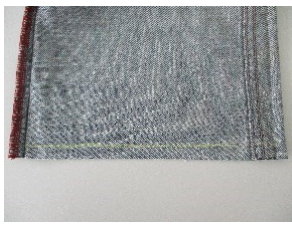
2.3.3.3 Worksheet 3

I'll make something out of it – Upcycling

Project 1: Utensilo from trouser legs



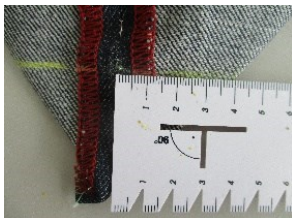
1. Cut off the trouser leg according to the desired length.



2. Close the bottom seam.



3. Sew the bottom: Place the bottom seam on the side seam.



4. Mark the desired depth (3-4 cm on each side).



5. Sew the line with a straight stitch; you can cut off the outer part or leave it if the fabric is thin.



6. Turn over; finished!

Photos: CC BY-SA-ND Köhler

Project 2: Utensilo made from lined trouser legs

This project is good for the upper parts of the leg, which have cut edges on both sides.

1 - 4. Refer to the steps from project no. 1 from the trouser leg.



5. Cut a rectangle from thinner cotton fabric with the measurements of the leg unfolded.



6. Close the seams at the sides and at the bottom.



7. Sew bottom: refers to project no. 1 steps 3 and 4.



8. Place trouser part and fabric bag with right sides together at the top edge; sew 1cm wide, leaving a gap of approximately 7cm.



9. Turn over, smooth out upper edge, open seam allowances
a) fold inwards,
b) place on top of each other and
c) stitch the whole edge; finished!

Photos: CC BY-SA-ND Köhler

2.3.3.4 Worksheet 4

I'll make something out of it – Upcycling



Who has not experienced this: a hole in your favourite knitted jumper?

These instructions explain how to make holes not only disappear, but also become eye-catchers. And this is how it works:

Visual Mending through darning

Material:

embroidery needle, embroidery floss or wool yarn



1. Thread the thread (e.g., embroidery floss or wool yarn) into a darning needle.
2. Secure the stitches by passing the thread through the open stitches and tensioning the warps.



3. Add more warps.



4. Pass the thread in horizontal direction always once over and under the warps. In the following row you must do it the other way round (plain weave).

Photos: CC BY-SA-ND Köhler



Visual Mending through embroidery motifs

Material: embroidery needle, embroidery floss or wool thread

Carefully pick up the stitches with a sewing thread and pull them together.

Embroider a motif on the created area.



Visual Mending through Needle Felting

Material: sewing needle and thread, loose sheep's wool, felting needle, suitable mat e.g., foam material

Carefully pick up the stitches with a sewing thread and pull them together.

Place loose sheep's wool (dyed or undyed) in the desired shape, place mat under the surface and stitch into the surface with the felting needle from top to bottom until the knitted fabric and the loose fibres join.

Make sure that the contours of the desired motif remain in place.



Photos: CC BY-SA-ND Köhler

2.3.3.5 Worksheet 5

And what does it look like elsewhere? – Boro and Sashiko from Japan

Boro and sashiko are traditional textile techniques from Japan that have been used to repair textiles for centuries and thus preserve them. Both are based on the Japanese principle of wabi-sabi. This is based on its own idea of aesthetics: the reduction to the essential. Moreover, it is about appreciating the beauty of imperfection, destruction and the ageing process as an aesthetic value in their own right. These traces remain visible, and the objects gain in significance and sublimity as a result. Crooked seams, faded colours, wear and tear increase the appreciation of the object.

In the Boro technique, worn-out and worn kimonos are torn apart and used to make blankets, mats and other items. Additionally applied embroidery stitches tone-on-tone are used to work on tears and holes in such a way that a stable surface is recreated.

The embroideries become an artistic decoration, on the one hand, through the composition of the motifs and, on the other hand, through the *Do*. In the traditional Japanese sense, the *Do* is the path that becomes the goal and gives the work an emotional and symbolic meaning beyond its actual result.

In sashiko, parallel lines, crosses, arcs and staircase-shaped lines, which in turn form further shapes, are pre-drawn and embroidered in the pre-stitch. The traditional colours for sashiko embroidery are white and blue. Either a blue thread is embroidered on white fabric or a white thread on blue fabric.

The patterns are not random and not just chosen for aesthetic reasons. Each pattern has traditional roots and a symbolic meaning, often related to the world of the gods in Shintoism. According to the traditional understanding, the meaning of the pattern should be transferred to the wearer of the garment and his or her everyday life.

Tasks:

1. Research for more information on the history and significance of the techniques of boho and sashiko on the internet. Present similarities and differences to the use of textiles in the context of fast fashion.
2. Find three patterns of the sashiko, draw them and note their meaning.

2.3.3.6 Worksheet 6

Boro-style cushion



1. Assemble rectangles of desired size into a cushion panel (seam allowance 1cm).



2. Accentuate the seam with a running stitch.



3. Accentuate the seam with a herringbone stitch.



4. Overstitch the seam with stitches at a right angle.

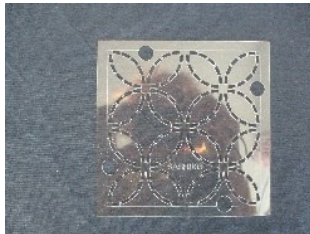


Photos: CC BY-SA-ND Köhler

2.3.3.7 Worksheet 7

Sashiko from Japan - Postcards with Sashiko Motifs

Materials: Fabric or garment to embroider / mend; long sewing needle, embroidery thread in your desired colour, ruler for drawing the pattern, tailor's chalk, pins, pencil for tracing, pattern template (self-drawn or copy), fabric scissors



1. Transfer the pattern: place the pattern on the fabric, trace the pattern lines with a needle, rub tailor's chalk over the pattern so that the chalk is visible through the holes on the fabric.
Trace the pattern with chalk. / Alternatively, you can directly draw the patterns on the fabric with chalk.

2. Stitch the design with a small, regular pre-stitch (approx. length of a grain of wheat); it should look like a dotted line. The stitches on the front must not touch at the crossing points of the lines.

3. Running stitch (a characteristic of Sashiko is this way of working the running stitch): The long needle is passed up-down-up-down through the fabric several times and the thread is then pulled through.

4. Smaller motifs are done in this way and then the pieces of fabric are presented behind a piece of cardboard as if behind a passepartout.

Photos: CC BY-SA-ND Köhler

2.3.4 References

Text

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2.4 Avoiding Waste

Dorit Köhler

2.4.1 Introduction

This unit's focus is on strategies for waste avoidance. Sources of waste will be identified and possibilities for action in terms of the responsible use of raw materials and the environment. Thereby, it should be shown that this does not imply focusing on renunciation but on creativity and design possibilities instead.

Competencies and Learning Content

- understand and recognise the excessive amount of waste and its problematic nature.
- identify the microplastic pollution of the oceans as one dimension of education for sustainable development.
- recognise possibilities of avoiding waste, e.g., in the area of packaging, and act in the sense of sustainability.
- recognise opportunities that show that waste prevention is about acting creatively and responsibly instead of relinquishing.
- master various textile techniques and apply them as a design element.

2.4.2 Overview of working materials

Teaching module 1

Topic 1: Waste as a phenomenon

Worksheet: 1 What is rubbish? And what is waste?

Teaching module 2

Topic 2: Generation of plastic waste

Worksheet: 2 That adds up to quite a lot – plastic waste in Europe

Teaching module 3

Topic 3: Microplastics

Worksheet: 3/1 Microplastics – inconspicuous and everywhere

3/2 Microplastics from textile fibres

Teaching module 4

Topic 4: Gift packaging

Worksheet: 4/1 Looks nice, but does not create any waste – sewing gift bags

Work materials: fabric scraps (need to be hotly ironable), sewing thread, sewing machine, cord/tape.

Teaching module 5

Topic 5: Shopping without a bag

Worksheet 5/1: Crochet a shopping net

Work materials: about 100g cotton yarn (thickness 3.5-4), crochet hook of appropriate thickness, and darning needle for sewing the threads.

2.4.3 Materials

2.4.3.1 Worksheet 1

What is rubbish? And what is waste?

Colloquially, the terms rubbish and waste are used interchangeably. However, in technical language, waste refers to things that are defined by law as the substances or objects that a person discards as (s)he wants or must do so. The decision about what is still usable and what is already unusable is very individual and cannot be clearly defined.

According to preliminary estimates, Germany generated an average of 646 kilograms of municipal waste per inhabitant in 2021. This was significantly higher than the EU average of around 530 kilograms per inhabitant. Only Luxembourg (793 kg), Denmark (786 kg), and Belgium (759 kg) had even higher waste quantities than Germany. Especially in the eastern EU countries, waste generation was significantly lower. The lowest quantities per inhabitant were recorded in Romania (302 kg) and Poland (362 kg) (DeStatis Europe, n.d.).

Municipal waste includes the following materials: paper, cardboard and paper products, plastics, glass, metals, food, and garden waste as well as textiles. It is the waste generated in households, trade, commerce, offices as well as institutional facilities. It also includes bulky waste, leaves and tree cuttings, street sweepings, and the contents of waste containers (DeStatis Europe, n.d.).

Tasks:

1. Formulate your personal definition of waste.
2. Where and how does waste arise in your household? What can you do to reduce it, besides cutting down on your consumption?
3. Make a table of your amount of waste in one week and think about alternatives.
4. My amount of waste in one week

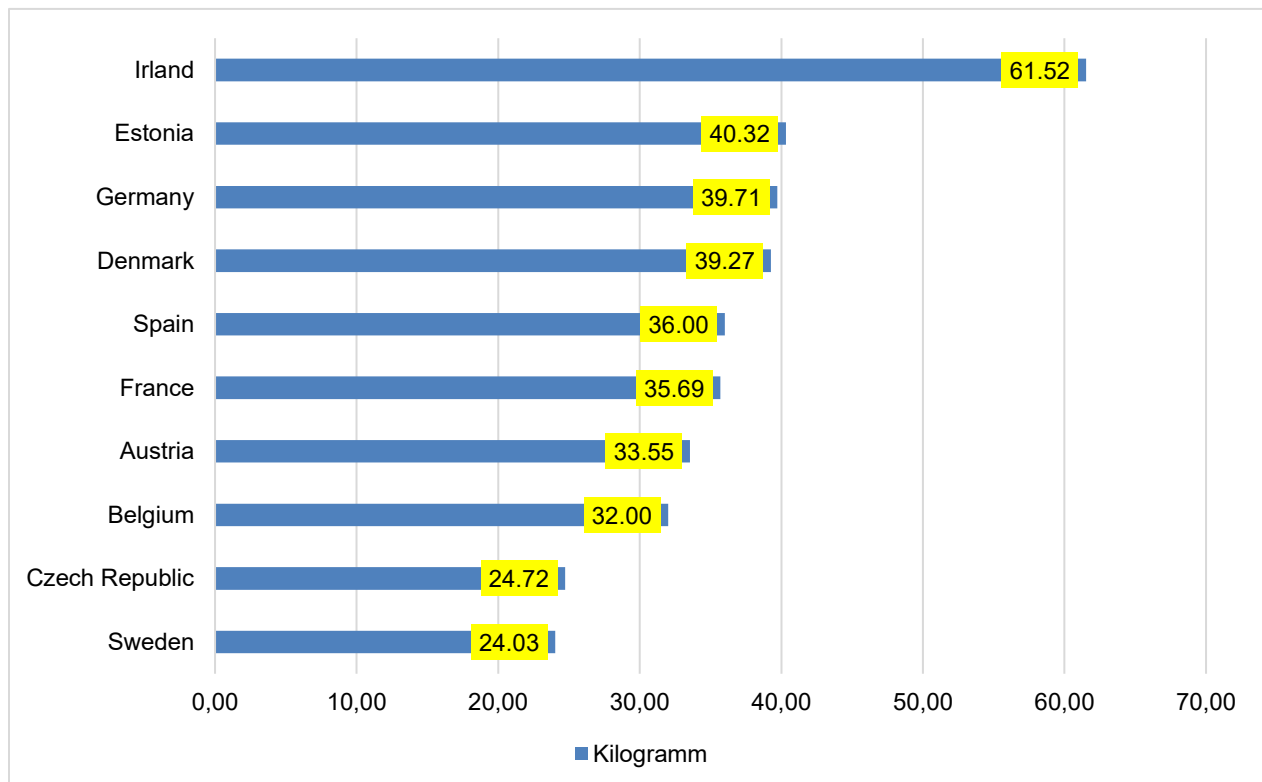
| Type of waste | Alternative purchase | Alternative use |
|-----------------------------|-------------------------------|-----------------------------------|
| Plastic packaging for fruit | Unpacked fruit / shopping net | |
| Discarded blouse | | Patches/fabric stock for quilting |
| ... | | |
| ... | | |

2.4.3.2 Worksheet 2

That adds up to quite a lot - plastic waste in Europe

The table below shows the amount of plastic produced in kilograms per inhabitant in selected EU countries in 2020. It covers every type of plastic material which is consumed and then disposed of.

Fig. 2: Plastic packaging waste per inhabitant (in kg) in selected EU countries in 2020 (EU average: 34.55 kg).



Source: Statista Research Department, 2023

Tasks:

1. Create a mind map of the areas where plastic waste is created. Then search the Internet for figures showing the percentage distribution in your country.
2. Look at the table. Then think about which countries have a particularly high and which a particularly low amount of plastic packaging.
3. Consider why this might be the case and formulate at least one reason.

2.4.3.3 Worksheet 3

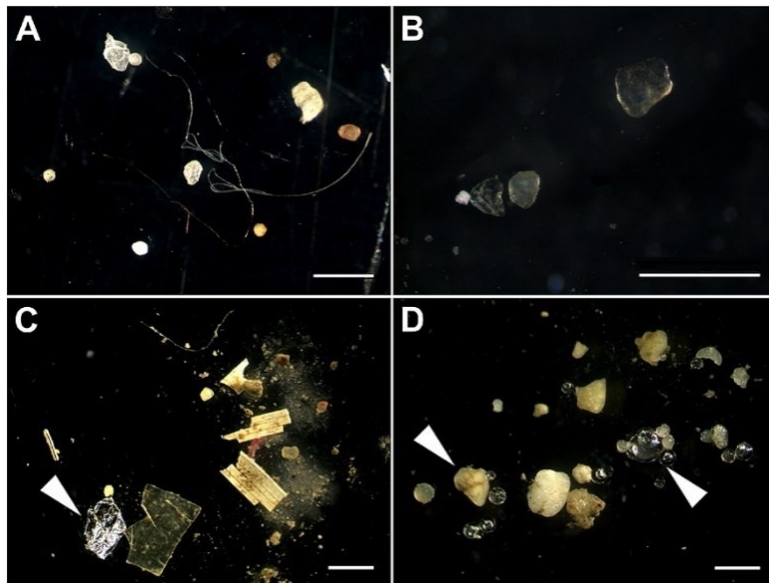
Microplastics – inconspicuous and everywhere (1/2)

Microplastics are ubiquitous nowadays. Tiny particles of ground-up plastic material can be found in oceans and rivers, but also in fields, food, and the stomachs of animals.

The term microplastic is usually used when speaking of plastic particles that measure less than five millimetres. However, there is still no scientific definition or legally defined term for this phenomenon. This makes comparing the results of studies difficult while also making greenwashing easier for companies.

NABU (n.d.) calls for all input pathways of microplastics to be examined for their reduction potential and measures developed for all sources. This goes hand in hand with the precautionary principle.

Fig. 3: Microplastics in sediments



Microplastics in the sediment of the rivers Elbe (A), Moselle (B), Neckar (C), and Rhine (D). (Note the diverse shapes (filaments, fragments, and spheres) and that not all items are microplastics (e.g., aluminum foil (C), glass spheres and sand (D), white arrowheads). The white bars represent 1 mm.)

CC BY 4.0 Martin Wagner

Tasks:

1. Search the internet for the sources of microplastics and their share in Europe. Write down at least three sources.
2. Research alternatives and possible actions to reduce microplastics. Formulate at least two alternative actions that you would implement.

Microplastics from textile fibres (2/2)

More than one third of the microplastics in the seas come from textiles. This is because synthetic fibres from clothing dissolve when washed and end up in the sea. A single fleece jacket can release up to one million fibres per washing cycle, and a pair of nylon socks another 136,000. According to an EU study, Europe's washing machines alone flush 30,000 tonnes of synthetic fibres into the wastewater every year (Greenpeace, 2017).



Fig. 4: Fibres as a source of microplastics,
CC BY-SA Anne-Marie Grundmeier

Synthetic fibres are polymer fibres produced synthetically from petroleum. They are used as filaments or staple fibres to produce many textiles and make up more than half of the world's fibre consumption.

Pictures of plastic accumulations on the shore or garbage patches in the oceans go around the world. However, it seems to be less recognised that similar tragedies are taking place in the microscopic world of plankton (Greenpeace, 2017).

Some of the fibres can be retained in sewage treatment plants. However, a large part ends up in rivers and seas. Since textiles made of synthetically produced fibres are not biodegradable, they break down into even smaller particles and accumulate in the water. They also enter the food chain of animals and ultimately humans. It has not yet been conclusively investigated what damage the smallest particles can cause to health. However, studies show that marine animals do not thrive as well when they ingest plastic particles (Cole et al., 2011).

To date, there is no sign of a reduction in fibre use. There are calculations that the clothing industry can increase its use of synthetic fibres by another 62 per cent by 2030. Thus, the world's population will consume 102 million tonnes of clothing. This amount is equivalent to 500 billion T-shirts. These textiles will be made up of almost 70 per cent synthetic fibres (Greenpeace, 2017).

Fig. 5: Fleece as a source of microplastics



Tasks:

1. Research the advantages of synthetic fibres compared to natural fibres. Name and justify at least one advantage.
2. Which alternatives do you think are possible? Think for yourself and search the internet to see what solutions can be found. Describe one solution in detail.

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2.4.3.4 Worksheet 4

Looks nice, but does not create any waste – sewing gift bags



Cut a rectangle of fabric.
The size is arbitrary, so fabric scraps
can be reused very well.



Mark 2 and 5cm on both sides of the
fabric piece for the fold/cover.



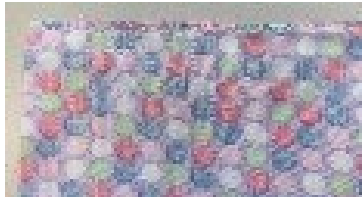
Press the fold over so that the edge of
the fabric meets the 2cm mark.



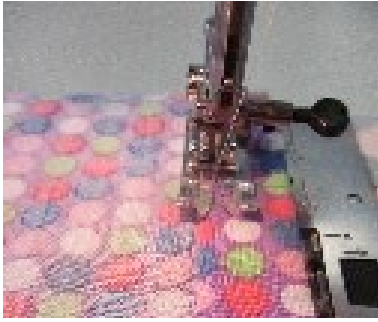
Press the cover over so that the fold
meets the 5cm mark.



Fold up the pressed edges and sew the
side seams with a seam width of 1cm.



Neaten the seam edges together.
If you want to create a tunnel, neaten
the upper 5cm separately.



Fold back the hoop edges and topstitch them close to the edge.

If you want to create a tunnel, leave the upper seam edges folded apart when folding over and stitching down. Open the side seam at the top over 2cm so that a cord or ribbon can be pulled in here.

Done!



Photos: CC BY-SA-NC-ND Dorit Köhler

2.4.3.5 Worksheet A5

Crochet a shopping net



Cast on 5 chain crochets and close the crochets to a round with 1 slip crochet, as shown in the picture.

Crochet solid crochets in rounds, increasing at the following rate:

Mark the beginning of the round.

Double every crochet in the first round.

Double every other crochet in the second round.

Double every third crochet in the third round, etc.

After the fifth round, switch from solid crochets to double crochets and continue to increase.

Crochet air crochet arcs. When the circle has reached the desired size for the bottom:

Make 3 chain crochet and skip 1 crochet.

Crochet a solid crochet and continue crocheting in rounds until the desired height is reached.

Handle: Make solid crochets along the top edge to where you want the handle to begin.

Make a chain of chain crochets in your desired length, attach it to the other side with a slip stitch, turn it, and crochet 2 rows of solid crochets on top of it.

Make solid crochets along the top edge to the other side where you want the handle to start.

Repeat this process with solid crochets at the beginning, cut the thread, and sew.

The net is finished!

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2.5 Craftivism

Dorit Köhler

2.5.1 Introduction

This unit's focus is on the phenomenon of craftivism. The term is a neologism that combines aspects of craft with activism. Typically, politically relevant issues, such as anti-capitalism, environmentalism, solidarity, pacifism, and feminism, are taken up and made public. Usually, textile objects are designed and produced as they are visible, thus calling for joint action. Sometimes activists also distribute objects with messages that call for reflection and action in cloak-and-dagger operations. This includes, for example, knitted and crocheted graffiti, which enriches the streetscape.

Closely related to craftivism are participatory art projects (also with textile materials), in which exhibition visitors are invited to participate in the creation of the artwork and become part of it during the exhibition or in advance.

Competencies and Learning Content

- describe the phenomenon of craftivism and participatory art and carry out or participate in their own actions.
- become aware of one's personal responsibility for political action and, ideally, act in this sense.
- name representatives of craftivism and participatory art as well as their actions and participate in them if desired.
- use different textile techniques and apply them as design elements.

2.5.2 Overview of working materials

Teaching module 1

Topic 1: Craftivism as a phenomenon

Worksheet 1: Making Protest Visible through Textiles – Craftivism and Knitted Graffiti

Teaching module 2

Topic 2: Performative art projects

Worksheet 2: Crocheting for Corals – The art project to participate and change the world

Teaching module 3

Topic 3: Design and create embroidered protest patches

Worksheet 3: That's what I'm for! - Embroidering Protest Patches

Work materials: Embroidery hoop, fabric for embroidery, embroidery thread, embroidery needle; optional: beads, stones, etc.

Teaching module 4

Topic 4: Arpilleras – tradition and own production of textile picture stories

Worksheet 4/1: Arpilleras – South American everyday life and resistance on sackcloth

Worksheet 4/2: What should change – picture stories on political topics as mixed media

Work materials: Paper, pencils, solid base material (jute, felt, etc.), fabrics for appliqué, yarn, realia (metal, plastic, glass, etc.), paint, and brushes

Teaching module 5

Topic 5: T-shirts as a carrier of meaning

Worksheet 5/1: I wear the message on my chest – T-shirts as carriers of meaning

Worksheet: 5/2 That's what I want to say – T-shirts with self-printed messages

Work materials: Cotton T-shirt, cotton fabric, letter stamps, stamp pad with fabric paint, foam rubber, wooden blocks, scissors, glue

2.5.3 Materials

2.5.3.1 Worksheet 1

Making Protest Visible through Textiles – Craftivism and Knitted Graffiti

Non-commercial handicrafts in the field of textiles are closely linked to gender identity, the socialisation of women, and the role expectation of the *good housewife*. This determined and still determines the education of young girls in the field of textile handicrafts. The young woman doing needlework became a metaphor for female education and virtue, as she combines endurance, patience, precision, uniformity in execution, and manual dexterity. For centuries, the display cabinet with self-sewn or self-embroidered linen and clothing as well as the embroidered sampler were considered products of a specifically female *quality criterion*, which were also publicly exhibited. An activity that otherwise tended to take place in the domestic sphere served as a sign that the socially determined role expectation had been fulfilled (Köhler, 2022, p. 38).

In the Craftivism movement (e.g., Corbett, 2017), the stereotypical and archetypal image of women and textile handicrafts is questioned and transformed into a means of expression, in which needlework takes place decidedly in public space and is associated with a political statement. The Knitting in Public (KIP) movement aims to irritate through the public practice of a quiet activity that is traditionally more associated with the home (Mandell, p. 1ff). With the bright pink self-knitted *pussyhats*, which function as a protest sign against Donald Trump (Lemire, 2022, p. 118ff), women set an example for women's and human rights "by promoting dialogue and innovation through the arts, education and intellectual discourse" (Lemire, 2022, p. 118).

Craftivism, as a connection between "craft" and "activism", can be defined as a "way of looking at life where voicing opinions through creativity makes your voice stronger, your compassion deeper and your quest for justice more infinite" (Greer, 2014):

Sarah Corbett, the London-based founder of the Craftivism Collective, describes the aim as "to expose the scandal of global poverty and human rights injustices through the power of craft and public art. This will be done through provocative, non-violent creative actions" (Corbett, 2017, p. 45). With *The craftivism manifesto* she manifests global claims.

Corbett speaks of *public art* and thus places the public, *craft* and *art* in one context. In the art scene, the discussion of ecological issues and current environmental problems is also perceived as a public process. In participatory art projects, the experience and engagement with issues are intensified through one's involvement (Sawer, 2021, p. 10).

Tasks:

1. Research craftivism projects and present two examples in text and drawing or as a collage.
2. Create a mind map on possible topics for your project.
3. Develop your own project that you represent as a picture.

2.5.3.2 Worksheet 2

Crocheting for Corals – The art project to participate and change the world

One of the world's largest participatory art and science projects is the Crochet Coral Reef. It has so far involved more than 10,000 people in twelve countries and the exhibition has been seen by more than two million people in various locations.

Local organisers work towards the basic organisational requirements of the project in terms of a public venue (often a museum), funding, marketing and more. They call for crocheting coral elements from textile or other materials that, like plastic, illustrate the pollution of the oceans even more vividly, and organise workshops to learn the technique and the community work (Köhler, 2022, p. 39). The organisers assemble the coral elements to form a reef that can have a wide variety of shapes. The coherent reef combines different aesthetic dimensions and is associated by the organisers with different environmental actions (Mayer, 2015, p. 138).

The aim of performative art projects is to convey a sense of community and the importance and responsibility for the preservation of valuable living spaces for the individual. When making one's own piece, each person takes responsibility for his or her own project; it only becomes whole when the pieces are put together. Putting together a small part to form a large whole in a community is what gives it its strength. The aim is to convey the courage to get involved in socially relevant fields of action in a creative and action-oriented way.

Fig. 1: Coral reef Wyk on Föhr



CC-BY-SA-3.0
NearEMPTiness

Task:

In which fields could performative art projects create change?
Search for examples and think about how such a project could be initiated concretely.
Let's go!

2.5.3.3 Worksheet 3

That's what I'm for! - Embroidering Protest Patches



Make a design for a round or square patch and transfer the lines with a transfer pen to a neutral fabric background.

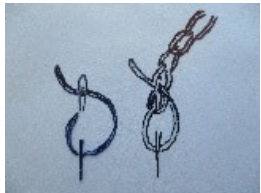
Example: J. Gessner, University of Education Freiburg



Embroidering contours: backstitch/lockstitch
Cut out, skip fabric threads to the right, stitch in, double the number of skipped fabric threads to the left and stitch in.



Embroider contours: stem stitch
Stitch out, skip fabric threads to the right, stitch in, and work left to about half of the previous stitch, stitch out. Always leave the work thread on the same side of the needle.



Embroidering contours: Chain stitch
Stitch out, stitch close to this point in again, make a loop, stitch out below the point of stitching, pull the thread through; stitch in next to the point of stitching out, make a loop, and so on. Secure the loop with a catch stitch on the last stitch.



Fill an area: satin stitch
Embroider in an embroidery hoop. This stitch consists of parallel stitches next to each other. Their direction determines the effect of the area.



Examples: Several students, University of Education Freiburg

2.5.3.4 Worksheet: 4

Arpilleras – South American everyday life and resistance on sackcloth (1/2)

Arpillera is a Spanish word that translates as burlap. Arpilleras are fabric paintings embroidered on burlap, mainly produced in South America. They depict everyday life from neighbourhoods and villages. Women come together in groups and make the arpilleras by handicrafts. This work gives them the opportunity to bring oppressive experiences into the picture and to inform and process what they have experienced.

At the time of dictator Augusto Pinochet's government in Chile (1973-1990), the economy declined, resulting in famine. People were persecuted by the secret service and political murders took place. In Santiago, poor neighbourhoods were surrounded by police and residents were arrested. Prisoners were tortured, taken to notorious camps, or disappeared. All this, but also the resistance of the population against oppression and mismanagement, was put into pictures using Arpilleras.

The arpilleras were made in women's groups initiated by the Vicaría de la Solidaridad (Vicariate of Solidarity) from 1976 to 1990. The Vicaría was an institution of the Catholic Church that provided legal assistance and concrete help to the persecuted population. The Vicariate also cared for the unemployed and organised groups for women who could do handicrafts and thus receive money to support their families. (Cristo Vive Europa e.V., 2021).

After mass protests flared up in 2019 following the increase in bus and train ticket prices, life in Chile has not settled down. Calls for social justice and constitutional change grew louder. Despite violent attempts by President Piñera's government to intimidate and silence the people through the military and police, the people prevailed. On 25 October 2020, there was a referendum in which 78% of the people voted in favour of changing the constitution. Now a group of representatives from different political camps and social organisations will work on a draft constitution. It will be a long road, but the first and decisive step towards a new and more just social order has been taken (Cristo Vive Europa e.V., 2021).

Fig. 2: Example: T. Schwering, University of Education Freiburg

Photo: CC BY-SA-NC-ND Dorit Köhler

Tasks:

1. Summarise essential features of the arpilleras.
2. Research for pictures of arpilleras and print or draw them.
3. Create a mind-map of issues about sustainability and political change that you would present on an arpillera.



What should change – picture stories on political topics as mixed media (2/2)



Make a design.
Cut the base (felt, jute, etc.) into a rectangle, eventually sew on a neutral cotton fabric in the same format and transfer the design.
Example: E. Haag, University of Education Freiburg



Design a picture: Painting and printing
Or else: Creating a picture by painting and printing



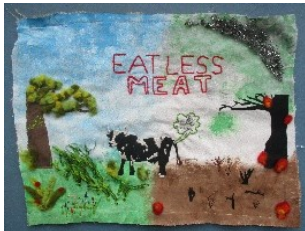
Design a picture: Appliqué



Design a picture: Machine embroidery



Design a picture: Hand embroidery



Example: N. Sommer, University of Education Freiburg

2.5.3.5 Worksheet 5

I wear the message on my chest – T-shirts as carriers of meaning (1/2)

The T-shirt's history starts close to humans: as underwear for men. Back then the T-shirt was covered by outerwear and was only visible during physical work. Examples were the Navy matrons who were allowed to wear the T-shirt while working on deck. In 1913, a white cotton T-shirt became the official underwear.

As a sign of rebellion against the establishment, the white T-shirt then gained value as a protest garment of youth culture with actors like James Dean and Marlon Brando wearing it. However, it did not yet have a print.

Since the 1960s, the T-shirt has increasingly become a space for political, promotional, or humorous messages. Thanks to screen printing, it became easier and cheaper to print on fabric since the early 1960s. As a result, personalised T-shirts were available from the 1970s onwards and their potential as a merchandising product was recognised quickly.

At the same time, ragged T-shirts or those with provocative prints and designs (e.g., with chicken bones) became an essential clothing feature of the punk subculture. This subculture was essentially co-determined by Vivienne Westwood. Her action of producing an iconic shirt for Queen Elizabeth II's Jubilee showing a portrait of the Queen with a safety pin poking through her lip became legendary.

The fashion designer Katherine Hamnett used slogan T-shirts in the 1980s to make statements against nuclear weapons and social injustices on the body in public.



Fig. 3: Sex Pistols, 1977
CC0 Odd Amundsen / Riksarkivet

Tasks:

1. Research the history of the T-shirt as a carrier of meaning.
2. Think about which messages would be on your T-shirt. Collect them first, then decide on one and make drafts for the realisation.

That's what I want to say – T-shirts with self-printed messages (2/2)

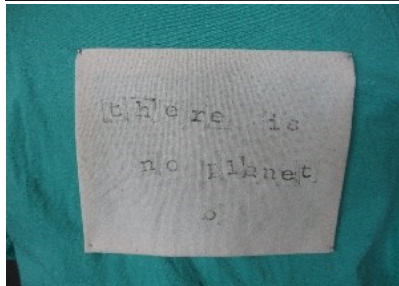


Think of a text. Stamp it onto a cotton fabric or directly onto the T-shirt.
Iron the fabric hot to set the colour.



Fold the sides 1cm inwards and iron the edges.

(Only follow this step, if you have not put the stamp on your t-shirt directly.)



Sew the fabric to the T-shirt.

(Only follow this step, if you have not put the stamp on your t-shirt directly.)



For a self-made stamp, cut out a motif from foam rubber and glue it onto a wooden block.



Color the surface with paint and print on fabric. You can also combine the motifs with the letter stamps.

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Images

Fig. 1: Coral reef Wyk on Föhr, NearEMPTiness, CC-BY-SA-3.0,
https://upload.wikimedia.org/wikipedia/commons/thumb/4/42/The_F%C3%B6hr_Reef_in_T%C3%BCbingen.JPG/1920px-The_F%C3%B6hr_Reef_in_T%C3%BCbingen.JPG

Fig. 2: Example: T. Schwering, University of Education Freiburg
Photo: CC BY-SA-NC-ND Dorit Köhler

Fig.3: Sex Pistols i Norge, 1977, Odd Amundsen / Riksarkivet, CC0,
[https://commons.wikimedia.org/wiki/File:Sex_Pistols_i_Norge,_1977_\(6263353228\).jpg](https://commons.wikimedia.org/wiki/File:Sex_Pistols_i_Norge,_1977_(6263353228).jpg)

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2.6 Sustainable Costume Design

Cathrine Strobel-Theunissen

2.6.1 Introduction

For a performance of the musical “Alice in Wonderland”, a cooperation of the Kerschensteinerschule in Stuttgart and the association “Musik auf Schloss Filseck” in Uhingen [Music at Filseck Castle in Uhingen], located in the federal state of Baden-Württemberg in Southwest Germany, took place in the summer of 2022. The musical was directed by Gerald Buß. It was a joint project of vocational school students (textile and fashion tailors, bespoke tailors, milliners) and pupils from the district of Göppingen. A separate casting took place for the speaking parts of the children’s musical. The stage choir consisted of the children’s choir of the Reuschgemeinde in Göppingen and the choir project of the Janusz-Korczak School in Göppingen.

The students at the fashion department of the Kerschensteinerschule Stuttgart developed ideas and designs for costumes for “Alice in Wonderland” and partially designed them. The focus of the designs was on sustainability-oriented work as a guiding principle. Resource conservation, appreciation of textiles, creative use of existing materials instead of buying new ones as well as the “pyramid for sustainable consumption” should in this way not only be dealt with theoretically but also be applied within the framework of specialised artistic practice.

The theme “Alice in Wonderland” was addressed in a project-oriented way over several teaching units in different subjects. Thereby, a total of 36 school hours of theoretical lessons were used in the vocational college subjects of fashion design and fashion drawing as well as the vocational school learning fields of technology and design. Additionally, three workshop days of 8 school hours each were used to create the costumes. The project’s period covered the months of May to July 2022. The performance took place at Filseck Castle.

Competences and Learning Objectives

- Describe the collection development process.
- Collect ideas, present, and discuss them in plenary.
- Check ideas and designs for their sustainable feasibility.
- Develop ideas via drafts.
- Develop ideas about modelling on the 1:2 scale miniature bust.
- Rework existing textiles from a collection and create new costumes.
- Work in a resource-saving way with existing materials (paper, fabric scraps, ...).
- Work with and apply the body proportions of children.
- Develop patterns for children’s sizes.
- Make the costumes for the first fitting, make adjustments and alterations.
- Support the presentation of the costumes during the performances by creating hairstyles and make-up for the child actors.

2.6.2 Overview of Working Materials

Lesson module 1:

Topic: Introduction to the topic, reading the script, listing the roles, character description, brainstorming

Worksheet: A1 Brainstorming & creating the mood boards

Lesson module 2:

Topic: Sifting through the existing / fundus

Worksheet: A2 Sifting through the existing

Lesson module 3:

Topic: Ideation: developing drafts + drawing sketches + modelling on the ½-bust

Worksheet: A3 Ideation: sketches + modelling

Lesson module 4:

Topic: Planning and preparation of the designs' implementation

Worksheet: A4 Planning and preparation of the designs' implementation

Lesson module 5:

Topic: Realisation of the costumes

Worksheet: A5 Realisation of the costumes

Lesson module 6:


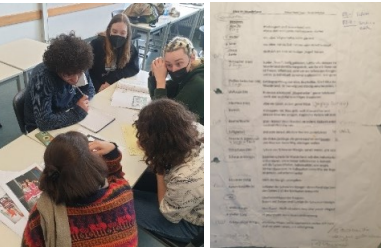

Topic: Musical Performance: make-up, hairdressing, and dressing of the performers

Worksheets: A6 Musical Performance

2.6.3 Materials

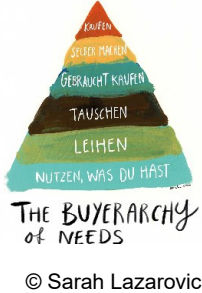






2.6.3.1 Worksheet 1

Brainstorming & creating the mood boards

| Process | Didactic-methodical procedure | Documentation |
|---|---|--|
| Introduction | Introduction to the topic. <ul style="list-style-type: none"> Who knows the story? The film? Which film version? (Let the students) tell the content and plot of the story. |  |
| Presentation of the project 2x 2 teaching units | Children's musical (by children for children) <ul style="list-style-type: none"> Reading the script Listing of roles and character descriptions according to the script/director Instructions from the director regarding set and costume design |  |
| Working on the project in small groups 2x 4 teaching units | <ul style="list-style-type: none"> Grouping and role assignment Conducting research Brainstorming Creating the mood boards Presentation/introduction of the ideas |  |

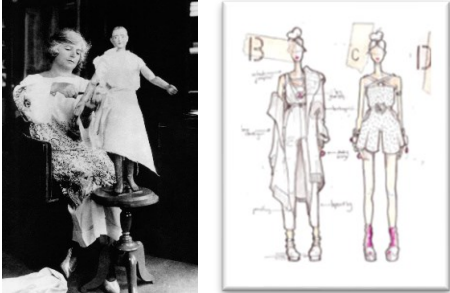


2.6.3.2 Worksheet 2

Sifting through the existing

| Process | Didactic-methodical procedure | Documentation |
|---|--|---|
| <p>Introduction</p> | <p>Introduction of the pyramid for sustainable consumption for the material use.</p> |  |
| <p>Sifting through the existing</p> <p>4 teaching units</p> | <p>Pyramid for sustainable consumption/base: 1.) Use what you have</p> <p>Application/implementation on the musical project:</p> <ul style="list-style-type: none"> • Sifting through and collating existing material: <ul style="list-style-type: none"> ➤ Costume collection musical ➤ School's collection of materials ➤ School's fabric depot • Assignment of characters/pre-selection (e.g. clock from fundus could be used for the "White Rabbit"; hats could be stacked and sprayed on to become the headgear for the "Hatter") <div style="display: flex; justify-content: space-around; margin-top: 20px;">    </div> | <div style="display: flex; justify-content: space-around; margin-bottom: 20px;">   </div>  |

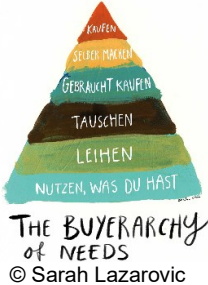


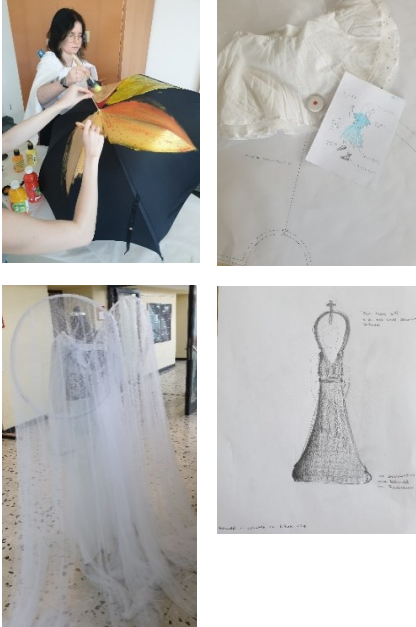
2.6.3.3 Worksheet 3

Ideation: sketches + modelling

| Process | Didactic-methodical procedure | Documentation |
|--|--|--|
| <p>Finding ideas</p> | <p>Show and discuss the possibilities of drawing design and modelling on the bust.</p> <p>Picture 1: Madeleine Vionnet in her studio (1930), Source: Getty Picture 2: © Mode Zeichnen, Lórien Crishna</p> |  |
| <p>Developing drafts and sketches by drawing</p> <p>4 teaching units</p> | <p>Group work in thematic groups (sweets, trees/bushes, Alice, etc.) and presentation of the results in plenary.</p> |  |
| <p>Modelling on the ½-bust</p> <p>4 teaching units</p> | <p>Group work in thematic groups (black queen, white queen, flowers, sweets, etc.) and presentation of the results in plenary.</p> |  |

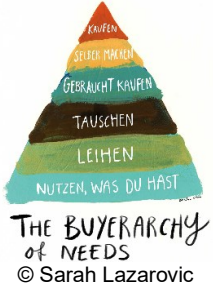


2.6.3.4 Worksheet 4

Planning and implementation of the designs

| Process | Didactic-methodical procedure | Documentation |
|---|--|---|
| Introduction | Discussion of the pyramid for sustainable consumption for the further use of materials in the design of the stage costumes. |  |
| Planning of implementation of the designs 2x 2 teaching units | Use the pyramid for sustainable consumption as a basis for implementation planning. Criteria: 1.) Use what is already existing, 2.) Buy second-hand, 3.) Do it yourself, 4.) Buy new <ul style="list-style-type: none"> • Research „Do it yourself“ • Shopping list for second-hand purchases • Shopping list for new purchases |  |
| Preparation for the implementation 2x 4 teaching units | <ul style="list-style-type: none"> • Pattern construction • Calculation of the material demand • Create material samples (can umbrellas be painted?) • Second-hand shopping (mosquito net, sleeping bag, shirt, blazer, etc.) • New purchases from a DIY superstore and Decathlon (bathing caps, pool noodle), etc.  |  |






2.6.3.5 Worksheet 5

Realisation of costumes

| Process | Learning objectives | Documentation |
|---|---|---|
| Introduction | Using the pyramid for sustainable consumption as a basis for the implementation planning. Criteria: <ul style="list-style-type: none"> • Do it yourself |  |
| Workshop: Making the costumes 16 teaching units | Implementation of the ideas and realisation of the costumes in the sewing workshop. <ul style="list-style-type: none"> • Redesign existing (blazer, sleeping bag/caterpillar, white queen, etc.) • New manufacturing (Alice's skirt, black queen's dress, etc.) |  |
| Design studio: Making the costumes 8 teaching units | Realisation of the ideas and costumes in the studio. <ul style="list-style-type: none"> • Making the "Sweets" cardboard outfits • Designing trees and bushes • Spraying on umbrellas/flowers, hats, etc. |  |

2.6.3.6 Worksheet 6

Musical Performance

| Process | Learning objectives | Documentation |
|--|--|---|
| Hair and make-up | The students of the vocational college for fashion do the make-up and hair of the actors for the stage performance. |  |
| Dressing | The students of the vocational college for fashion dress the actors for the stage performance. |  |
| Coordination | The students of the vocational college for fashion care for the performers backstage and coordinate their appearance on stage. |  |
| Stage performance: in the morning and in the evening | <ul style="list-style-type: none"> • Practical use of the costumes in combination with hairstyles and make-up. • Production of the children’s musical "Alice in Wonderland" in the courtyard of Filseck Castle.  |  |

2.6.4 References

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Madeleine Vionnet in her studio (1930), © Getty,
<https://www.businessoffashion.com/articles/news-analysis/madeleine-vionnet-1876-1975/>

Mode Zeichnen, © Lórien Crishna,
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2.7 Microplastics through Textiles

Maleika Schmidbleicher & Anne-Marie Grundmeier

2.7.1 Introduction

Before the lesson begins, the teacher prepares the learning environment by setting up the stations and placing a little box, which has sand and textile microplastics in it, on each pupil's seat. It might be helpful to also have a visible stopwatch in the classroom so that the pupils can always check how much time they have left during the group work.

At the beginning of the lesson, the teacher plays an audio file that asks the pupils to touch the content of their boxes. By asking the pupils if they know what microplastic is, the teacher simultaneously asks them about their previous knowledge and thereby activates it. The teacher might add to the descriptions and explains the term *textile microplastic*. Then, (h)she should explain the lesson's topic, its schedule and rules as well as the procedure of forming the groups.

After the groups have been formed, the work phase takes place. In this phase the pupils work in their groups on the learning stations one to three and then on the learning station number four. Each station has mandatory tasks and a rewarding additional task, which helps to meet the pupil's different learning levels and builds in a time buffer. By working on the tasks in the booklet, the pupil's newly gained knowledge is already being secured. In order to recall what they have just learned the teacher asks the pupils to either draw a picture or write a sentence that they consider to be particularly important. After the pupils have written their statement or drawn their picture, a circle of chairs is being formed. The pupils then should present their statement/picture in the plenary and explain why they have chosen it. As this last phase of the lesson takes place in the plenary, the teacher can assess the pupil's learning process and end the lesson in a concise manner.

Competences and Learning Objectives

- Describe the terms *microplastic* and *textile microplastic*.
- Describe primary and secondary microplastics.
- Analyse the connection between synthetic textiles and the occurrence of microplastics in the environment.
- Deduce that textiles made from synthetic fibres produce microplastics directly and indirectly.
- Know that besides the type of washing machine and its load, the use of fabric softener and detergent determine the number of emitted fibres.
- Know that electric laundry dryers lead to the release of microfibrils.
- Know that online retailing generates more plastic waste than traditional retailing.
- Know that there are products that can help to reduce the pollution from textile microplastics and become aware of how to avoid creating an impact-shift.
- Know that avoiding consumption can effectively contribute to tackling the problem of microplastics.
- Derive selected strategies for the avoidance of synthetic microfibrils and evaluate these regarding their feasibility.

2.7.2 Overview of Working Materials

Lesson module 1:

Topic: Introduction to the topic of textile microplastics

Worksheet 1: Introduction to the topic and rules for a successful station work

Lesson module 2:

Topic: Station 1 – Textile production

Worksheet 2: Station 1: Textile production with audio transcript

Worksheet 3: Station 1: Textile production – Solutions

Lesson module 3:

Topic: Station 2 – Textile care

Worksheet 4: Station 2: Textile care

Worksheet 5: Station 2: Textile care – Solutions

Worksheet 6: Station 2: Textile care – Card matching

Worksheet 6: Station 2: Textile care – Card matching – Solutions

Lesson module 4:

Topic: Station 3 – Textile disposal

Worksheet 7: Station 3: Textile disposal

Lesson module 5:

Topic: Station 4 – Avoidance strategies

Worksheet 8: Station 4: Avoidance strategies

Worksheet 9: Station 4: Avoidance strategies – Solutions

2.7.3 Materials

2.7.3.1 Worksheet 1

Introduction to the topic and rules for a successful station work

Audio transcript:

Please open the box on your table. Now close your eyes - we will go on a little journey together.

...

Imagine you are on holiday.

The sun is shining and you are taking a walk on the beach. You hear the waves come and go (*play wave sound*) and feel more relaxed than you have in a very long time.

You watch the surfers and the small boats on the sea.

While you are walking, you find something on the ground. It must be a shell. It shimmers beautifully in the sunlight, and you decide to pick it up. You want to look at it more closely. So, you bend down.

You now touch the content of your box to lift up the shell. (different pitch)

But in the sand, you feel something completely different....

What's that?

Rules for a successful station work:

We handle the materials with care. When we leave a station, we put everything back as it was.

We speak as quietly as possible so that we do not disturb our classmates.

If I / we struggle with a task, I / we ask our teacher for help. (S)he is happy to help.

We only leave our station when the time is up and our tasks are accomplished. We do not jump back and forth between stations.

We only check our results when we are done with all tasks at the station. If something is wrong, we correct it on our own. If we have any questions, we can always turn to our teacher.

2.7.3.2 Worksheet 2



Station 1: Textile production

Listen to the audio and answer the following questions. If necessary, listen to the audio or parts of it again.

Tasks:

- 1. Which problems are addressed in the audio?

- 1. What solutions are mentioned?



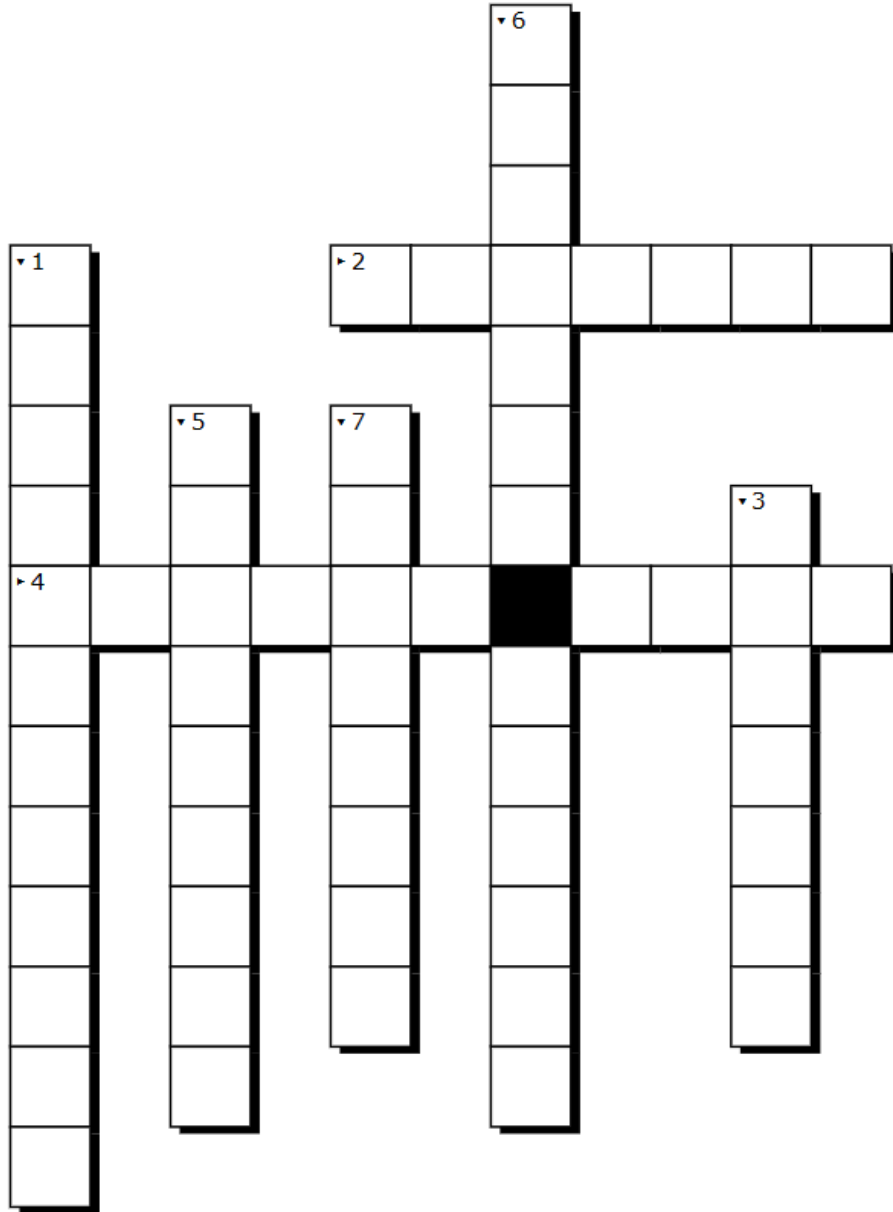
- 2. Can you think of other solutions that have not been mentioned?



Additional task for the early finishers:

Have you answered all the questions, checked your results and improved or added to them if necessary? Great! Now do the crossword on the next page.





1. What is generated at each stage of the production of synthetic textiles?
2. Fibres become detached when ... fabrics.
3. Thrown away after a single use:
4. A lot of packaging material is used here:
5. The fibre which makes up the largest percentage of synthetic fibres:
6. Used again and again:
7. Where does the plastic packaging end up when it is no longer needed?

2.7.3.3 Worksheet 3



Station 1: Textile production – Solutions

Listen to the audio and answer the following questions.
If necessary, listen to the audio or parts of it again.

Tasks:

1. Which problems are addressed in the audio?

Textile microplastics are generated in every production stage of a textile made from synthetic fibres.

Packaging waste is generated throughout the supply chain of a textile.

2. What solutions are mentioned?



Natural fibres do not produce microplastics.

Along the textile supply chain, the plastic is partly reused (e.g., clothes hangers).

Reusable boxes are used; polybags are avoided as much as possible.

Avoid buying clothes from online retailers; rather buy them in traditional stores.

3. Can you think of other solutions that have not been mentioned?

I bring my own bag when I go shopping.



Additional task for the early finishers:



Have you answered all the questions, checked your results and improved or added to them if necessary? Great! Now do the crossword on the next page.

Audio Transcript:

Good morning, everybody!

Thank you very much for inviting me to your school. That gives me the opportunity to talk about the textile and fashion industry and its impact on the release of microplastics into the environment. Since I work for a sportswear company, I am very interested in this topic. My company relies heavily on polyester because of its great properties. Did you know that polyester is the most important fibre in the world? About 55 percent of all fibres worldwide are made from polyester. If the fibers are less than 5 millimeters long – that is about the size of a sesame seed – they are called microplastics. These microplastics are produced at every stage of textile production no matter whether they are natural or man-made fibres.

There are of course differences in the discharge of fibres. An important factor is the textile construction, whether it is a woven or knitted fabric or a fibre compound. But this is all rather theoretical and complicated, so I will not bother you with it...

Maybe you already noticed that a lot of fibres are loosened during the textile care process at home. But did you know that in all processes of textile finishing, in other words in the steps in which the clothes are made beautiful and trendy - e.g., during dyeing – a much higher amount of fibrous microplastics is discharged, than during the washing at home?

That doesn't only sound shocking, it is! Especially when we consider that most of our clothing is produced in countries where the sewage system is less developed than in Europe. This means that even more microplastic ends up in the environment. Shocking, isn't it?

Of course, not everything is good in Europe either. During production a lot of synthetic microfibrils are also discharged here.

Unfortunately, this is further compounded by the fact that packaging is constantly produced throughout a textile's entire supply chain. The packaging is mainly made of paperboard and plastics. It primarily fulfils a protective, transport and labelling function. The packaging might appear in the form of polybags, protective films, tags and hangers.

Some of the plastic is reused. This is the case for some clothes hangers and most polybags. Polybags are these transparent packages in which textiles that you can buy in the supermarket are usually packed.

In a multi-stage production, there is even more plastic waste. Because then the clothes must be repacked for the transport of half-finished products. This means: the more production stages, the more packaging waste is generated. That's logical, isn't it?

By the way, not only the half-finished textiles are packaged, but also the "ingredients" such as buttons and zippers. That means even more packaging waste!!!

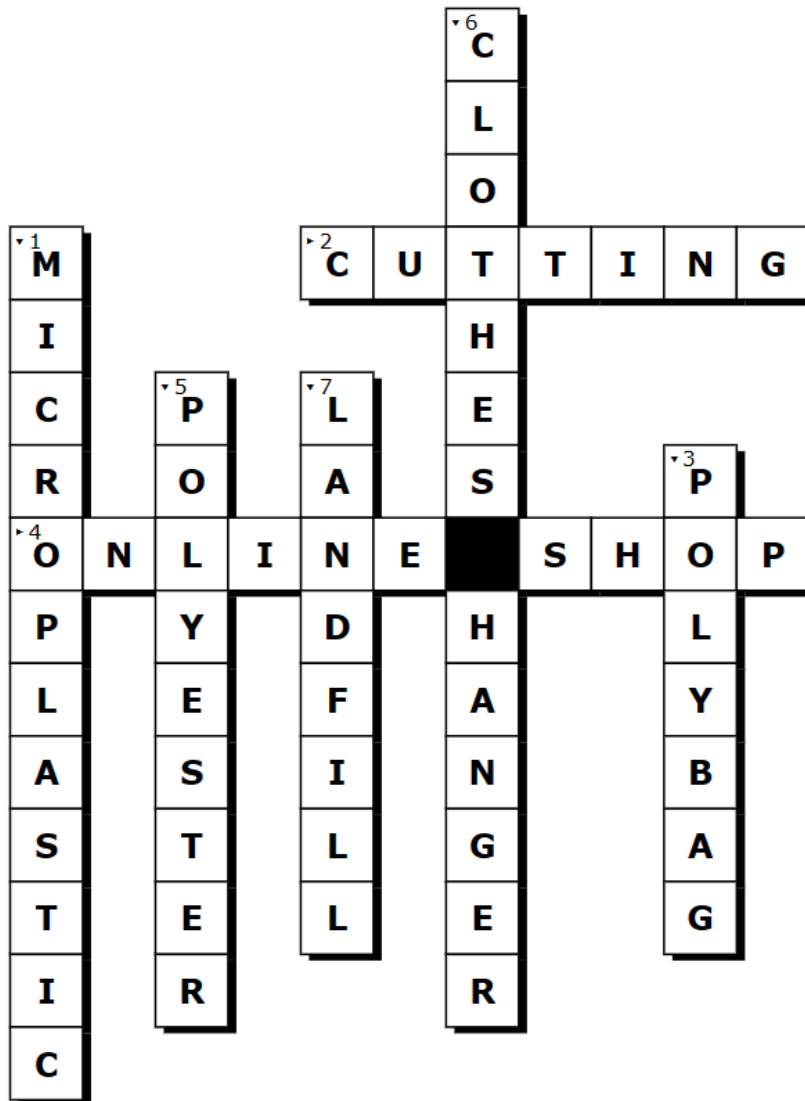
In the textile and fashion industry we partly use reusable boxes and try to avoid polybags. Unfortunately, it's not that easy. The textiles must not be soiled or damaged. So, unfortunately, we can't completely do without polybags.

Finally, we come to a very interesting point: online shopping. I'm sure you've all ordered something online at some point. Compared to traditional retail - i.e., the clothes shop around the corner - the use of packaging materials is greatly increased in online retail. This is because the clothes are usually repackaged in smaller units. If there are returns, the use of packaging material increases even more. This is because most of the packaging cannot be used again as it is often damaged.

But when it comes to returns there is an even bigger problem: The returned clothes. Often they get destroyed and are not being sold again as this appears to be cheaper and faster for the sellers. Since the return rate is very high, these practices create tremendous amounts of waste that end up in landfills. The textiles made from synthetic fibres break down over time into smaller and smaller components and become microplastics, which end up in the environment.

I hope you now understand why microplastics are one of the main problems in the textile and fashion sector. In any case, stay tuned to this topic. It is not only interesting but will probably keep us busy for the upcoming decades.

Thank you for your attention and for listening.



1. What is generated at each stage of the production of synthetic textiles?
2. Fibres become detached when ... fabrics.
3. Thrown away after a single use:
4. A lot of packaging material is used here:
5. The fibre which makes up the largest percentage of synthetic fibres:
6. Used again and again:
7. Where does the plastic packaging end up when it is no longer needed?

2.7.3.4 Worksheet 4

Station 2: Textile care

Answer the following questions individually.



1. What comes to your mind when you hear the term textile care?

2. How many times per week do you do the laundry at home?

- Every day.
- Approximately every second day.
- Approximately three times a week.
- Approximately twice a week.
- Approximately once a week.
- Approximately every fortnight.
- Not regularly.
- I do not know.

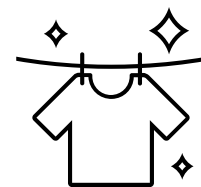


3. Do you use fabric softener?

- Yes.
- No.
- I do not know.

4. How is your laundry being dried?

- On the clothesline (air drying).
- In an electric tumble dryer.
- Other solution: _____
- I do not know.



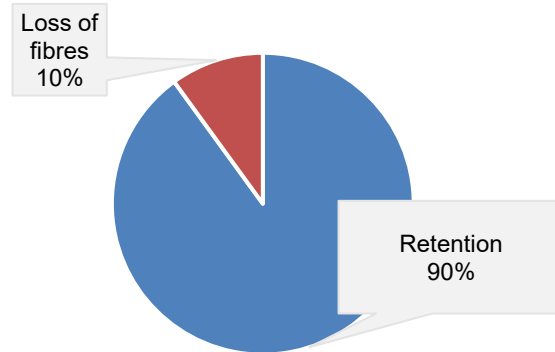
Read the article on the next page.
While reading, mark important parts with a highlighter.

How Textile Care Contributes to Microplastic Pollution

Plastic is the most prevalent type of marine debris in our oceans. Plastic debris can come in all shapes and sizes, but those that are less than 5 millimeters in length are called *microplastics*. Microfibres released during washing range from 124 to 308 mg per kg washed fabric depending on the textile construction.¹ The fibre release is mainly caused by the spinning process and by the contact of the textiles with each other. If detergent and fabric softener are used, the number of detached fibres increases additionally.

The type of washing machine also plays a role in fibre release. Another important factor is the load of the washing machine. As a rule of thumb, the lower the load, the higher the mechanical stress on the textiles.

The fibres released through the washing process enter the sewage treatment plants via the domestic wastewater. The sewage treatment plants, however, can only retain about 90% of the microplastics from the wastewater. This means that about 10% of the microplastics end up in rivers. From there, the microplastics find their ways into the oceans.



The wastewater treatment in the sewage treatment plants produces so-called sewage sludge. This contains the microfibres that are retained by the sewage treatment plant. Although sewage sludge can be incinerated, it is often used as a fertiliser in agriculture. Worldwide, several hundred thousand tonnes of microplastics are released into the soil every year through the spreading of sewage sludge. Microplastics are an environmental hazard. How to deal with the contaminating plastic waste in our natural waters and landscapes is therefore a critical topic. Another central question is how to reduce and monitor the current emissions.

Once the textiles have been washed, they must also be dried. If this gets done with the help of an electric tumble dryer, the release of microfibres increases even more. This is because electric tumble dryers - just like washing machines - loosen fibres through mechanical stress. Larger fibres are filtered out of the air by a filter. Smaller fibres, on the other hand, are released with the dryer's exhaust air. They can potentially be transported over longer distances and be released into the environment. (1) Source: de Falco et al., 2019)

Answer the following questions in your group and write down your results. If necessary, read certain parts of the text again.

1. What influences the number of discarded fibres during textile care?

2. How can the number of discarded fibres be reduced during the textile care process?

3. What do you (not) find particularly easy to implement? Why?



Additional task for the early finishers:

Have you answered all the questions, checked your results and improved or added to them if necessary? Great! Now match the cards on textile care.

2.7.3.5 Worksheet 5

Station 2: Textile care – Solutions

Answer the following questions in your group and write down your results. If necessary, read certain parts of the text again.



1. What influences the number of discarded fibres during textile care?
 - The use of detergents and fabric softeners.
 - The type of washing machine.
 - The load of the washing machine.
 - The use of a tumble dryer.


2. How can the number of discarded fibres be reduced during the textile care process?
 - Loading the washing machine fully. → Only wash when the machine is full.
 - Avoid using fabric softener.
 - Choose a washing machine that loosens fewer fibres.
 - Do not use an electric tumble dryer. → Dry the laundry on the line.

3. What do you (not) find particularly easy to implement? Why?
 - Individual answer. An example:
 - I would find it difficult to wash less because I am used to wearing a T-shirt only once. ...

2.7.3.6 Worksheet 6

Station 2: Textile care – Card matching


Connect the matching cards on the right side with arrows.

| | |
|--|--|
| <p>The lower the load of the washing machine, ...</p> |  |
| <p>Influence the number of released fibres</p> | <p>... filters large fibres out of the air.</p> |
| <p>Washing machine</p> | <p>... the higher the mechanical stress on the textiles and thus also the number of released fibres.</p> |
| <p>This is how much microplastic the sewage treatment plants can retain from the wastewater:</p> | <p>... the microfibres that were retained by the sewage treatment plant.</p> |
| <p>This is produced in the sewage treatment plant and is often used as a fertiliser:</p> | <p>... the higher the mechanical stress on the textiles and thus also the fibre discharge.</p> |
| <p>The lint filter in the tumble dryer ...</p> | <p>Use of detergents and fabric softeners. Type of washing machine. Load of the washing machine.</p> |
| <p>The lower the load of the washing machine, ...</p> | <p>Sewage sludge</p> |
| <p>The sewage sludge contains ...</p> | <p>Approximately 90 %</p> |

2.7.3.7 Worksheet 6

Station 2: Textile care – Card matching – Solutions

Connect the matching cards with arrows.

| | |
|---|---|
| (A) The lower the load of the washing machine, ... | (A) ... the higher the mechanical stress on the textiles and thus also the number of released fibres. |
| (B) Influence the number of released fibres | (B) Use of detergents and fabric softeners. Type of washing machine. Load of the washing machine. |
| (C) Washing machine | (C)  |
| (D) This is how much microplastic the sewage treatment plants can retain from the wastewater: | (D) Approximately 90 % |
| (E) This is produced in the sewage treatment plant and is often used as a fertiliser: | (E) Sewage sludge |
| (F) The lint filter in the tumble dryer ... | (F) ... filters large fibres out of the air. |
| (G) The lower the load of the washing machine, ... | (G) ... the higher the mechanical stress on the textiles and thus also the fibre discharge. |
| (H) The sewage sludge contains ... | (H) ... the microfibres that were retained by the sewage treatment plant. |

2.7.3.8 Worksheet 7

Station 3: Textile disposal



Look at the picture. What could it be about? Write down your thoughts in bullet points.

- _____

- _____

- _____

- _____

Read the following text carefully.
While reading, mark important parts / words with a highlighter.

What happens to our clothes when we no longer wear them?

We all have favourite clothes that we feel comfortable and beautiful in, which is why we would like to wear them every day. But at some point, we stop wearing them.

What happens to our clothes we once loved?

Some people give their thrown out clothes to friends and family members, others sell them and others redesign these garments. In these ways, our favourite items make someone else happy and they get a new life. But no matter how long we try to keep a piece of clothing, we have to admit that at some point it will no longer be used.

What happens to our clothes once they are thrown away?

Via some detours, our favourite pieces then end up in landfills. This happens to all clothes – no matter whether they are made of natural and cellulosic fibres (like cotton, wool and viscose) or synthetic fibres (like polyester, polyamide and elastane).



Is there a difference between the fibres?

The only difference is that garments made of natural and cellulosic fibres decompose as they are biodegradable. This means that over time microorganisms can dissolve the respective material into its elementary components, such as carbon, oxygen, hydrogen and other minerals. This process is different for synthetic textiles. They are likely to sit in landfills for up to 200 years and decompose into ever smaller plastic particles over decades. Unlike natural fibres, they are not broken down into their components. The result is textile microplastics.

Why are microplastics harmful to the environment?

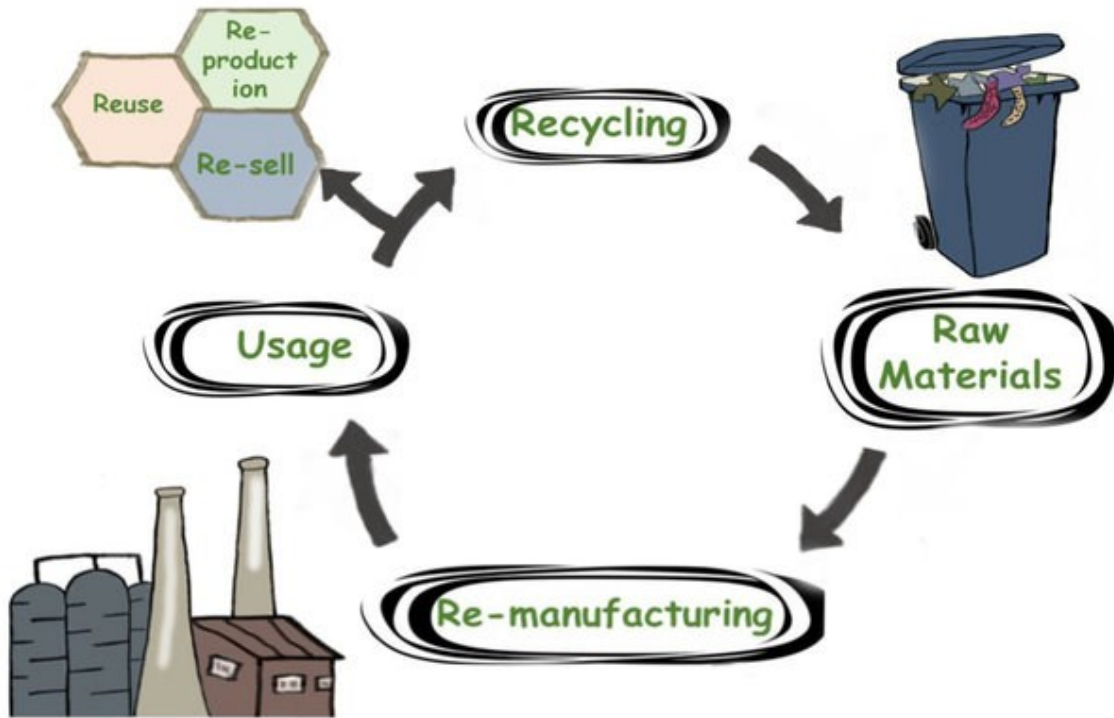
Microplastic particles do not stay in place. They are carried to many different places by winds and rain. Depending on where the microscopic fibres land, they can potentially cause environmental damage. Partly they are eaten by animals, what harms them. Pollutants can adhere to them and enter our food chain.

What remains to be done? To say it with Vivienne Westwood: Buy less, choose well, make it last!

Read the blog carefully. Clarify unknown words and questions in the group. If you need help, contact your teacher.

What are the problems we face with textile waste and what can we do about it?

Use the information from the text and have a look at the graph.



The critical point of CE,
© Damayanti, Wulandari, Bagaskoro, Rianjanu & Wu, CC-BY 4.0

CE (Circular Economy) utilises resources to produce, use, and dispose of in favour of as much reuse and recycling as possible including fabric waste and post-consumer waste. Re-manufacturing describes the process of reconstructing textile waste to create new garments. The question is where you come in:



Additional task for the early finishers:

Now use your mobile phone to find out more about the Atacama Desert in Chile and the environmental impact of textile waste. Discuss your findings with your group.

2.7.3.9 Worksheet 8

Station 4: Avoidance strategies

Read the blog post on the next page carefully.
Then answer the following questions and do research on the internet if needed.

1. What does Amy suggest to tackle textile microplastics?

2. What can you find out about the gadgets that are mentioned?

3. Why does Amy recommend using the clothesline instead of an electric tumbler?

4. Which textiles do not emit any or less plastic due to their raw materials?

Blog post: Me Against Microplastics

Hi people! Have you heard about microplastics? It's all over the media now. I just found out that microplastics are created when we wash our textiles. 🧺 👗 👖

Both detergent and fabric softener cause more fibres to come out. Washing without detergent seems to be difficult, but from now on I will ditch the fabric softener. That's a real shame because I like it super cosy. 😞 But I like our planet even more. 🌍 One simple trick to reduce textile microplastic is loading a washing machine to the full. As a rule of thumb: More load means less fibre output and less work. 😊

I also found some innovative gadgets on the internet. One of them is a ball that is designed to retain the microfibrils that have already been created. Another one is a bag in which you put the clothes before washing. However, a key issue remains: the final disposal of the retained textile microplastics. 😞 So, it is better that textile microplastics don't even occur! That's why I decided to no longer use an electric tumble dryer. In the future, I will simply use the good old clothesline. 😊 I also thought about using textiles that do not emit any or less plastic due to their raw materials.

In the long run, I think that the only solution is to satisfy our greed for new textiles. 😞 We need high-quality textiles which are less likely to loosen fibres when being washed and can be used for a long time. They must also be compatible with recycling at the end of their lives. 🙄

That means: Consume less! Or in other words:

Go on a fashion DIET! 🍷👉

XOXO Amy

5. Group work: Think about further strategies to avoid / reduce textile microplastics.

6. Individual work: Which of the strategies are feasible for you?

Would you use them? Why?





Additional task for the early finishers:

Have you answered all the questions, checked your results and improved or added to them if necessary? Great! Now you can use your mobile phone to search for further strategies to avoid microplastics (not only textile microplastics). Note them down and present them in class:

2.7.3.10 Worksheet 9

Station 4: Avoidance strategies – Solutions

1. What does Amy suggest to tackle textile microplastics?

- a. *Avoid using fabric softener.*
- b. *Load the washing machine to a full.*
- c. *Use a clothesline instead of a tumble dryer to dry clothes.*
- d. *Use textiles that do not emit any or less plastic due to their raw materials.*
- e. *Buy less new clothing.*

2. What can you find out about the gadgets that are mentioned?

Guppy Friend:

It is a bag in which you put the clothes before putting them into the washing machine. The bag protects clothes against mechanical stress during the washing process and thus aims to reduce the creation of microfibres.

Cora Ball:

The Cora Ball is a laundry ball that catches microfibers which shed off from clothing in the washing machine.

Studies show very different results regarding the gadgets' retention capacity. Additionally, the final disposal of the retained textile microplastics still remain an unsolved problem.

3. Why does Amy recommend using the clothesline instead of an electric tumbler?

Electric tumble dryers - just like washing machines – put textiles under mechanical stress. Therefore, the textiles lose fibres. The clothesline, on the other hand, does not put the textiles under such stress and additionally does not require electricity, which makes it more environmentally friendly.

4. Which textiles do not emit any or less plastic due to their raw materials?

Textiles made from natural fibres, such as cotton, silk and hemp, do not emit any plastic. However, it must be ensured that ecological risks are not created at any other point. In other words, that no impact shift occurs. Cotton cultivation, for example, is extremely water-intensive and requires a lot of pesticides.

5. Group work: Think about further strategies to avoid / reduce textile microplastics.

Individual answers.

a. ...

6. Individual work: Which of the strategies are feasible for you?

Would you use them? Why?



Individual answers.

a. Prefer textiles without synthetic fibres if possible.

b. ...

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2.8 Textile Quartet

Anne-Marie Grundmeier & Kim Jara Frank

2.8.1 Introduction

The Textile Quartet is a comprehensive and engaging learning unit designed to enhance students' understanding of various aspects of the textile industry. It incorporates information texts and interactive activities to explore textile segments, manufacturing processes, materials, and related topics in a holistic manner.

Through the Textile Quartet, pupils delve into the diverse world of textiles, including textile segments such as clothing, technical textiles, textile toys, and home textiles. They gain insights into the intricate processes involved in textile production, such as spinning techniques like wet spinning, dry spinning, and melt spinning. Additionally, they explore the different types of yarns, ranging from multifilament and monofilament yarns to spun and assembled yarns. The unit also covers a wide range of fibres, including plant fibres, animal fibres, and chemical fibres derived from natural and synthetic polymers.

The Textile Quartet fosters an interactive and immersive learning experience. Students get the opportunity to engage with information texts, examine textile samples, and participate in hands-on activities that reinforce their understanding. This comprehensive approach not only develops their knowledge of textile terminology and concepts but also nurtures critical thinking, problem-solving, and collaborative skills.

Furthermore, the Textile Quartet explores the various textile professions and career paths, from traditional apprenticeships in clothing production to specialized professions in technical textiles and beyond. It also sheds light on different textile labels and standards that promote sustainability, health, and environmental consciousness in textile production.

By actively participating in the Textile Quartet, students develop a deep appreciation for the significance of textiles in everyday life, as well as their impact on the environment, society, and the economy. They acquire valuable knowledge and competencies that can guide them toward potential career paths in the textile industry while fostering a sense of curiosity, creativity, and responsibility in their engagement with textiles.

Competences and Learning Objectives

- **Knowledge about textile segments:** The students acquire comprehensive knowledge about textile segments such as clothing, home textiles, technical textiles, and textile toys. They become familiar with the manufacturing processes, materials used and the specific properties of these segments.
- **Knowledge about fibres:** The quartet provides information about different types of fibres, including plant fibres, animal fibres, and man-made fibres from natural and synthetic polymers. When using the quartet, the students will gain a detailed understanding of the properties and characteristics of these fibres, their origins, processing methods and applications. This enables the learners to recognise the differences between the various types of fibres and to analyse their advantages as well as disadvantages.
- **Knowledge of yarn types:** The quartet provides students with information about different types of yarns, such as spun and assembled yarns, monofilament and multifilament yarns. They learn about the manufacturing methods of these yarns and their specific properties. Furthermore, they will be familiarised with the wide range of applications of these yarns.
- **Understanding of spinning processes:** The quartet covers different spinning processes such as wet spinning, dry spinning, melt spinning and the lyocell spinning process. Students develop an in-depth understanding of how fibres are transformed into yarns. They learn the differences between the various processes, their advantages and disadvantages, and their areas of application.
- **Knowledge about textile fabrics:** Students acquire a sound knowledge of different textile fabrics such as woven fabrics, knitted fabrics, nonwoven fabrics, and transparent and open-work fabrics. They learn about the different types of surface structures, their properties and manufacturing methods. This enables them to differentiate surface materials and understand their areas of application.
- **Understanding of textile finishing:** The quartet provides information about different textile finishings such as pre-treatment techniques (e.g., bleaching), colouring processes (dyeing/printing) and wet or dry finishing (e.g., hydrophobising or roughening), including laminating and coating (e.g., artificial leather). Students develop an in-depth understanding of these finishing processes' effects on the properties of textile surfaces. They can analyse and evaluate the optimal finishing techniques for specific requirements and purposes.
- **Knowledge of textile labels and certificates:** The quartet informs students about different textile labels that are relevant in the context of health protection, environmental protection, and social standards. These include labels like *OEKO-TEX® STANDARD 100* and *UV-Standard 801* for health protection, *Global Organic Textile Standard Organic Cotton (GOTS)* and *Naturtextil IVN certified BEST* for environmental protection and social standards in the natural fibre production chain, *Fair Wear* and *Fairtrade Cotton* for social sustainability as well *OEKO-TEX® MADE IN GREEN* and *bluesign® PRODUCT* for ecological and social standards. The students learn how these labels ensure the quality, sustainability, and production standards of textiles and can recognise and evaluate the corresponding certificates.

- **Knowledge of textile apprenticeships:** The quartet highlights a wide range of apprenticeships in the textile industry, including apprenticeships in the field of clothing such as fashion seamstresses, fashion tailors, and custom tailors as well as other apprenticeships in the textile sector. In addition, school-based apprenticeships, further training to become a master craftsman, technician, or specialist, as well as study opportunities in the textile sector are covered. Students gain a comprehensive understanding of the required skills, qualifications, and career opportunities in these occupational fields.

Methods and Approaches for Classroom Instruction

The following methods can be used to incorporate the Textile Quartet into a dynamic and comprehensive learning unit, providing students with a rich educational experience that explores various aspects of the textile and clothing industry.

Method 1: Textile Quartet “Game”

A Textile Quartet “game” may be an engaging and participatory method to improve learning in the classroom. It could be used as follows:

- 1. Introduction and Familiarization:** Start by explaining the “Textile Quartet” game’s concept to the students. Explain that it is a game designed to reinforce their understanding of textile segments, processes, materials, and related topics.
- 2. Divide the Class into Groups:** Divide the class into equal-sized groups as much as possible. This encourages cooperation, teamwork, and active participation.
- 3. Assign Textile Topics:** Provide each group with a specific textile topic from the quartet, such as a textile segment (like clothing, home textiles, technical textiles or textile toys), fibre categories (such as plant fibres, animal fibres, man-made cellulosic or synthetic fibres), spinning processes (such as wet spinning, dry spinning, melt spinning or the Lyocell process) or yarn types (such as spun yarns, monofilament and multifilament yarns or assembled yarns) and so on.
- 4. Provide Information Texts:** Give each group the corresponding quartet cards related to their assigned topic. Make sure to assign students the task of thoroughly understanding the cards. Ensure that questions can be answered using the resources at hand, like research books, internet access, and so forth.
- 5. Game Rules and Objectives:** Describe the game’s rules and goals. The objective is for each group to become an expert on the textile topic that they have been given and to compete with other groups.

6. Gameplay: From their supplied information texts, each group evaluates and highlights relevant information. After that, they work together to develop a list of quiz questions based on the material. The questions should cover key concepts, characteristics, processes, or examples associated with their textile topic.

7. Presentations and Quizzes: Each group takes turns presenting their textile topic to the class. They give a brief presentation, emphasizing the important details and providing interesting information. The group quizzes the other groups with its prepared questions after the presentation. The other teams can score points by providing the right answers.

8. Conversation and Reflection: Encourage group conversations throughout the quiz sessions. Motivate students to provide new knowledge, articulate ideas, and engage in constructive competition. Facilitate a quick discussion to highlight the key aspects learned from every textile topic after each round.

9. Rotation and Feedback: In order to provide each group the chance to learn about different textile segments, processes, materials, or related topics, rotate the topics among the groups for the following rounds. This provides the possibility for having an in-depth understanding of the subject matter.

10. Game Conclusion and Recap: Summarize the important ideas discussed in each round to bring the game to an end. Draw attention to the connections between the textile-related themes and reaffirm the most important concepts acquired throughout the game.

The Textile Quartet game strengthens understanding, critical thinking, and knowledge retention in addition to encouraging active engagement and teamwork. It gives students the chance to learn from their classmates, demonstrate their understanding of particular textile subjects, and delve deeper into those areas.

Method 2: Interactive Textile Stations

1. Textile Exhibition and Analysis: Set up a textile exhibition in the classroom by displaying various textile components, procedures, supplies, and associated objects described in the instructional texts. Samples of various textile items, such as clothing, yarns, and fabrics, should be included.

2. Guided Exploration: Separate the students into pairs or small groups and give each group a particular textile fragment or theme to explore. Give them worksheets or questions with answers linked to their received segment.

3. Research and Investigation: Instruct the groups to thoroughly examine the exhibited textiles, read the accompanying information, and conduct additional research using provided resources, such as books or online materials. Encourage the students to take notes, analyse the characteristics and properties of the textiles, and investigate the processes involved in their production.

4. Presentation and Analysis: Give each group the opportunity to present their findings and analysis to the class. The groups can showcase the textile samples, explain the key features of their assigned segment, and discuss the significance and applications of the textiles within that segment.

5. Comparative Discussions: Initiate group discussions in which students compare different textile segments presented by their peers. Encourage them to identify similarities and differences in terms of materials, manufacturing processes, and end-use applications. This promotes critical thinking, analytical skills, and a broader understanding of the textile industry.

6. Reflection: Facilitate a reflection session where the students discuss their overall learning experience throughout the Textile Quartet activities. Encourage them to identify the skills they have developed as well as connections they have made between different textile segments and the real-world applications of their knowledge.

Method 3: Textile Quartet Challenge

1. Textile Quartet Challenge: Divide the class into teams and provide each team with a set of information texts related to textile segments, processes, materials, and related topics covered in the Textile Quartet.

2. Task Assignment: Assign each team a specific challenge related to textiles. For example, they could be tasked with designing an innovative textile product, creating a marketing campaign for a sustainable clothing line, or developing a proposal for improving textile manufacturing processes.

3. Research and Planning: Give the teams time to thoroughly study the provided information texts. Encourage them to conduct additional research, brainstorm ideas, and develop a strategic plan to tackle the assigned challenge. Provide guidance and support as needed.

4. Implementation and Presentation: Give the teams a designated period to work on their challenge and bring their ideas to life. They can create prototypes, design visual aids, prepare presentations, and assemble any necessary materials. Encourage them to think creatively and to consider different factors, such as sustainability, functionality, and market appeal.

5. Showcase and Evaluation: Organise a showcase event where each team presents their solution to the assigned challenge. Invite other classes, teachers, or industry professionals to serve as evaluators. The evaluators can assess the teams' presentations based on criteria, such as creativity, feasibility, research depth, and problem-solving skills.

6. Reflection and Discussion: After the presentations, facilitate a reflection session where students discuss their learning experiences and the knowledge gained throughout the Textile Quartet challenge. Encourage them to reflect on the strengths and weaknesses of their solutions, as well as the collaborative skills and insights they acquired.

7. Awards and Recognition: Recognise the teams' efforts and accomplishments by presenting awards in various categories, such as best design, most sustainable solution, or most effective marketing campaign. This reinforces the importance of teamwork, innovation, and critical thinking in the context of the textile and clothing industry.

By transforming the Textile Quartet in a challenge-based activity, students are actively engaged in problem-solving and creative thinking. They develop a deeper understanding of textile concepts and their practical applications, while also honing essential skills, such as research, collaboration, presentation, and critical analysis. This approach encourages student ownership of the learning process and fosters a sense of excitement and achievement in the classroom.

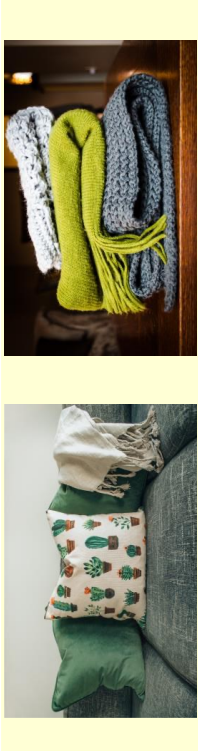
2.8.2 Overview of Working Materials

| Categories | Card 1 (A) | Card 2 (B) | Card 3 (C) | Card 4 (D) |
|---|--|--|---|---|
| 1. Textile Segments | 1.1. Clothing | 1.2. Home Textiles | 1.3. Technical Textiles | 1.4. Textile Toys |
| 2. Fibres | 2.1. Plant Fibres | 2.2. Animal Fibres | 2.3. Man-made Cellulosic Fibres | 2.4. Synthetic Fibres |
| 3. Yarns | 3.1 Spun Yarns | 3.2. Monofilament Yarns | 3.3. Multifilament Yarns | 3.4. Assembled Yarns |
| 4. Spinning Processes (Man-made Fibres) | 4.1 Wet Spinning Process | 4.2 Dry Spinning Process | 4.3 Melt Spinning Process | 4.4 Lyocell Process |
| 5. Textile Fabrics | 5.1. Woven Fabrics | 5.2. Knitted Fabrics | 5.3. Nonwoven Fabrics | 5.4. Transparent and Open-work Fabrics, Laces, Nets |
| 6. Textile Finishing | 6.1. Pretreatment | 6.2. Colouring | 6.3 Textile Finishing | 6.4. Coating and Lamination |
| 7. Textile Labels | 7.1. Health Protection | 7.2 Natural Fibre Labels | 7.3. Social Sustainability | 7.4 Sustainable Production |
| 8. Apprenticeships (based on the German vocational system) | 8.1. Apprenticeships in the fashion sector | 8.2. Apprenticeships in the textile sector | 8.3. School-based apprenticeships in the fashion and textile sector | 8.4. Further training opportunities in the fashion and textile sector |

2.8.3 Materials

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Textile Segment (1 B)
Home Textiles

| | |
|-------------------------|--|
| Definition | Home textiles include all textiles used in private and public households. |
| Special Features | The home textiles segment includes household textiles (table, hand, and bath towels), table and bed linens, blankets, curtains, carpets, textile floor coverings, upholstery fabrics, textile home accessories, and much more. In some cases, different production processes are used than for clothing textiles, for example, the knotting and tufting (to) tuft: to decorate with tufts) of carpets. |
| Function | Home textiles are essential in any private or public household. Table and bed linen, as well as home textiles, are necessities in everyday living. We use them to decorate and functionally design our living space. |
| ?! | Did you know that permanent used home textiles in public buildings such as kindergartens, schools, hotels, and restaurants must meet brand protection requirements? |



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Textile Segment (1 A)
Clothing




| | |
|-------------------------|---|
| Definition | The word clothing stems from the old English clādas, which means cloth – a woven or felted material to wrap around oneself. |
| Special Features | We distinguish target group-specific clothing segments such as women's, men's and children's clothing as well as sports and leisurewear from accessories as accompanying fashionable items. Before T-shirts, jeans and other garments end up in our wardrobes, most of them have travelled the world along the textile manufacturing chain and industrial garment production (ready-to-wear). |
| Function | Clothing fulfils numerous functions: It protects us from climatic influences (wetness, wind, temperatures, sun) and decorates us. We communicate who we are and who we would like to be mostly non-verbally through our clothing. Fashionable clothing is a subject to constant change. |
| ?! | Did you know that the vast majority of clothing is made in Far Eastern countries like China and Bangladesh? |



Textile Segment (1 C) Technical Textiles



Definition

Technical textiles are functional materials designed to meet specific requirements. They have unique material properties for a variety of industrial applications.

Special Features

Their applications range from traditional products such as fishing nets to modern high-tech textiles. These include textiles in construction technology, agricultural technology and landscaping, industrial textiles such as filters and medical textiles. In the automotive and aerospace industries, technical textiles are found not only in the interior but also in the bodywork of vehicles.

Function

The requirements for technical textiles are very different. A fire hose, for example, must be very robust and resistant to aging, heat and cold. A silage film, on the other hand, is characterized by high tear strength, stretchability, and resistance to weathering.



Did you know that so-called high-performance fibres with special physical and chemical properties are used for technical textiles?

Textile Segment (1 D) Textile Toys



Definition

Textile games and toys are objects for children's play, a high proportion of which are made of textile materials.

Special Features

Movement games with balls and ropes belong to the textile games, furthermore, learning and perception games or simulation and role-playing games. The doll is considered the oldest toy. As early as the Stone Age, children played with dolls made of clay and later of wood. Around 200 years BC, the dolls were then decorated with clothes and hair.

Function

Through playful interaction with textiles, children acquire the world and learn a lot about its properties such as colorfulness, haptics, elastic stretchability and tear resistance. Textile toys for young children should be washable for hygienic and health reasons and should not contain any harmful substances.



Did you know that according to an American tradition, the teddy bear got its name from the American president Theodore Roosevelt? His nickname was "Teddy" and he loved to hunt bears.

Fibres (2 A)

Plant Fibres



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the European Union



Plant fibres consist mainly of cellulose. There are subtropical or tropical fibre plants such as cotton, jute and ramie, or domestic ones such as flax and hemp.

Definition

The biomolecule cellulose for man-made fibres is mainly obtained from fast-growing wood species such as eucalyptus, pine, bamboo and beech wood as pulp. By means of chemical-physical spinning processes, the cellulose is brought into solution and made spinnable in this way. Cellulose fibres absorb moisture very well, swell strongly and can be dyed in brilliant colours. They are also very kind to the skin. They are processed as filaments (continuous fibres) or spun fibres.

Special Features

Cellulose fibres are often used for underwear and nightwear, because they are very good at absorbing body moisture and are very comfortable to wear on the skin.

Function

Did you know that the wood used in the production of cellulose fibres today comes mainly from sustainable forestry?



Fibres (2 B)

Animal Fibres



Co-funded by
the European Union



Animal fibres consist mainly of protein. Sheep's wool comes mainly from Australia, China and New Zealand. Silk comes from China, India and other Asian countries.

Definition

Animal fibres have a very complex chemical structure. Wool naturally curls and warms, it is elastic and hardly wrinkles. The wool fibre absorbs water vapor in its fibre trunk but repels water with its outer cuticle. Like wool, silk is wrinkle-resistant, but very sensitive to moisture. Its smooth surface gives it a noble shine. It is the only natural continuous fibre that we use in textiles.

Special Features

Sheep's wool, goat's hair and silk are the most commonly used animal fibres in clothing. High-quality winter clothing is made of fine animal hair such as alpaca, cashmere, or virgin wool, sheared from live sheep. Silk is used for luxurious clothing and home textiles.

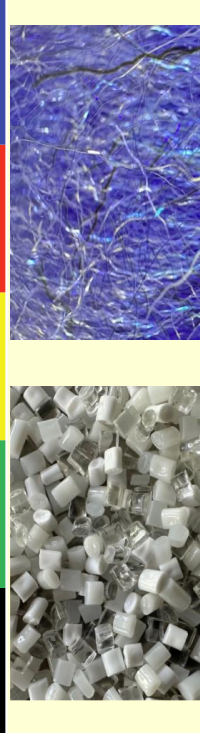
Function



Did you know that a sheep provides up to 4.5 kg of wool per year? About six sweaters can be made from this.



Fibres (2 D) Synthetic Fibres



Definition
Synthetic man-made fibres such as polyester, polyamides, polyacrylic, polypropylene and elastane are produced worldwide. Their raw materials are mainly obtained from petroleum and are formed by stringing together many (= poly) chain molecules of carbon, water, oxygen, and other elements.

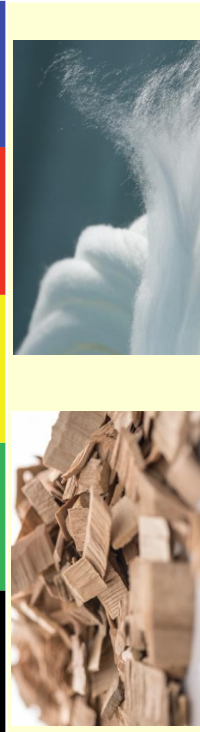
Special Features
Synthetic man-made fibres can be very well adapted in their property profile to the desired area of application. They are fibres made to measure. They absorb little moisture, so they dry quickly and are easy to care for, but they become statically charged. They are light, hard-wearing, retain their shape, and hardly wrinkle. Polyester, polyamides, and polypropylene deform when exposed to heat; they are thermoplastic.

Function
Synthetic fibres are found in all clothing segments - especially in sportswear and corsetry - as well as in home textiles and as high-tech fibres for technical textiles. They are frequently blended with natural fibres.

Did you know that polyester is the world's largest fibre by volume, with well over 50% of the market?



Fibres (2 C) Man-made Cellulosic Fibres



Definition
The man-made fibres viscose, modal and lyocell are the most widely used fibres based on the natural polymer cellulose.

Special Features
Their applications range from traditional products such as fishing nets to modern high-tech textiles. These include textiles in construction technology, agricultural technology and landscaping, industrial textiles such as filters and medical textiles. In the automotive and aerospace industries, technical textiles are found not only in the interior but also the bodywork of vehicles.

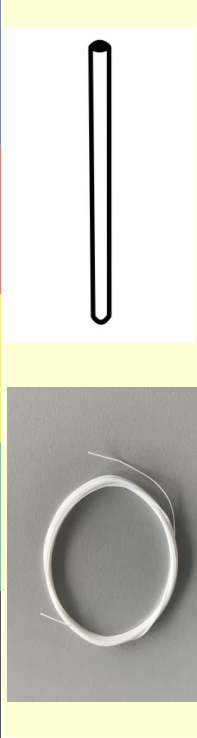
Function
Their applications range from traditional products such as fishing nets to modern high-tech textiles. These include textiles in construction technology, agricultural technology and landscaping, industrial textiles such as filters and medical textiles. In the automotive and aerospace industries, technical textiles are found not only in the interior but also the bodywork of vehicles.

Did you know that so-called high-performance fibres with special physical and chemical properties are used for technical textiles?





Yarns (3 B) Monofilament Yarns



Definition

A monofilament yarn consists of a single (=mono) continuous fibre and is spun from a single spinneret.

Material

Exclusively man-made fibres belong to the monofilament yarns.

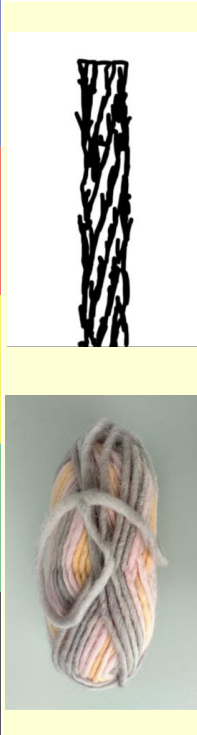
Features

Monofilament yarns are fine, transparent, and widely used for embroidering sequins or beads. They are also tear-resistant, making them suitable for basting threads. Polyamide monofilaments, known for their strength, are commonly used in fishing lines and kite strings. The characteristics of monofilaments, including cross-section, length, and raw materials, vary based on the application and spinning process. Monofilaments can have round, triangular or hollow structures, with the melt-spinning process being frequently employed for polyester and polyamide monofilaments.

Did you know that silkworms and spiders have been the natural models for spinning monofilaments because they spin very long, fine and stable threads?



Yarns (3 A) Spun Yarns



Definition

A staple fibre yarn is formed by twisting short (staple) fibres into a yarn. The fibres remain together as a yarn composite due to static friction.

Material

Staple fibres include all natural fibres with the exception of reel silk, the only natural continuous filament, as well as torn and cut man-made fibres. These can also be spun into staple fibre yarns if they have been shortened to a predetermined length.

Features

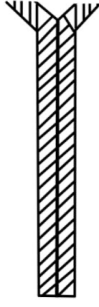
Staple fibre yarns have very different properties, which depend on the fibre materials, the yarn structure and the spinning process. The orientation, arrangement and length of the fibres are decisive for the subsequent yarn properties, as are the number of fibres in the yarn cross-section, their degree of bonding and the twist.

Did you know that spinning fibres into yarns is, along with weaving, one of man's oldest cultural techniques?





Yarns (3 D) Assembled Yarns



A plied yarn consists of at least two yarns, which are not twisted together (twisted), but led parallel.

Definition

With plied yarn, different yarn qualities and colours can be freely combined with each other. They are mainly used for handicrafts such as knitting. Folded yarns are also called fancy yarns if they consist of different single yarns with special properties, which leads to optical effects. These can be colour and shape effects. Staple fibre yarns and filaments can also be combined to form fanned yarns.

Material

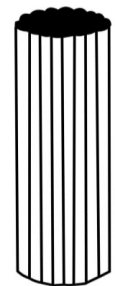
The properties of a plied yarn depend on the particular combination of individual yarns used. Predominantly they are needlework yarns.

Features

Did you know that you can also make your own plied yarn by joining at least two yarns together in parallel?



Yarns (3 C) Multifilament Yarns



The multifilament yarn is an endless yarn consisting of many (=multi) filaments. The filaments are combined either with or without twist.

Definition

Multifilament yarns include the reel silk and man-made fibre filaments.

Material

Multifilament yarns are smooth, dense, and uniform, commonly used in high-quality apparel textiles, technical textiles, and sewing threads. They are primarily man-made fibres, except for reel silk produced by cultivated mulberry spinners, which is a natural multifilament used in fine fabrics. Multifilaments have a shiny appearance with low twist and high tear resistance, making them suitable for fishing nets and tennis strings.

Features

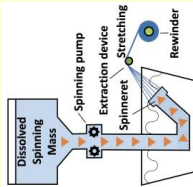
Did you know that multifilament yarns made from man-made fibres can be spun much finer than the finest silk thread?



Spinning Processes (4 A)

Wet Spinning

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the European Union



Definition

In the wet-spinning process, fibres are made from polymer solutions such as liquefied pulp, which are spun out into a chemical bath.

Procedure

When entering a so-called precipitation bath, the chemicals re-solidify the dissolved polymers so that they coagulate. The spinneret is located in the precipitation bath for this purpose. The still soft filaments can be easily stretched. In a post-treatment, the fibres are cleaned of the chemicals. Wet spinning is used for fibre raw materials that are very temperature-sensitive or cannot be melted, or whose processing is only possible in special solvent systems.

Examples of fibres

The wet-spinning process is used, for example, to produce the cellulosic man-made fibres viscose and modal.

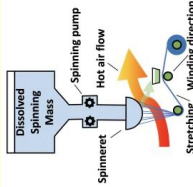


Did you know that this spinning process, which is about 100 years old, originated from the desire for a substitute fibre for silk?

Spinning Processes (4 B)

Dry Spinning

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Definition

In the dry spinning process, the spinning mass is dissolved in an organic solvent.

Procedure

The dissolved spinning mass is spun out by a stream of warm air into a spinning shaft several meters high. In the process, the solvent evaporates, whereupon the fibre solidifies. In order not to stick together, the filaments must not touch each other during spinning. The solvent is recovered from the spinning shaft and can be reused.

Examples of fibres

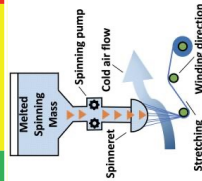
The dry spinning process produces, for example, polyacrylic and acetate. Acetate is obtained from cellulose and is called artificial silk because it is very similar in appearance and properties to real silk.



Did you know that acetate, because it is not a pure cellulose fibre, has different properties than viscose and modal? It resembles a synthetic fibre in its property profile.

Spinning Processes (4 C)

Melt Spinning



Definition

The melt spinning process is only suitable for thermoplastic fibre raw materials that do not decompose at their melting temperature.

Procedure

The spinning mass is melted, filtered and then forced through the spinneret. In the spinning chute, which is several meters high, the hot spinning jets are cooled under a stream of cool air, causing them to solidify rapidly at very high take-off speeds. At the end, they are drawn and wound up. It is the simplest and most economical spinning process with high take-off speeds of the fibre.

Examples of fibres

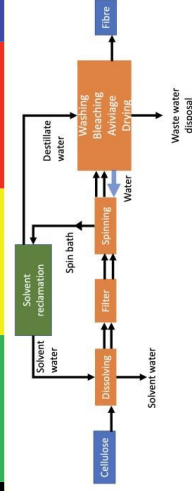
The melt spinning process is used to produce the thermoplastic synthetic fibre polyester, polyamides and polypropylene.



Did you know that beverage bottles made of PET - the raw material for polyester - are crushed, cleaned and remelted to save raw materials and energy?

Spinning Processes (4 D)

Lyocell Process



Definition

The solvent process is an ecological special spinning process for the cellulosic man-made fibre Lyocell.

Procedure

The pulp is dissolved with the organic solvent N-methylmorpholine-N-oxide (NMMO) in an aqueous system to form a viscous spinning solution. This is filtered to remove coarse components and then spun out through spinnerets into an air gap. The filaments are then coagulated in a bath of aqueous NMMO solution. The lyocell fibres are washed and aftertreated, and over 99% of the remaining NMMO is recovered and recycled.

Examples of fibres

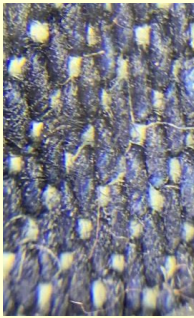
Lyocell is a shiny, skin-friendly fibre that is strong both when dry and wet and retains a lot of moisture, making it suitable as a next-to-skin layer for functional sportswear.



Did you know that Lyocell for clothing is produced by Lenzing AG under the brand name Tencel™ ?

Fabrics (5 A)

Woven Fabrics



Definition

A fabric is formed by the alternate interlacing of at least one transverse weft thread and one longitudinal warp thread system.

Technology

The warp threads are raised and lowered. The weft thread is inserted into the resulting shed by means of weaving shuttles (today only on handlooms), grippers, projectiles and air nozzles and beaten up by the reed to the previously inserted weft threads. The crossing of warp and weft threads can result in different types of weave.

Features

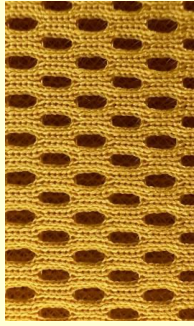
By alternately lifting and lowering the warp threads, the plain weave is created as a simple and firm weave, e.g. for shirts, blouses and dress fabrics. Twill weave fabrics with a diagonal twill ridge fall softer, are nevertheless hard-wearing and may have a warming function. The atlas or satin weave uses long floats to create smooth and shiny fabrics called satin.



Did you know that your jeans are made of a twill weave fabric called denim?

Fabrics (5 B)

Knitted Fabrics



Definition

Knitted fabrics are created by thread stitches that are interlocked using one or more needles.

Technology

Knitwear is divided into two basic groups: Knitted fabrics, in which the rows of stitches are formed from a transverse thread that can be drawn up, and warp knitted fabrics, in which the stitches are formed by a warp thread system. Warp knitting is only possible by machine and the fabric can hardly be drawn on.

Features

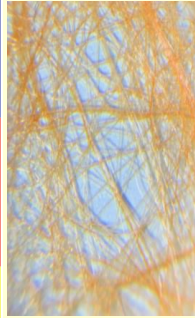
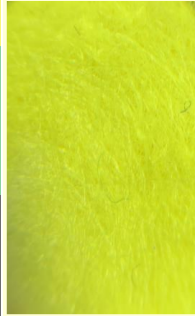
In addition to their high elasticity, knitted fabrics are crease-resistant, air-permeable and, depending on the thickness of the knitted construction, warming. The stitches trap air, which is warmed up by the body and thus forms a warming air cushion. Knitted fabrics are mainly used for stockings, underwear, sportswear and winter clothing because they are supple and follow all body movements.



Did you know that knitwear for T-shirts is produced on large circular knitting machines as a knitted tube?

Fabrics (5 C)

Nonwoven Fabrics



Definition

The most important types include nonwovens, tulling and needle felts, constructed by mostly random layers of natural or man-made fibres.

Technology

Nonwovens are formed by spreading and layering fibres. They can be mechanically, chemically and thermally bonded. Felts have a fibre fleece as their basis. A wool fibre fleece is rolled under the action of a washing lye and is thus compacted into a wool felt, as the wool fibres interlock with each other due to their scaly layer. Fibre fleeces are mechanically compacted by needling to form needle felts. A fleece can also be thermally welded or chemically bonded with binding agents.

Features

The properties of fibre composites vary depending on their use, whether as disposable items such as nappies and handkerchiefs or as temperature and sound insulating layers in clothing, buildings and vehicles or as filters.



Did you know that the felting process of wool fibres leads to irreversible surface shrinkage? This sometimes happens unintentionally in the washing machine.

Fabrics (5 D)

Transparent and Open-work Fabrics, Laces, Nets



Definition

Transparent and open-work textile surfaces can be produced in a wide variety of patterns by weaving, finishing or in a combined manner.

Technology

Using weaving and knitting techniques as well as knitting and crochet, openwork effects and transparent surfaces are created for clothing and home textiles. Lace is an openwork textile surface made of yarn and fabric or yarn alone, with decorative patterns. Tulle and lace such as Raschel lace for lingerie and transparent clothing are rationally produced on warp knitting machines. In Raschel lace, pattern threads are worked into the tulle base.

Features

Lace fabrics and tulle have a decorative and elegant effect. Handmade lace is very complex to produce and correspondingly expensive.



Did you know that in the 16th century, various European cities such as Venice, Brussels and Plauen became centres for handmade lace?

Textile Finishing (6 A)

Pretreatment



Co-funded by the European Union



Definition

Pre-treatment is the optimisation of a textile material for the subsequent processing steps.

Procedure

With processes such as washing, bleaching, mercerising and desizing, textile raw materials are freed from natural impurities such as capsule residues of cotton fibres or from specifically applied substances such as the sizing agents for weaving, in order to prepare them for the subsequent processes. For example, bleaching gives natural fibres a white hue as a prerequisite for light dyeing.

Features

The pre-treatment processes remove colour pigments, fats, paraffins and dirt from the textiles, which can account for up to 30% of the fibre weight.



Did you know that bleaching agents are not only used in textile finishing, but also in heavy-duty detergents? There, they not only specifically remove coloured soiling, but also have a disinfecting effect.

Textile Finishing (6 B)

Colouring (Dyeing & Printing)



Co-funded by the European Union



Definition

Textiles can be dyed as well as printed. Dyeing is understood to be the uniform dyeing of textiles. A print creates a localised pattern that is repeated as a pattern repeat.

Procedure

Textiles are dyed in a dye solution enriched with various additives such as salts, alkalis and acids. The dye either penetrates the inside of the fibre or accumulates on the fibre surface. It is possible to dye fibres, threads, textile surfaces and even garments. Printing is mainly done on textile surfaces and ready-made clothing such as T-shirts.

Features

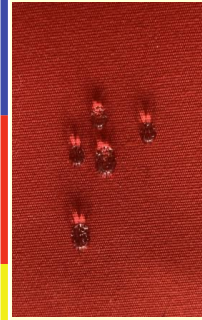
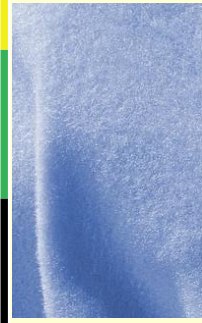
The dyes are used fibre-specifically, because not every dye reacts equally well with every fibre. Some fibres are less reactive than others and therefore combine with dyes only with difficulty and not permanently.



Did you know that for thousands of years the dye of the purple snail was the most expensive colour in the world, which only very few people could afford? It takes about 12,000 snails to make 1.5 grams of purple pigment.

Textile Finishing (6 C)

Finishing



Definition

Finishing is used to specifically change the properties of the textiles. There are mechanical, mechanical-thermal and chemical processes.

Technology

In mechanical and mechanical-thermal processes, the textile surface is mainly changed by physical means. This includes, for example, napping, in which the textiles are roughened with the help of metal scratches and given a soft, fluffy feel. In chemical finishing, chemicals can be used to change the properties of textiles or create new ones. Impregnation, for example, makes textiles water-repellent.

Features

The finishing processes change, among other things, the surface texture and the utility properties of textiles and in some cases achieve functional properties that fibres do not have naturally.



Did you know that wellness equipment includes underwear and stockings with skin-care substances?

Textile Finishing (6 D)

Coating and Lamination



Definition

In coating and laminating, a textile surface is permanently bonded to another surface, which may also be non-textile, for specific areas of application.

Technology

Coating is the application of natural substances such as wax or synthetic substances such as polyurethane to a textile surface and the layer is permanently consolidated. Lamination is the process of either gluing (laminating) or welding textile surfaces together or bonding a textile surface to a non-textile surface such as paper or a film.

Features

By coating and laminating on one or both sides, the property profile of textile surfaces is completely changed and functionalised, i.e., the textile is given new properties such as flame resistance.



Did you know that coatings and laminations are very common, especially in weatherproof clothing and technical textiles?

Textile Labels (7 A)

Health Protection



With its tests for harmful substances, the **OEKO-TEX® STANDARD 100** is based on the actual use of the textile: the more intensive the skin contact of a product, the stricter the requirements it must meet. According to the modular principle, all textile and non-textile materials as well as accessories, such as buttons, rivets, zips, etc. are tested for freedom from harmful substances. The limit values exceed national and international legal requirements. The criteria catalogue is updated once a year.

Textile sun protection is intended to protect the skin of children from long-term damage caused by exposure to the sun. The measurement of the UV protection factor according to **UV STANDARD 801** is based on the wearing conditions and the stress on clothing: Stretching of textiles when worn, moisture from perspiration or water, abrasion and wear. Textiles should guarantee the certified sun protection factor during use. **UV STANDARD 801** goes far beyond the requirements of the Australian/New Zealand standard AS/NZS 4399.



Did you know that the **OEKO®-TEX STANDARD 100** is one of the world's best-known labels for textiles tested for harmful substances?



Textile Labels (7 B)

Natural Fibre Labels



The **Global Organic Textile Standard (GOTS)** is an internationally valid standard for textiles made from natural fibres. Their share from organic cultivation must be at least 70%. Only environmentally friendly substances and processes are allowed from cultivation to the finished product. All processing stages are certified by independent laboratories and inspected annually. Strict social criteria are used to guarantee fair working conditions for the workers in the production chain. GOTS is the world's leading textile processing standard for organic fibres.

The label **Naturtextil IVN certified BEST** represents guidelines with very high ecological and social requirements. The label is owned by the International Association of the Natural Textile Industry (IVN), which was founded in 1999. Textiles are certified if they contain at least 95% natural fibres. The natural fibres must be 100% organically grown. The criteria for awarding the label are developed by independent bodies. The label is valid for one year.



Did you know that organic cotton accounts for about 1% of the world's cotton harvest each year?



Textile Labels (7 C)

Social Sustainability



The label of the **Fair Wear Foundation** (FWF), an independent foundation in Amsterdam, is awarded to companies in the clothing industry that comply with the guidelines for working conditions of the International Labour Organisation (ILO). The aim is to improve working conditions and pay living wages. The awarding of the label is co-developed by independent bodies. The Labour Code of Conduct covers humane and fair working conditions from the supply chain to the final product. FWF cooperates with the Clean Clothes Campaign, among others.

For cotton textiles bearing the **Fairtrade Cotton** label, farmers receive cost-covering minimum prices for their cotton. The cotton fibres must be obtained without the use of genetic engineering, certain pesticides and fertilisers. The cotton's path is traceable and compliance with ILO core labour standards must be proven. There is a financial premium for community projects. The focus is on compliance with minimum social standards along the entire supply chain.



Did you know that the garment industry is based in so-called low-wage countries to keep labour costs as low as possible?

Textile Labels (7 D)

Sustainable Production



The **OEKO-TEX® MADE IN GREEN** label from OEKO-TEX Service GmbH is awarded to textiles that come from a production facility that is certified according to **OEKO-TEX® Step 1**. This checks production companies to ensure that their products are manufactured in an environmentally friendly and socially responsible manner and that they have a corresponding eco-quality management system. In addition to the absence of harmful substances in the textiles, emissions to air, water and soil as well as energy consumption and occupational health and safety are tested.

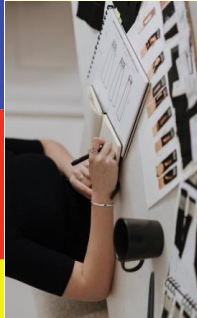
With the **bluesign®** standard of bluesign technologies ag, based in Switzerland, the use of chemicals and the manufacturing processes are checked for sustainability and social compatibility. There is a comprehensive list of all substances that are either recommended, restricted or banned. The orientation is based on the best available technologies. Environmental and climate protection, health and occupational safety in all process stages as well as social standards in the companies are assessed.



Did you know that the bluesign® standard is mainly found in outdoor and functional textiles?

Apprenticeships (8 A)

Fashion



WANTED !

Are you creative, passionate about fashion and interested in its creation and production? Do you like to work precisely and take great care in your work? One of the four professions below could be your dream job. Find out.

Textile and fashion seamstresses or **textile and fashion tailors** mainly work for industrial fashion labels or in fashion studios. **Fashion seamstresses** produce small series or prototypes. They use patterns as a guide and select processing techniques and materials. They transfer the patterns to fabrics, cut them to size, and assemble them into a garment or textile object. **Fashion tailors** convert pattern cuts developed by designers into production cuts, which today are mainly CAD-supported. They produce or optimise prototypes and models and take on tasks in logistics.

Custom tailors make individual garments and costumes according to their own designs and advise their customers on the choice of materials and cut designs. **Alteration tailors** also take customer wishes into account. However, they do not make new clothes but repair and alter clothes and home textiles to fit.

Apprenticeships (8 B)

Textile



WANTED !

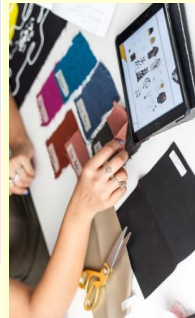
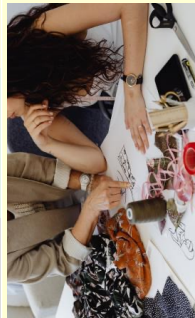
Are you artistically talented, interested in chemical or physical processes or fascinated by technical processes? The textile industry offers you a variety of professions that reflect your interests. One of the seven apprenticeships below could be your dream job. Find out.

All stages of the textile production process—from spinning the fibres into yarns to producing fabrics to creating technical textiles—are carried out by **machine and plant operators**, **production mechanics**, **product finishers**, **product testers**, and **technical garment makers**. They equip, operate and repair textile machines, monitor textile processes and test materials, rectify faults, finish, cut and join textiles.

Textile laboratory technicians investigate and analyse the chemical and physical properties of fibres, fabrics, dyes, and textile auxiliaries used in production, and are involved in quality assurance. **Textile product designers** create textile patterns of all kinds using graphic and design software, which are intended to be put into mass production based on sample data carriers. For this purpose, the designs of the textile patterns must be technically and economically producible. A prototype is produced to verify the sample properties.

Apprenticeships (8 C)

School-based



WANTED !

Are you creative, passionate about fashion and interested in the fashion industry? Do you like to work accurately and take great care in your work? The following school-based apprenticeships reflect your interests:

Fashion designers create models ranging from individual garments to entire collections. They develop model sketches and patterns by hand or, today, mainly use CAD design programmes. They arrange for and supervise the production of samples, models or small series.

Garment technical assistants work hand in hand with the design department. They produce design sketches and work out patterns and garment-technical model descriptions together with the material designer. This full-time school-based occupation is similar to the dual training occupation "textile and fashion tailor".

Textile technical assistants are involved in all production steps of textile manufacturing. They produce and test raw materials and finished products for their textile properties and thus determine whether materials meet the specified norms and quality standards. This full-time school-based occupation is similar to the dual training occupation "textile laboratory assistant".

Further Training Opportunities in Textiles and Fashion (8 D)




WANTED !

After successful completion of an apprenticeship or fulltime school education and initial work experience, there is the possibility of further training to become an **industrial foreman** in the textile industry. The tasks become more complex and responsible. In manufacturing and processing, foremen take on technical and management tasks and act as a link between company management and the team of employees. They plan and coordinate production processes and supervise skilled workers.

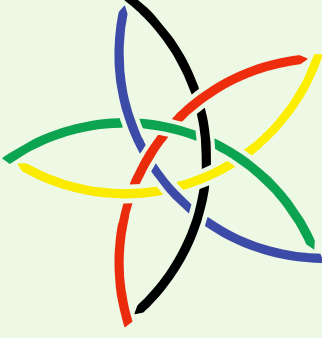

There is also the possibility of further training to become a **technician** specialising in **textile technology** or the **clothing industry**. The fields of activity of the profession already acquired are broadened and deepened. Technicians are professionals in planning, monitoring and optimising production processes and are very familiar with the machines.

Textile laboratory technicians investigate and analyse the chemical and physical properties of fibres, fabrics, dyes, and textile auxiliaries used in production, and are involved in quality assurance.


Textile product designers create textile patterns of all kinds using graphic and design software, which are intended to be put into mass production based on sample data carriers. For this purpose, the designs of the textile patterns must be technically and economically producible. A prototype is produced to verify the sample properties.



Fashion DIET



Fashion DIET



2.8.4 References

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Images

Textile Quartet No. 1: Textile Segments

Clothing:

Left: Dresses, © Anne-Marie Grundmeier

Right: Left: Jeans, © Anne-Marie Grundmeier

Home Textiles:

Left: No title, DESIGNCOLOGNIST, <https://unsplash.com/de/lizenz,https://unsplash.com/de/fotos/SQuY313aZyA>

Right: No title, Kelly Sikkema, <https://unsplash.com/de/lizenz,https://unsplash.com/de/fotos/CNjfgzoY8JU>

Technical Textiles:

Left: No title, Kristin Snippe, <https://unsplash.com/de/lizenz,https://unsplash.com/de/fotos/3odFXGvFnp8>

Right: No title, Kelly Sikkema, <https://unsplash.com/de/lizenz,https://unsplash.com/de/fotos/jinWKnH0m5A>

Textile Toys:

Left: No title, Romina BM, <https://unsplash.com/de/lizenz,https://unsplash.com/de/fotos/GtUNA6ysR5s>

Right: No title, Oxana Lyashenko, <https://unsplash.com/de/lizenz,https://unsplash.com/de/fotos/FtNM2H1RXZ8>

Textile Quartet No. 2: Fibres

Plant Fibres:

Left: No title, Sze Yin Chan, <https://unsplash.com/de/lizenz,https://unsplash.com/de/fotos/cE35j-5Y7Ug>

Right: Hemp fibres, © Anne-Marie Grundmeier

Animal Fibres:

Left: No title, Sam Carter, <https://unsplash.com/de/lizenz>,
<https://unsplash.com/de/fotos/GHOiyov2TSQ>

Right: 21-day-old silk worms between mulberry leaves in the Suzhou No. 1 Silk Mill
(Jiangsu), China, Armin Kübelbeck, CC-BY-SA, Wikimedia Commons,
https://commons.wikimedia.org/wiki/File:Silk_worm_21_days_01.jpg

Man-made Cellulosic Fibres:

Left: Wood chips, Franz Neumayr, © Lenzing AG,
<https://www.lenzing.com/newsroom/image-archive/filter1>

Right: Lenzing fibres, Markus Renner, © Lenzing AG,
<https://www.lenzing.com/newsroom/image-archive/filter1>

Synthetic Fibres:

Left: Polyester Granulate, © Anne-Marie Grundmeier

Right: Polyester Fibres, © Anne-Marie Grundmeier

Textile Quartet No. 3: Yarns

Spun Yarns:

Left: Photo Spun Yarn, © Anne-Marie Grundmeier

Right: Drawing Spun Yarn, © Kim Frank

Monofilament Yarns:

Left: Photo Monofilament Yarn, © Anne-Marie Grundmeier

Right: Drawing Monofilament Yarn, © Kim Frank

Multifilament Yarns:

Left: Photo Multifilament Yarn, © Kim Frank

Right: Drawing Multifilament Yarn, © Kim Frank

Assembled Yarns:

Left: Photo Assembled Yarn, © Kim Frank

Right: Drawing Assembled Yarn, © Kim Frank

Textile Quartet No. 4: Spinning Processes

Left: Drawing Wet Spinning, © Kim Frank

Right: Drawing Dry Spinning, © Kim Frank

Left: Drawing Melt Spinning, © Kim Frank

Right: Drawing Lyocell Process, © Kim Frank

Textile Quartet No. 5: Fabrics

Woven Fabrics:

Left: Weaving, © Kim Frank

Right: Denim, © Kim Frank

Knitted Fabrics:

Left: Blue Knitwear, © Anne-Marie Grundmeier

Right: Warp Knitted Fabric, © Anne-Marie Grundmeier

Nonwoven Fabrics:

Left: Yellow Felt, © Kim Frank

Right: Orange Nonwoven, © Kim Frank
Transparent and Open-work Fabrics, Laces, Nets:
Left: Handmade Lace, © Anne-Marie Grundmeier
Right: Raschel Lace, © Anne-Marie Grundmeier

Textile Quartet No. 6: Textile Finishing

Pretreatment:

Left: Bleaching, © Anne-Marie Grundmeier
Right: Mercerising, © Anne-Marie Grundmeier

Colouring:

Left: Dyed Fabric, © Anne-Marie Grundmeier
Right: Printed Fabric, © Anne-Marie Grundmeier

Finishing:

Left: Blue Fleece, © Anne-Marie Grundmeier
Right: Hydrophobic Fabric, © Anne-Marie Grundmeier

Coating and Lamination:

Left: Coated Fabric, © Anne-Marie Grundmeier
Right: Laminated Fabric, © Anne-Marie Grundmeier

Textile Quartet No. 7: Textile Labels

Health Protection:

Left: Oeko-Tex Service GmbH (n.d.). *OEKO-TEX® Standard 100. What does the label mean?* <https://www.oeko-tex.com/en/our-standards/oeko-tex-standard-100>

Right: Secretariat of the International Association of Applied UV Protection (n.d.). *UV 801 Standard.* <https://www.uvstandard801.com/en/>

Natural Fibre Labels:

Left: Global Standard gGmbH (n.d.). *Global Organic Textile Standard. Ecology & Social Responsibility.* <https://global-standard.org/>

Right: Internationaler Verband der Naturtextilwirtschaft e. V. (IVN). *Naturtextil IVN zertifiziert BEST.* <https://naturtextil.de/qualitaetszeichen/qualitaetszeichenbest/>

Social Sustainability:

Left: Logo Fair Wear Foundation, Buro RuSt (2020, June 2). *Fair Wear member brand communication guide and policy.* Version 0.2 June 2020. FairWear-Member-Brand-Communication-Guide_-08-DEF.pdf

Source: Fair Wear Foundation (n.d.). *Discover the impact of Fair Wear.* <https://www.fairwear.org/>

Right: Transfair e. V. (n.d.) *Fairtrade Cotton.* <https://www.fairtrade-deutschland.de/was-ist-fairtrade/fairtrade-siegel>

Left: OEKO-TEX Service GmbH (n.d.). *What does the certification mean?* <https://www.oeko-tex.com/en/our-standards/oeko-tex-step>

Right: Die Verbraucher Initiative e. V. (n. d.). *bluesign®.* <https://label-online.de/label/bluesignR/>

Source: bluesign technologies ag (n.d.). *bluesign®.* <https://www.bluesign.com/en>

Textile Quartet No. 8: Apprenticeships

Fashion Apprenticeships:

Left: No title, Tima Miroshnichenko, <https://www.pexels.com/de-de/lizenz/>,
<https://www.pexels.com/de-de/foto/fashion-arbeiten-manner-muster-6766286/>

Right: No title, Anete Lusina, <https://www.pexels.com/de-de/lizenz/>,
<https://www.pexels.com/de-de/foto/licht-fashion-frau-kreativ-7256897/>

Textile Apprenticeships:

Left: Lyocell-Produktion, Lenzing AG,
<https://www.lenzing.com/de/newsroom/bildarchiv/browsepage/5?cat=922&chash=3671e54852d78a960cd76d682fe6ad09&cHash=637cbf138c91fb6d871757b897281cd4>

Right: No title, Thies Rätzke, © Hohenstein, <https://www.hohenstein.de/de/>

School-based Apprenticeships:

Left: No title, Karolina Grabowska, <https://www.pexels.com/de-de/lizenz/>,
<https://www.pexels.com/de-de/foto/frau-geschäft-kreativität-stil-8527751/>

Right: No title, Los Muertos Crew, <https://www.pexels.com/de-de/lizenz/>,
<https://www.pexels.com/de-de/foto/fashion-frau-hand-technologie-8030145/>

Further training opportunities in textiles and fashion:

Left: Schutzbekleidung, Cheung Chi Lock, © Lenzing AG,
<https://www.lenzing.com/de/newsroom/bildarchiv/browsepage/6?cat=922&chash=3671e54852d78a960cd76d682fe6ad09&cHash=637cbf138c91fb6d871757b897281cd4>

Right: No title, Thies Rätzke, © Hohenstein, <https://www.hohenstein.de/de/>

3 Access to Databases

Fashion DIET website - Since the start of the project, the major project website continuously reports on the project's progress. The website represents the key access point to the information and e-learning platform.

Link to Fashion DIET website: <https://fashiondiet.eu>

Glocal Campus - The teaching and learning arrangements of the project are provided as Open Educational Resources on the open access e-learning platform Glocal Campus. Glocal Campus is a Moodle-based online platform that has transformed into an international university network enabling virtual cross-university exchange in a wide range of subjects.

Link to Glocal Campus: <https://glocal-campus.org/login/index.php>

Fashion + Textile Database (F+TD) – This portal is a comprehensive and systematic database for collecting current information on fashion and textile topics, which is developed in co-creation. The F+TD is the place to find, create, and analyse textile- and fashion-related data. Foci of the F+TD are usability studies of online shops, consumer behaviour surveys and analysis of communication concepts.

Link to F+TD: <https://opus.bsz-bw.de/ftrc/home>

4 List of Authors

Frank, Kim Jara is a Master's student in European Education with a specialisation in Everyday Culture and Health. She worked as a student assistant on the "Fashion Diet" project in collaboration with Anne-Marie Grundmeier. Kim Jara Frank's academic pursuits align with her passion for exploring the intersections of everyday culture and health in the context of education in an international perspective.

Grundmeier, Anne-Marie (First and Second State Examination and Diploma in Vocational Education) is a full professor in the field of fashion, textile sciences, and its didactics at the University of Education Freiburg in Germany. She is head of the Department of Fashion and Textiles and the Institute of Everyday Culture, Sport and Health. She holds a PhD in economics and worked as a vocational schoolteacher. Her research interests are fashion and textile sciences, emphasizing Education for Sustainable Development, (inter-)cultural and vocational education.

Köhler, Dorit is an academic staff member in the field of fashion, textile sciences, and its didactics at the University of Education Freiburg in Germany. She holds a PhD in history of art and worked as a textile restorer and as a teacher in secondary education. Today, she works in the teacher education Bachelor and Master programmes of the Department of Fashion and Textiles and the Institute of Everyday Culture, Sport and Health. Her research interests are history of fashion and textiles, and cultural developments especially in the field of textiles and sustainability.

Schmidbleicher, Maleika is a Master's student at the University of Education Freiburg in Germany with a specialisation in Everyday Culture and Health. She worked as a research assistant on the "Fashion Diet" project in collaboration with Anne-Marie Grundmeier. She holds a Bachelor's degree in Secondary Education and has worked as an instructor at the University of Iowa. Her research interests are in Education for Sustainable Development, especially in fashion and textiles.

Strobel-Theunissen, Cathrine is a fashion designer and an academic teacher at a vocational school in Stuttgart, Germany. Based in the fashion department, she educates different fashion and textile professions in the dual system, in the college of fashion design and in the master class for tailors. She also worked at the University of Education Freiburg as a research assistant on the Master's degree programme in Vocational Education in Textile Technology and Clothing/Economics and was responsible for the implementation of a scientific elective module for bachelor students in textile and clothing engineering at Reutlingen University.