TRAINING BOOK

Output of O2: Industrial design and design thinking book for intensive summer training

The DESTEX project, February 2022

DESTEX Training Book

This is the English version of the DESTEX Training Book.

A formal output of the project Destex - Industrial and Creative Design in Advanced Textile Manufacturing project, reference number 2019-1-SE01-KA203-060379 (2019-2022) funded by Erasmus+.

Project partners:
AEI TÈXTILS, Spain
CIAPE, Italy
CRE.THI.DEV, Greece
Design School Kolding, Denmark
LCI Barcelona, Spain
Materially, Italy
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1. INTRODUCTION

1.1 THE DESTEX PROJECT

Destex - Industrial and Creative Design in Advanced Textile Manufacturing is an Erasmus + funded project. Taking place from 2019 - 2022, it covers different topics related to Advanced Textiles in Product Design. The main objective is to promote the uptake of creativity culture as a catalyst to unlock the innovation potential in the advanced textile materials' sector. With a focus on fostering transnational collaborations and knowledge creation, the Destex project constitutes of eight partners from academia and industry from five European countries.

The higher education partners are:

- LCI Barcelona, Spain,
- Politecnico di Milano, Italy
- University of Borås, Sweden
- Design School Kolding, Denmark

The partners from the industry are represented with:

- AEI TÈXTILS, Spain
- CIAPE, Italy
- Materially, Italy
- CRE.THI.DEV, Greece

Connected by the work in the textile industry, a special interest is put on the emerging sector of Advanced Textile Materials. As a driver to unlock the latent innovation potential in this sector, the Destex project puts interdisciplinary innovation to the forefront. By merging it with creativity and industrial design, it creates an impact for the many distinct stakeholders and project partners. With a broad view, it looks into pioneering areas ranging from sustainability to digital fabrication and from smart textiles to business opportunities. The partners are developing a set of tools to bridge industrial and creative design to the manufacturing companies in the advanced textile materials' sector.

1.2 THE TRAINING BOOK

The training book is the output of O2 - Industrial design and design thinking book for intensive summer training. The book presents a collection of 23 learning activities aiming to activate the Open Education Resources (OERs) developed in O1 – Development of virtual training program.

Whereas the OERs have been developed for the student to read, listen and learn about a specific topic in relation to textile production and product design, the learning activities have been developed for the tutor as a means to activate the OERs in the classroom.

1.3 USING THE TRAINING BOOK

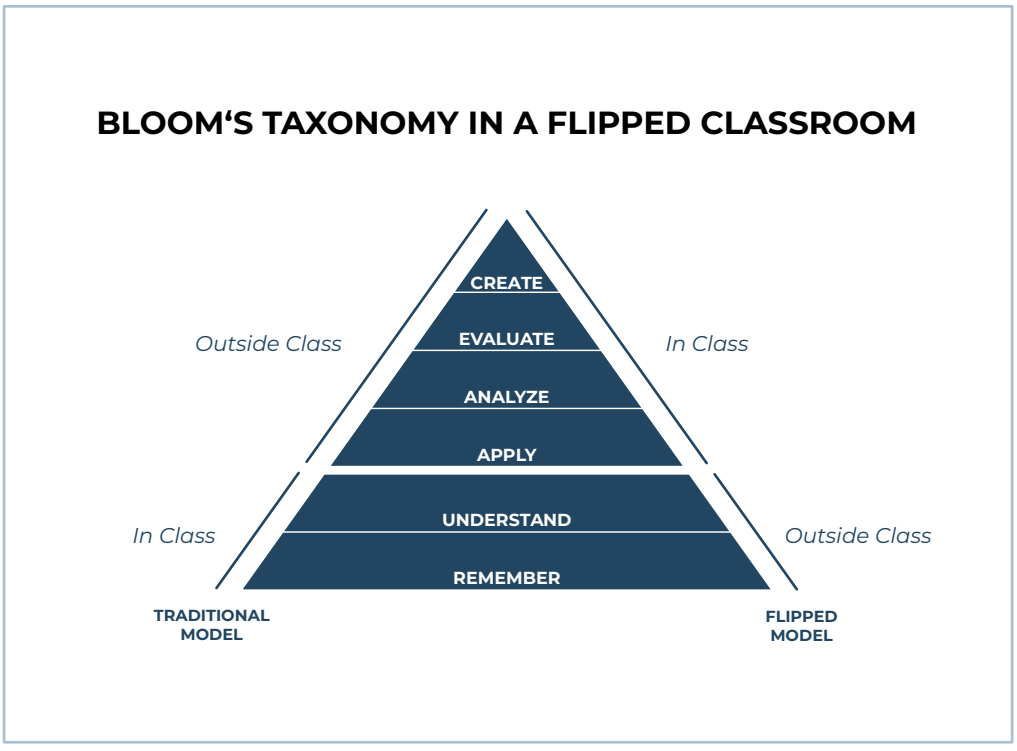
The Open Educational Resources and the learning activities have been developed using an active and blended learning strategy to facilitate a flipped classroom setup (Bergmann & Sams, 2015). In the flipped classroom, students are expected to complete readings or targeted input from other information media at home and to engage with activating and often practice-based exercises during class time.

Bergmann, J., & Sams, A. (2015). Flipped Learning: Gateway to Student Engagement. International Society for Technology in Education.

The pedagogic principles of the flipped classroom model can be described using Bloom's Taxonomy of learning (Anderson et al., 2014). In the traditional model, students are to remember and understand new material in class, e.g. through lectures and readings and then to apply, analyze, evaluate and create themselves based on this material but outside class. In the flipped classroom model, students are to remember and understand new material before attending class, while classroom activities aim to help students apply, analyze, evaluate and create based on the prepared for material.

The argument behind this model is that the flipped class helps engaging students with activities in class that in different ways challenge their understanding of the material they're working with.

Anderson, L. W., Krathwohl, D. R., Airasian P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., & Wittrock, M. C. (2014). A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives. Pearson.



The role of the tutor here shifts from being an informer and disseminator of a topic to becoming a facilitator of one or more activities in class.

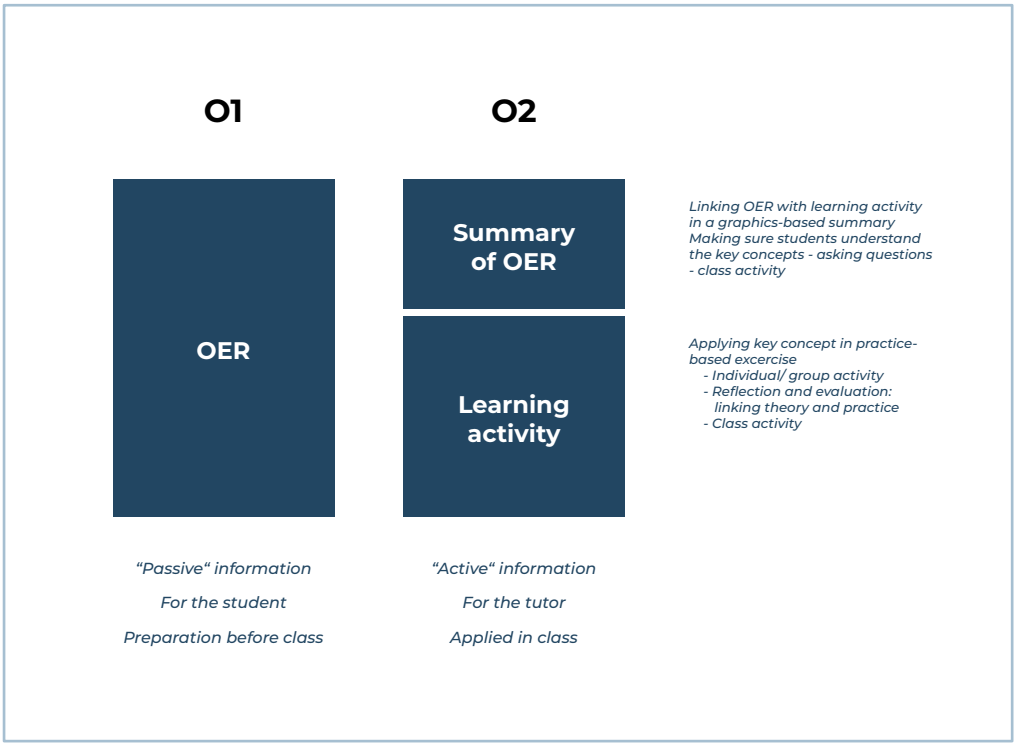
The format supports shifting between activities with different teaching approaches such as individual, group work and plenary discussion and between different learning modes such as between theory and practice and between analysing and synthesizing. Consequently, the model can facilitate teaching students on different levels and from different disciplines simultaneously (Holzer et al., 2018).

Holzer, A., Gillet, D., & Laperrouza, M. (2018). Active Interdisciplinary Learning in a Design Thinking Course: Going to Class for a Reason. Proceedings of IEEE Tale.

OER summary presentations

Each learning activity links to an Open Educational Resource. To support the connection between an OER and the corresponding learning activity, a summary presentation of the OER has been developed. This is for the tutor to use or find inspiration in for a short presentation in the beginning of a class to ensure that students understand the topic of the learning activity and that they have the possibility to ask questions before initiating the learning activity.

In the section 'Support material' in the learning activity, titles and links to corresponding OERs and summary presentations can be found.



2. STRUCTURE

The training book gives an introduction and overview of the presented material used during the project. The focus lies on the learning activities in Chapter 3.

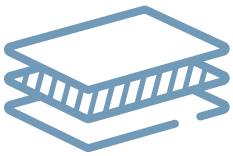
Chapter 2 informs on eight categories addressing the various priorities of the project and presents the applied design process forming a base and structure for the learning activities that build on it.

2.1 CATEGORIES

Eight categories were formulated to get further acquainted with the topic of the project. The categories are:

- Textile technology
- Advanced textile technology
- Textile surfacing and printing
- Smart textiles
- Design process
- Product design
- Sustainability
- Business and marketing

These categories build the theoretical framework and describe the focal points of the project. What gets introduced on the following pages can be seen as background knowledge.
This knowledge enables the student to participate in various activities and to understand material that is presented throughout the project.



TEXTILE TECHNOLOGY

From its origin, humans had the need to dress and, because of this, the first cloths are born. Since then, the processes have been modernized and adapted to the new times, also the chemicals, whether polymers for fibres or products for dyeing and finishing.

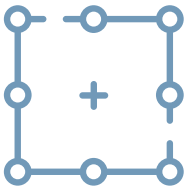
Textile technology come to understand the fundamentals of textile materials and processes, the integral development of textile products and industrial garment making, linear textile structures and non-woven fabrics (technical and smart fabrics), processing and finishing operations.

There are a lot of paths to follow when producing a textile product, depending on what is being created and with which purpose. The chosen material/s are converted into a filament and then into a yarn, then are woven or knitted to make a fabric. Finally, this fabric needs a dyeing and finishing process in order to be ready to its use. All these steps determine the final aspect and function of the product.

Adanur, S. (1995). Wellington Sears Handbook of Industrial Textiles. CRC Press.

Sinclair, R. (Ed.). (2014). Textiles and Fashion: Materials, Design and Technology. Woodhead Publishing.

textileblog.(2020,October 26). Textile Manufacturing Processes for Students and Professionals. TextileBlog. https://www.textileblog.com/textile-manufacturing-processes/



ADVANCED TEXTILE TECHNOLOGY

The first-generation textile fibres were those that were procured directly from the nature and that era lasted for 4,000 years. Since then, the textile technology has evolved a lot, including the man-made fibers and, nowadays, the development of very specific fibres, fabrics and finishing processes, using technology to meet customer demands.

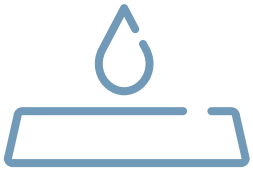
Currently, there are some lines of research that should be mentioned for their outstanding contribution to the needs of the market. For example, 3D structures, seamless garments and composites are three important lines in the current innovations in structures. Speaking about functionalization, electrospinning, plasma and nanotechnology are highlighted trends to mention alongside with graphene as a research line in terms of materials. These technologies pretend to give a response to the key challenges of various technical sectors: healthcare, aeronautics, automotive, sports, building, personal protection, etc.

Apart from the contributions generated by new technologies, the sustainability of new proposals is also currently being considered.

Horrocks, A.R.; Anand S.C. 2000. Handbook of Technical Textiles. UK. Woodhead Publishing Limited. 9781782424659.

Senthil Kumar, R. 2014. Textiles for Industrial Applications. CRC Press, Taylor & Francis Group. 9780429187353.

Tao, X. M. (2001). Smart Fibres, Fabrics and Clothing. Woodhead Publishing.



TEXTILE SURFACING AND PRINTING

The surface properties of textiles play an important role in determining their characteristics such as comfort, wettability, dyeability and adhesion to coatings. The surface morphology and chemistry of textiles can be modified by several chemical and physical methods. The modified surfaces allow the use of textiles in a wide range of applications, from apparel and fashion sectors to technical and industrial textiles, including automotive, medical, sports, geotextiles and protective garments (Muthu & Gardetti, 2020).

The main purpose of surface modification is to alter the functionalities (including wettability and biocompatibility) and properties (like color and texture) of the treated textile without compromising their desirable inherited bulk properties (as in comfort and electrical conductivity etc.) (Luo & Van Ooij, 2002; Shahid & Adivarekar, 2020).

In this context, the literature reports on developments in the use of polymerization, nanotechnologies, plasma treatment, 3D printing, digital inkjet printing, enzyme treatment, microencapsulation, laser treatment and sol gel techniques to impart novel properties to a textile surface such as hydrophilicity, water-repellency, flame-retardancy and antibacterial properties (Nadi, Boukhriss, Bentis, Jabrane, & Gmouh, 2018). Additionally, these treatments allow the modification of surface morphology and facilitate further processing like improved adhesion with coatings, 3D printed patterns and matrix in composites.

Luo, S., & Van Ooij, W. J. (2002). Surface modification of textile fibers for improvement of adhesion to polymeric matrices: A review. Journal of Adhesion Science and Technology, 16(13), 1715–1735.

Nadi, A., Boukhriss, A., Bentis, A., Jabrane, E., & Gmouh, S. (2018). Evolution in the surface modification of textiles: a review. Textile Progress, 50(2), 67–108.

Shahid, M., & Adivarekar, R. (2020). Advances in Functional Finishing of Textiles. Springer.

Muthu, S. S., & Gardetti, M. A. (Eds.). (2020). Sustainability in the Textile and Apparel Industries - Production process sustainability. Springer.

SMART TEXTILES

Smart textiles are defined as textiles (in the shape of shirts, socks, shorts, belts, etc.) that can sense and react to environmental conditions or stimuli, from mechanical, thermal, magnetic, chemical, electrical, or other sources to provide functions such as health monitoring and activity tracking. They are able to sense and respond to external conditions (stimuli) in a predetermined way. Given, the diversified panorama of smart textiles, a clarification about the meaning of smart textiles is here needed.

They can be classified as passive or active smart textiles: the first ones are materials to which a specific function is added by means of material, composition, construction, and/or finishing (e.g., by applying additives or coatings) (Cherenack & van Pieterson, 2012).

On the contrary, active smart textiles, are those capable of sensing, reacting, and adapting to the environment or stimuli and integrate actuators and sensors (Vagott & Parachuru, 2018).

Berglin, L. (2013). Smart Textiles and Wearable Technology- A study of smart textiles in fashion and clothing. A report within the Baltic Fashion Project (p. 33). The Swedish School of Textiles; University of Borås.

Cherenack, K., & van Pieterson, L. (2012). Smart textiles: Challenges and opportunities. Journal of Applied Physics, 112(9), 091301

Vagott, J., & Parachuru, R. (2018). An Overview of Recent Developments in the Field of Wearable Smart Textiles. Journal of Textile Science & Engineering, 8(4), 1-10

DESIGN PROCESS

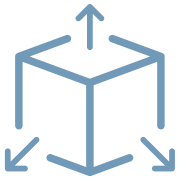
‘Design is what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers. In this sense, Design may be described as creativity deployed to a specific end.’ (Cox, 2005).

Therefore Design, understood as an intellectual and abstract creation activity that allows solving a problem and meeting a need (tackling complex social, economic, technological and environmental issues), implies the implementation of a process. ‘It can be regarded as a creative problem-solving (Koberg, 1981) methodology through a series of steps, which lead the designer from the initial challenge to the product’s realization.’ (Ledbury, 2018)

Many frameworks, models, and theories have been formulated to determine the design process and through the years they have been updated, revised and sometimes dismissed, according to the changes in social and economic context. However, most of them coincide with the ‚Double Diamond Model‘ proposed by the British Design Council in 2004 that defines a sequence of activities that comprehend Discover (‚identify the problem to solve‘), Definition (‚and frame the problem‘), Develop (‚generate and evaluate solutions‘) and Deliver (‚finalize and hand off solution‘).

Cox, G. (2005) Cox Review of Creativity in Business: Building on the UK’s Strengths. London: Design Council.

Ledbury, J. (2018). Design and product development in high-performance apparel. High-Performance Apparel, 175–189. https://doi.org/10.1016/b978-0-08-100904-8.00009-2



PRODUCT DESIGN

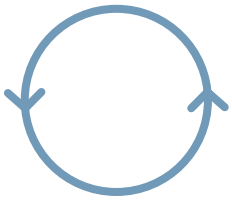
The core of product design is the design of something, a product, that meets a need. The term can both relate to the process of designing a product and the designed product.

The process of designing a product includes aspects such as user understanding and market analysis, aesthetics and functionality, material and production, concept development, prototyping and user testing and the term can thus be related to 'Industrial design' as well as 'Engineering design' (Kim & Lee, 2010).

Designed products can and are often related to physical objects of material substance, but designed products can also be immaterial and digital, for example Apps and webpages or be systems with both physical and digital components (ref.). Furthermore, product design can relate to the making and existence of the product itself, but also to the technological and social systems the product takes part of, is affected of and affects.

Product design is not restricted to one specific design discipline, but is to the profession of designing itself. Disciplines such as fashion design, textiles design, industrial design, design engineering, UX-design and communication design comprise of common ways of the act of designing but find expression in distinct objects of investigation.

Kim, K. M., & Lee, K. P. (2010). Two types of design approaches regarding industrial design and engi-neering design in product design. Proceedings of the International Design Conference - Design 2010, 1795–1806.



SUSTAINABILITY

Sustainable development relies on safeguarding natural resources and biodiversity for the future and is put into practice through the short-term and long-term adoption of combinations of resource efficiency, climate mitigation, carbon removal and biodiversity protection policies. Sustainable manufacturing should integrate environmental impact reducing activities at all levels of the process.

Determined by the increased speed with which nowadays it is possible to manufacture garments and accessories, and consequently fashion is delivered to consumers, paralleled by a significant fall in prices, in only a few decades a rise of 40% of the amount of clothes bought per person in the EU has been registered, causing fashion clothing purchasing habits to shift to clothing consumption habits, with amounts of unsold items to dispose of increasing accordingly. All processes involved - raw materials production, fiber spinning, textiles weaving, dyeing and finishing - require enormous amounts of water and chemicals, as well as energy, with the majority of clothes production taking place abroad. Textiles manufactured with both natural and synthetic fibres pose a significant risk to freshwater environments respectively during the production steps and during the use and end-of-life phases. In order to reduce the textile industry's environmental impact, a variety of aspects has to be carefully considered and efforts should be aimed at implementing or increasing recycled contents and/or biobased contents from easily and sustainably renewable resources, adopting or improving sorting and recycling technologies and processes, as well as wastewater-related good practices, reducing the use of toxic substances and processes and enabling virtuous EOL (end-of-life) options.

Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. Nature Reviews Earth & Environment, 1(4), 189–200.

Oberle, B., Bringezu, S., Hatfield-Dodds, S., Hellweg, S., Schandl, H., & Clement, J. (2019). Global Resources Outlook 2019: Natural Resources for the Future We Want. International Resource Panel (IRP) of the United Nations Environment Programme.

Šajn, N. (2019). Environmental impact of the textile and clothing industry. What consumers need to know [Briefing]. EPRS | European Parliamentary Research Service.

Stone, C., Windsor, F. M., Munday, M., & Durance, I. (2020). Natural or synthetic – how global trends in textile usage threaten freshwater environments. Science of The Total Environment, 718, 134689.

BUSINESS AND MARKETING

TechTex trade have grown very fast, the sector is today a major contributor to the EU textile industry and these positive trends are expected to continue (Adinolfi, 2019).

Technical textiles are today used for an increasing number of applications, constituting an example of “traditional sector” able to “reinvest itself” on new business models fully suited to the needs of the new industrial revolution (more smart, more inclusive and more sustainable). (Butaud-Stubbs & Niestroy, 2013).

Advanced materials, high-tech processes and manufacturing technologies as well as new business models, management and marketing concepts, by assuring products higher added value, become increasingly important factors for the industry competitiveness on the global market.

The main goal is to exit the price competition, towards a specialty and niche product strategy, where in addition to price factors such as quality, reliability, customisation, constant product improvement and innovation play a more important role.

Companies that want to successfully operate long-term with sufficient profitability need to adopt new business strategies that can provide them with a sustainable competitive advantage. Such strategies can be based on:

- Intellectual property (brands, designs, trademarks, patents)
- Unique design, manufacturing or marketing capabilities
- Backward or forward supply chain integration
- Differentiated product and product-service offerings

(Euratex, 2014)

Adinolfi, R. (2019, May). Statistics and trends of the EU technical textile production and international trade [Press Conference]. TechTextil, Frankfurt. https://s3-eu-west-1.amazonaws.com/ukft/wp-content/uploads/2018/05/16125453/Euratex-Technical-Textiles-stats-2019.pdf

Butaud-Stubbs, E., & Niestroy. (2013). Technical textiles [Opinion]. European Economic and Social Committee. https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/technical-textiles

Euratex. (2014). Study on Innovation and Technology in the European and Mediterranean Textile and Clothing Industry. http://www.enpicbcmed.eu/sites/default/files/texmed_study_innovation_and_technology.pdf

2.2 LEARNING MODES & DESIGN PROCESS

In this project, we apply the, Double Diamond model that has been developed by the Design Council as a way to describe the design process and make it more tangible for its users and collaborators (Design Council, 2021).

The model comprises two diamonds that each consist of two parts. The first diamond represents the analysing part of a process and consists of the two phases 'Discover' and 'Define', while the second diamond represents the executing part of a process and consists of the two phases 'Develop' and 'Deliver'.

The model is related to other process models such as d.school's 5 stages in the Design Thinking Process, (Dam & Siang, 2021), the Circular Design Guide Mindset (Ellen MacArthur Foundation & IDEO, 2016), the 6C-model and the Co-Creation cards (Friis, 2016) and the methods toolkit from designkit.org.

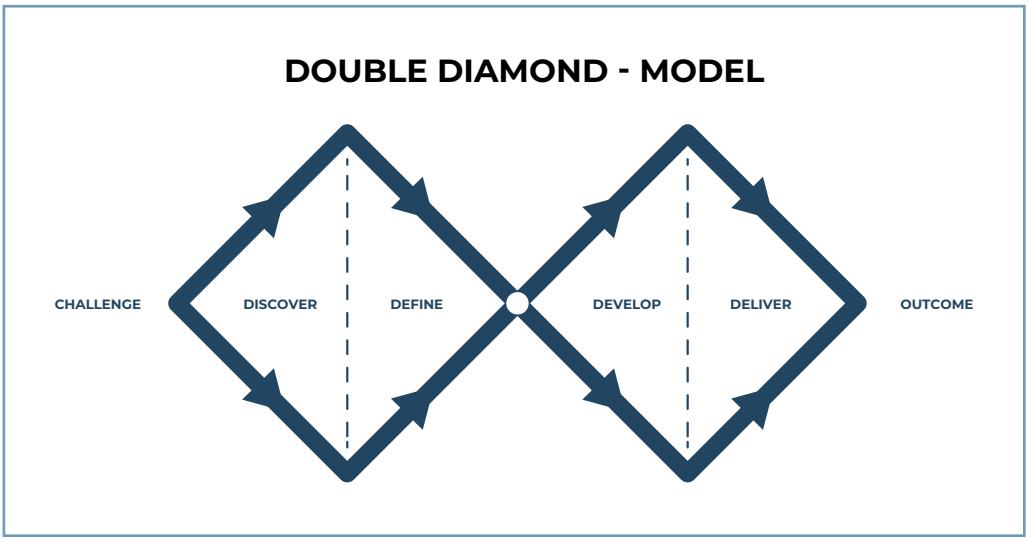
Dam, R. F., & Siang, T. Y. (2021). 5 Stages in the Design Thinking Process. Interaction Design Foundation. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process

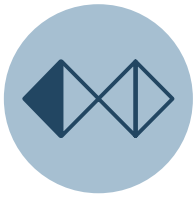
Design Council. (2021). What is the framework for innovation? https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond

Design Kit–Methods. (2021). https://www.designkit.org/methods

Ellen MacArthur Foundation, & IDEO. (2016). Circular Design Guide. https://www.circulardesignguide.com

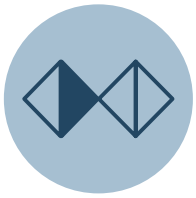
Friis, S. A. K. (2016). The 6C Model. The International Journal of Design in Society, Volume 10(Issue 3), 13–30.





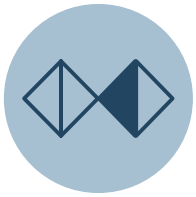
DISCOVER

The first diamond helps people understand, rather than simply assume, what the problem is. It involves speaking to and spending time with people who are affected by the issues.



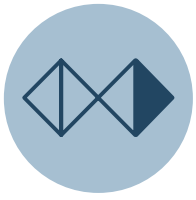
DEFINE

The insight gathered from the discovery phase can help you to define the challenge in a different way.



DEVELOP

The second diamond encourages people to give different answers to the clearly defined problem, seeking inspiration from elsewhere and co-designing with a range of different people.



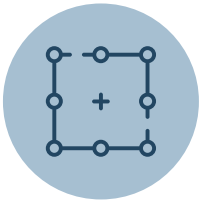
DELIVER

Delivery involves testing out different solutions at small-scale, rejecting those that will not work and improving the ones that will.

2.3 EXPLANATION OF ICONS

To visually guide the user while working with the learning activities, several icons are used. The first group of icons refers to the eight categories introduced in chapter 2.1. They explain to which categories the learning activity relates.

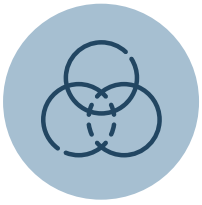
Textile Technology



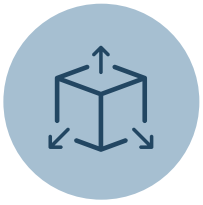
Advanced Textile Technology

Textile Surfacing and Printing

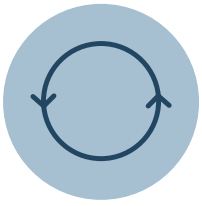
Smart Textiles



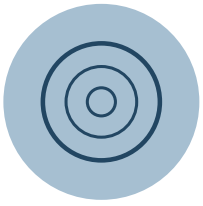
Design Process



Product Design

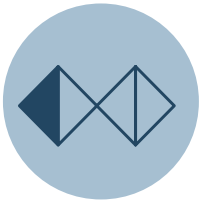


Sustainability

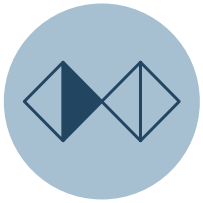


Business and Marketing

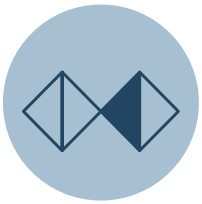
The subsequent icons stem from the double diamond model explained in Chapter 2.2 and indicate in which of the four phases a learning activity takes place.



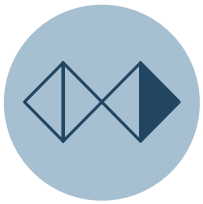
Discover



Define



Develop



Deliver

The last two icons indicate the amount of time that is approximately needed to complete an activity as well as the setting in which the task is supposed to be performed.

Less than or around an hour
Around half a day
A day or more than a day

Individual
Small group
Large group
Discussion

3. LEARNING ACTIVITIES

The project partners have developed a total of 23 learning activities. Every learning activity links to an OER that can be found on the project website.

The learning activities are described with an objective and scope including an activity question and learning goals to describe the aim of the given activity as well as support material, equipment and possible outcomes and one or two concrete deliveries of sub-activities marked with A and B.

The learning activities can be used as they are in class, but can also be adapted and serve as inspiration in combination with other activities and in other contexts and for other tasks.

3.1 LEARNING ACTIVITIES

1.
Card toolkit with innovative sustainability strategies

2.
Define a new product brand identity

3.
Define new product design strategies for market success

4.
Delving into the latest trends in the technical textiles sector

5.
Digital inkjet printing in textile industry

6.
Expand your knowledge on the textile materials

7.
Hands on Digital Fabrication Technologies

8.
How to affect the production processes

9.
How to contribute in making a more sustainable supply chain process

10.
Ideate a new product / design from one's own vision

11.
Instead of creating, how about recreating?

12.
Looking into company's work with sustainability in textile product design

13.
Material Mapping & Scouting

14.
Materials scenario

15.
Plasma treatment in textile industry

16.
Putting scaling textiles into practice

17.
Storytelling for understanding the user

18.
Technological watch process practice: How to do technological watch, tools and references on advanced textile materials

19.
Tinkering with and for bio and smart textiles: produce and explore a bio-yarn

20.
Toolkit (materials)

21.
Visual Thinking to find Business Opportunities

22.
Wearable Textile System. Design layered intelligent materials

23.
3D printing on textiles

CARD TOOLKIT WITH INNOVATIVE SUSTAINABILITY STRATEGIES

OER: CARD TOOLKIT WITH INNOVATIVE SUSTAINABILITY STRATEGIES

Objective & Scope

This open educational resource has a primary goal to offer an easy-to-follow methodology to apply advanced textiles in products taking into account sustainability aspects. This Learning activity is based into a typical four-stages design process like the Design council's double diamond while using some of the most common sustainable design strategies.

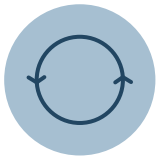
Activity Question

How is it possible to implement sustainable design strategies into de design process in order to achieve a result with the best possible environmental impact?

Learning Goals

- Ability to decide which sustainable design strategies are more coherent with the project they are developing, and to find the best application for them.
- Obtain the necessary level of empathy with the users to be able to develop a product that fulfills their needs.
- Learn how to transfer doing and thinking from one discipline to another to foster cross-disciplinary cooperation.
- Develop a good level of communication with people from different profiles in order to reach a good result in the design process

Categories



Sustainability

Design Process

Support material

- Sustainable design cards printed (or computers or tablets to see their digital version)
- OER
- Summary presentation

Equipment

- Tables to work in groups of 3-5 people and the needed
- Material to write and draw, including paper, pencils, post-its, markers, etc.

A.

Previous analysis

In the first stage of the design process, you need to use discussion between the group members as the main tool. After a brief debate with your team members, you need to answer these questions:

1.
What are the functional needs that this product has to cover?

2.
Are there other emotional needs that this product is fulfilling?

3.
How is this product produced in general? By who?

4.
What is the business model behind it? How do they make money with it?

5.
What is the system behind it along its complete life cycle, from material suppliers, factories or workshops, user, stores, distribution and transports, and its most common end of life?

6.
What steps does the user experience follow?

Less than or around an hour

Small group Discussion

Define

B.

Introduction of sustainable design strategies and conceptualization

1.
Using the cards included in the Open Educational resource start a discussion trying to decide which ones work better to improve the different aspects of the project: from the environmental one, to the business model, functionality, etc.

2.
Try to organize the chosen ones by priority or the influence they have in the project (main strategy/strategies, secondary one/s, tertiary, etc.)

3.
Sketch how the strategies would influence the general aspect of the product/service.

Less than or around an hour

Small group Discussion

Define

DEFINE A NEW PRODUCT BRAND IDENTITY

OER: BRANDING ASPECTS IN THE DESIGN PROCESS. CONSIDERING BRANDING STRATEGIES DURING A PRODUCT DEVELOPMENT PROCESS

Objective & scope

The scope of this learning activity is to let students familiarize with branding construction strategies, with the objective to create a clear visual identity for the product that is able to communicate exact messages, and to synthetize its attributes and the organisation values. Through this activity students will be asked to apply, with practical exercises, the concepts related to brand identity construction, applying strategies to differentiate and make a product recognizable into the market.

Activity question

What are the main features of the brand identity system do you want to build for your product and how you will communicate it?

Learning goals

- To acquire knowledge about how to construct a winning brand identity or to adapt an existing brand identity to a new product / design, and what are the different branding strategies to bring a product into the market
- To launch a new design or a new product keeping in mind the main aspects of a brand identity or what we want the new brand identity will communicate
- To define a branding strategy that is appropriate with the product features and the objective established

Categories

Business and Marketing

Design Process

References

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- Randall, G. (2000). Branding – a Practical Guide to Planning Your Strategy. London: Kogan Page.
- Lokmanoglu, Z. (2020). The Brand Identity Prism: what it is and how to use it. 99designs. https://99designs.it/blog/resources/brand-identity-prism/

Support material

- Template of the Kapferer Brand Identity Prism
- OER
- Summary presentation

Equipment

Computer

A.

Analysis of a company internal brand system and competitors' brand

1.
Introduce students to the concept of brand identity, the importance to build an effective brand identity and the different strategies that can be applied (recap to the OER' contents through a short presentation)

2.
Present to the students a case study: describe a company working in the technical textile sector, its product lines, production processes, history, typical customer profile etc. Propose to the students a new product this company is approaching to launch into the market.

3.
Establish groups and ask each one to make a strategic brand analysis: defining potential customers profile, motivation and needs (make a persona); analysing competitors brand image/identity (strengths, strategies, vulnerabilities); highlighting company internal capabilities, values and heritage

Less than or around an hour
Around half a day

Individual
Small group

Develop &
Deliver

B.

Use Kapferer Brand Identity prism to communicate brand values and attributes

1.
Based on the analysis conducted in the previous sub-activity, ask students to define the main features they want to communicate through their brand identity in term of: products attributes/qualities; organisation values; relationships with customers; visual imagery.

2.
Each different group is asked to synthetize what they want to communicate through their brand identity constructing a visual representation of the brand (logo), a slogan, a storytelling with the help of Kapferer Brand Identity prism (template to be provide).

3.
Each group will present its work to the other ones.

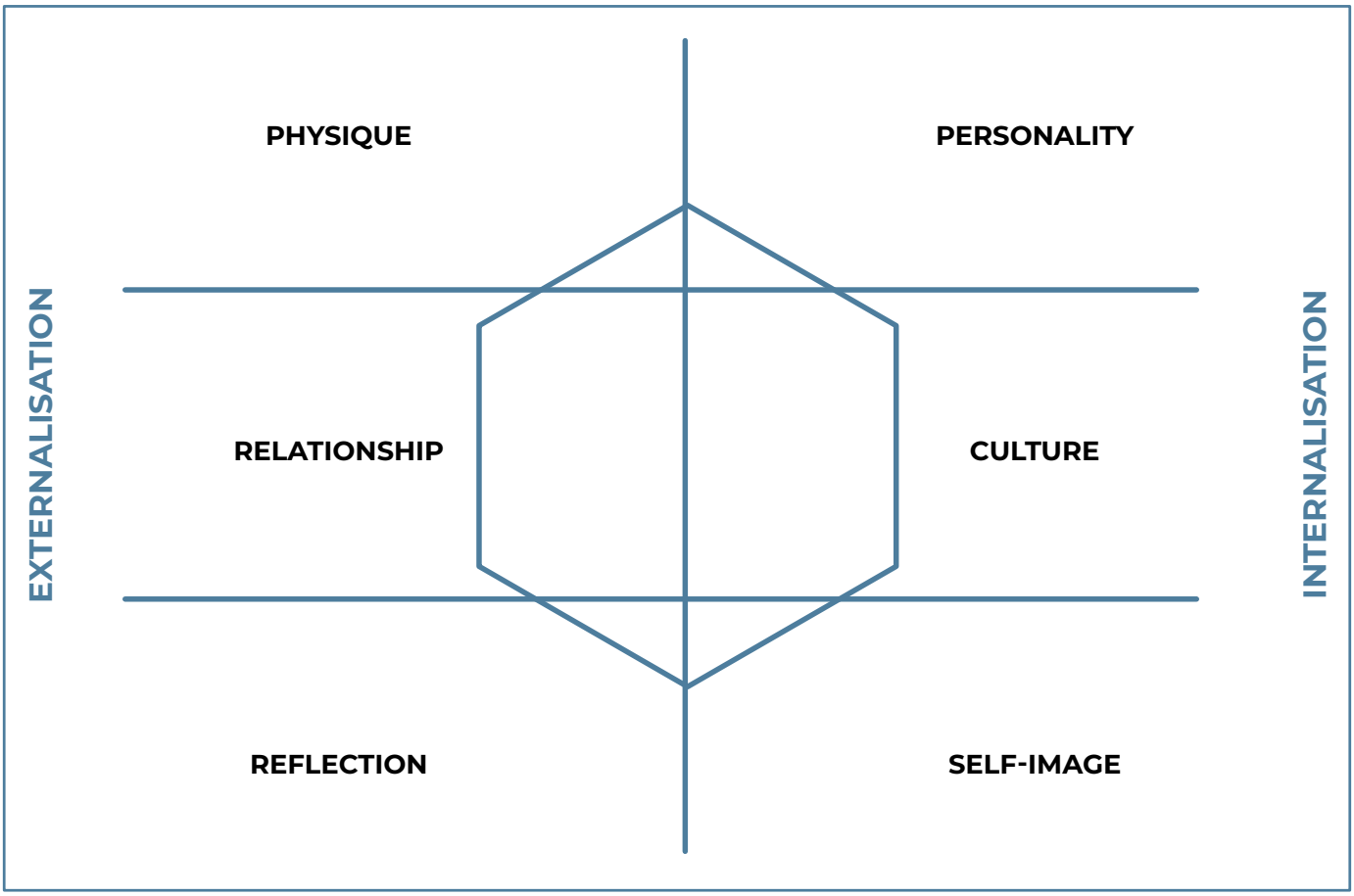
4.
At the end of the activity a discussion will be open to get feedback and reflections about the work done.

Less than or around an hour
Around half a day

Small group
Discussion

Develop &
Deliver

KAPFERER BRAND IDENTITY PRISM



DEFINE NEW PRODUCT DESIGN STRATEGIES FOR MARKET SUCCESS

OER: FORECASTING AND MARKET ANALYSIS TECHNIQUES

Objective & Scope

The aim of the learning activity is to identify strengths, weaknesses, opportunities and threats of a company working in the technical textile sector from different perspectives, stimulating students critical thinking in order to discover new product design possibilities. Students will be required to apply some of the market analysis techniques presented in the OER to find strategies in order to minimize the analysed enterprise weaknesses and exploit the underlined opportunities to develop successful strategies to adopt into the market.

Activity Question

Which features a new product / design should have to let the analysed enterprise to get a strategic advantage into the market?

Learning Goals

- To apprehend the process and the different steps needed to conduct a market analysis;
- To apply SWOT analysis to evaluate internal and external variables impacting on the lunch of a new product;
- To use the EMPHATHY MAP to analyse consumer' preferences and trends;
- To use the data resulting from the conducted market analysis to take decisions about the new product / innovative design to launch.

Categories

Business and Marketing

Design Process

Product Design

References

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- Brown, J. L. (n.d.). Empathy Mapping: A Guide to Getting Inside a User's Head. UXbooth. Retrieved 2021, from https://www.uxbooth.com/articles/empathy-mapping-a-guide-to-getting-inside-a-users-head/

Support material

- Table of standard question to ease the brainstorming process (first sub-activity)
- Templates for empathy map (second sub-activity)
- OER
- Summary presentation

Equipment

Computer

A.

Analysis of a company weaknesses and strengths through a SWOT analysis

1.
Recall the main purposes of a SWOT analysis and the procedures to be implemented (Small presentation to recap the OER related contents)

2.
Propose a real case study of a technical textile company to analyse

3.
Divide students in small groups (3-4 persons) and ask them to get relevant information about the company internal and external environment from website, studies, blogs, articles, statistical databases, journals and so on

4.
If possible let each group to have a direct interview with the company

5.
Conduct brainstorming sessions within each group for the creation of 4 different lists one for each SWOT macro area. During the brainstorming sessions propose students to use standard questions in order to ease the process (see slide 12 of the OER)

6.
Ask teams to prioritize the different elements emerged, for example asking to each team member to indicate the 3 most important elements of the 4 lists developed

Around half a day

Individual
Small group

Develop &
Deliver

B.

Concept poster of a new product / design

1.
Starting from the lists developed in the SWOT analysis ask teams (students continue to work into the groups defined for the previous sub-activity) to settle a strategy for each of the element to get the company underlined opportunities, exploit the strengths and to cope with threats and weaknesses

2.
Thinking about the main target of the analysed company the teams will develop an empathy map in order to get inside the customer mind (use the templates reported in the OER)

3.
Each group will put together the settled strategies with the empathy map findings and will develop an e-concept poster with the main features of the new product / design

4.
Each group will present its work to the other ones.

Less than or around an hour
Around half a day

Small group
Discussion

Develop &
Deliver

DELVING INTO THE LATEST TRENDS IN THE TECHNICAL TEXTILES SECTOR

OER: GENERAL TRENDS OF INNOVATION IN THE TECHNICAL TEXTILES' SECTOR

Objective & Scope

Based on the information given, expand on some aspects discussed in the OER. This activity allows the students to have a more specific knowledge about some points of the OER. This activity aims to encourage students' creativity and to seek information on a specific topic for themselves. This process will help them to create a real state of the art, which will be useful to them for later work situations.

Activity Question

What could you tell your classmates about the latest trends in the technical textiles sector?

Learning Goals

- Information search and filtration
- Synthetize

Categories

Advanced Textile Technology

Smart Textiles

Textile Technology

Support material

- OER
- Summary presentation

Equipment

- Computer with internet connection
- Online free tools such as Canva or Miro

A.

Information search

1.
Divide the students in small groups.

2.
Each group search information about a specific topic explained on the OER. (1h 30min)

3.
The group prepares a resume about the information they have found. (30min)

Topics:
nonwoven fabrics, plasma, nanotechnology, 3D fabrics, digital printing, electrospinning, ecologic finishing products, seamless fabrics

Around half a day

Small group

Discover

B.

Pitch

This activity is done once the first activity is finished.

The students share the information with the other groups in a one-minute pitch, using the “Elevator pitch” strategy. If they need visual support material, they can use online free tools such as Miro or Canva.

Less than or around an hour

Discussion

Define

DIGITAL INKJET PRINTING IN TEXTILE INDUSTRY

OER: DIGITAL INKJET PRINTING IN TEXTILE INDUSTRY

Objective & Scope

- Introduction of digital inkjet printing technology and its types to scholars
- Highlight the potential of DIJ printing as a dry and resource-efficient method in dyeing and functionalizing of textiles
- Application of digital inkjet printing as resource-efficient method to dye/functionalize textiles to better understand the theoretical part mentioned in OER, and implementation potential of this technology

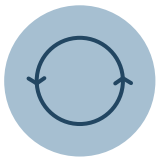
Activity Question

How can we minimize the material used and waste produced from printing onto textiles?

Learning Goals

- Developing practical skills
- Enhancing mastery of DIJ printing technology
- Improving team-work abilities among the scholars

Categories



Sustainability

Textile Surfacing and Printing

Textile Technology

References

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  Tawiah, B., Kofi Howard, E., & Asinyo, B. K. (2016). THE CHEMISTRY OF INKJET INKS FOR DIGITAL TEXTILE PRINTING -REVIEW. BEST Journals, 4(5), 61–78. https://www.researchgate.net/publication/332859751_THE_CHEMISTRY_OF_INKJET_INKS_FOR_DIGITAL_TEXTILE_PRINTING_-REVIEW
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  Yu, J., Seipel, S. & Nierstrasz, V.A. Digital inkjet functionalization of water-repellent textile for smart textile application. J Mater Sci 53, 13216–13229 (2018). https://doi.org/10.1007/s10853-018-2521-z
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Support material

- OER
- Summary presentation

Equipment

DIJ printing machine (DOD)
Photochromic dye ink,
White fabric that is compatible with ink,
UV light

A.

How can we minimize the amount of dyes and material used to give color or function to textiles without producing waste?

1.
Pre-session home reading of related OER and other references [1, 2]

2.
Buzz groups (3 max) activity comparing conventional dyeing and DIJ printing technologies (pros and cons) (20 mins) [3]

3.
Snowballing discussion (2 buzz groups) about the applications and possibilities of using DIJ printing in industry (20 mins) [3]

4.
Use post-it stickers on the board to organize the main ideas that resulted from the discussion

5.
Questions from participants (10 mins)

6.
3-min paper at the end of the session, describing the main points that are learned from this session about DIJ printing in textile industry and its contribution to sustainability

Less than or around an hour

Individual
Small group
Discussion

Develop &
Deliver

B.

How can we print a photochromic logo on a fabric using the minimum amount of materials?

1.
Quick introduction to digital inkjet printing instrument in location and safety measures (10 mins)

2.
Explain the photochromic property of dyes and its applications (10 mins)

3.
Introduce the plain white fabric into the instrument

4.
Insert the logo/pattern to the software of the instrument

5.
Conduct the printing process

6.
Remove sample after printing and apply any further post-treatment

7.
Activate the printed logo via sun or UV-light and observe the changes

8.
Explain the changes that have occurred and how we can customize treatment according to changing the ink used

9.
If instrument is not available in location, use pre-recorded video from HB labs conducting this process

Less than or around an hour

Small Group
Discussion

Develop

EXPAND YOUR KNOWLEDGE ON THE TEXTILE MATERIALS

OER: INTRODUCTION TO TEXTILE MATERIALS AND THEIR INNOVATIVE POSSIBILITIES

Objective & Scope

Based on the information given, expand on some aspects discussed in the OER. This activity allows the students to have a more specific knowledge about some points of the OER. This activity is important to revise the basic knowledge on textile materials that the students have.

Activity Question

What is your knowledge about the activities carried out in the textile production value chain?

Learning Goals

- Information search and filtration
- Synthetize

Categories

Textile Technology

Support material

- OER
- Summary presentation

Equipment

- Computer with internet connection.
- Online free tools such as Miro or Canva.

A.

Information search

1.
Divide the students into small groups.

2.
Each group search information about a specific topic explained on the OER.

Topics:
Coating & laminating, wrinkle free finishing, ultraviolet protection finishing, different printing processes, nonwoven fabrics, different kind of yarns, man-made synthetic fibres, natural fibres.

Less than or around an hour

Small group

Discover

B.

Pitch

This activity is done once the first activity is finished.

The students share the information with the other groups in a one-minute pitch, following the structure of an “elevator pitch”. If they need extra visual support, they can use online free tools such as Miro or Canva.

Less than or around an hour

Discussion

Define

HANDS ON DIGITAL FABRICATION TECHNOLOGIES

OER: NEW FRONTIER FOR TEXTILE. EXPLORING DIGITAL FABRICATION TECHNOLOGIES

Objective & Scope

The framework of technological access first, and the vision of design results related to digital technologies later, allow to envision the latent possibilities that may find space even in industrial applications, if properly grasped and scaled. Therefore, the activity has as its objective the conception and prototyping of design solutions that deploy subtractive and additive manufacturing technology for wearables with textile components (e.g. 3D punch cards, zero waste design, printing on fabric, creating flexible geometries using a rigid material, etc.). The goal of this activity is to nurture creativity in a way that is closely related to experimentation through technology.

Activity Question

How can additive and subtractive digital fabrication technologies be used in textiles to expand existing conceptional and production possibilities?

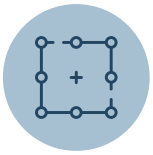
Learning Goals

- Be able to understand how to engage additive and subtractive digital technologies to do experiments with and on textile materials, starting from information and inspirations drawn from case studies.
- Be able to reproduce, produce, and conceive new product and process outputs.
- Be capable of understanding when digital fabrication technologies can be used at experimental or production level.
- Be able to propose and apply new design solutions related to the integration between digital technologies and textile material to develop scalable and sustainable innovations.

Categories

Design Process

Product Design



Advanced Textile Technology

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Support material

- Presentation outline, Data sheets, Technological information sheets
- Optional: material samples
- OER
- Summary presentation

Equipment

Laser cutter, FDM 3D printer(s), PLA/TPU/ABS filaments, synthetics fabrics, paper (for paper patterns and punch cards), threads of different thickness, potential analog or digital components to be integrated (optional)

Output

Vector and/or 3D file(s), study models, prototype, pictures, presentation, short description, short video (optional)

A.

Understanding technologies difference and possibilities

1.
Understanding the peculiarities of laser cutting technology through support materials (presentation and guideline sheets, and material samples, if available) provided by teaching staff

2.
Understanding the peculiarities of 3D printing (with particular attention to FDM technology) through support materials (presentation and guideline sheets) provided by teaching staff

3.
Identify inspirational case studies for both technology categories to support the following synthesis section. Students are asked to do a desk research, and then collectively return a selection of 5 case studies for each technology, selected to critically highlight their strengths.

Around half a day

Large group

Discover & Define

B.

Designing for technologies and experimenting with them

From 3d printing:

1.
Defining whether you want to work with subtractive or additive technology

2.
Choosing the strategy to adopt (use in prototyping or production phase) and the material on which to operate: for subtractive technology fabric, paper, etc; for additive technology fabric+PLA/TPU/ABS/PA, or use of 3D printed parts interconnected to the fabric etc.

3.
Developing the idea and preparing the vector and/or 3D file(s); then evaluating and designing any changes to be carried out to the machinery in the prototype phase, according to the technological constraints.

4.
Piloting and testing.

5.
Final presentation of the results of the trials, through which the objectives achieved, any failures and what has been learned from the testing should be highlighted.

A day or more than a day

Small Group

Develop & Deliver

HOW TO AFFECT THE PRODUCTION PROCESSES

OER: COMMUNICATION PLATFORMS AND CUSTOMIZATION

Objective & Scope

Introduce the participants into a number of technologies that are currently available and can directly affect the production processes. These technologies have been introduced in the corresponding OER.
Identify the development and production processes affected by these technologies.
Understand the potential benefit stemming from their application.

Activity Question

How are the product development and production processes affected by current modern technologies such as Artificial Intelligence, Additive Manufacturing, Augmented Reality, as presented in the OER?

Learning Goals

- Analyse the product development and production processes
- Identify technologies to support operational improvement

Categories

Advanced Textile Technology

Design Process

Business and Marketing

Support material

- Communication platforms and customisation
- OER
- Summary presentation

Equipment

Computer

A.

Analysis of development and production processes

1.
Define groups and ask them to search for products that have made use of the technologies presented in the OER. Each group must choose a different technology, ie. artificial intelligence (AI) or additive manufacturing (AM), or augmented reality (AR).

2.
Analyse the role of the technology and Identify the areas of improvement, in the development or production process.

3.
Present findings in a plenary meeting.

Around half a day

Small Group Discussion

Discover, Define & Develop

B.

Proposed applications and expected results

1.
Present the technologies from OER.

2.
Divide participants in small groups and instruct them to select a product that they are well aware of its development and production process.

3.
Each group must identify areas where the presented technologies could be applied.

4.
Exploit advantages.

Around half a day

Small Group Discussion

Discover, Define, Develop & Deliver

HOW TO CONTRIBUTE IN MAKING A MORE SUSTAINABLE SUPPLY CHAIN PROCESS

OER: VIRTUAL PROTOTYPING AND USED TOOLS

Objective & Scope

The virtual garment, and the Virtual reality penetration of the market, and communication between supplier and manufacturer, are still in their infancy. The objective of this learning activity and the connected OER is to make the students involved get a closer look to the processes and communication of a garment making, between the parties involved, suppliers, manufacturers, designers. The scope of the LA is to bring the trainee up-close with the digitisation of the product and to guide them throughout the process of the supply chain steps which can be digitised, without needing the physical contact with the garment.

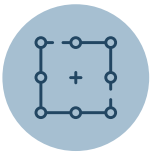
Activity Question

By examining the supply chain process of a garment making, the focus of this activity will be placed on the prototyping stages. How could virtual prototyping be applied to support designing and supplier and manufacturer communication?

Learning Goals

- Developing practical skills in using available databases for creating a digital garment
- Getting acquainted with the scope of virtual prototyping and the tools used for it
- Improving team-work abilities among the scholars

Categories



Advanced Textile Technology

Design Process

Product Design

Support material

- OER
- Summary presentation

Equipment

Computers and CLO3D software (available for trial mode also), any available 3D garment design software

A.

Why do we need to consider VR as a new method to support more sustainable supply chain processes?

Pre-session home reading of OER and other references

1.
Divide into small groups (4 persons max)

2.
Extract from the textile's supply chain model the prototyping stages and find the activities that are followed by the designer, supplier and manufacturer (Theoretical)

3.
If step one does not provide enough information through theory, you can search information from the website of Optitex, Browzwear or other software companies mentioned in the OER.

4.
Ask them questions about their supply chain procedure and more specifically, about the stages where the prototyping of the garment/ textile takes place.

5.
Calculate the amount of time, and if applied, the number of different places that the prototypes need to reach in order for the parties included to reach the final product

6.
List all the activities followed in the prototyping stage

7.
How many of these activities do you think are feasible to be completed via VR?

8.
What is your opinion and what would you suggest for the better communication between supplier/ manufacturer and the company?

9.
Discuss the advantages and disadvantages of the digitisation of the process above in class

Around half a day
A day or more than a day

Small Group Discussion

Discover & Define

B.

In order to visualise the theory above, can you perform a design of a 3D T-shirt and make changes on it?

1. Each group gets acquainted with the used tool for a digital garment (preferably CLO3D)

2. Get the required data for the pattern of a t-shirt

3. In each group, divide the members into roles (supplier, manufacturer, designer, etc.)

4. Roleplaying for making the T-shirt between the parties involved

5. Exchange designs in between parties according to different preferences (roleplaying of samples exchange in the supply chain)

6. Deliver and analyse results – Discuss improvements on the methodology

7. Indicate all the uncertainties that you have encountered. Use them for testing different scenarios

8. Make a roadmap of your results

9. Explore similar analysis and see similar results

10. Discuss the results

Look at the roadmap of your results and discuss different assumptions that you think will indicate the steps in your process. What do you see? What parts of your roadmap have the biggest impacts? What impacts change the most with different assumptions?
Interpreting your roadmap may cause you to rethink your boundaries or functional unit; that's ok, you can redo them and make new roadmap to interpret. Don't expect it to be a linear process.
Use your final assumption to estimate your priorities for a digital design and a digitization of the supply chain prototyping steps. Where should you focus your creative efforts? Where do you need to know more before moving ahead?

Around half a day
A day or more than a day

Individual
Small Group Discussion

Develop & Deliver

IDEATE A NEW PRODUCT/ DESIGN FROM ONE'S OWN VISION

OER: DESIGN THINKING, CREATIVE THINKING, CRITICAL THINKING, ART THINKING: APPLYING A DESIGN LED INNOVATION APPROACH TO THE ADVANCED TEXTILES SECTOR

Objective & Scope

The scope of this learning activity is to get acquainted with the art-thinking approach in order to come with breakthrough oriented possibilities helping students concretely visualize their projects/ideas. The exercise is meant to activate as much as possible the different thinking strategies analysed in the OER in order to generate innovative solutions able to get something new but feasible into the market.

Activity Question

Leveraging on your vision, feelings and experiences what innovative solutions come at your mind in relation to the proposed design challenge?

Learning Goals

- To understand how creative, critical and art thinking work and their interrelationship with design thinking.
- To apply different creative thinking techniques;
- To use art thinking approach to generate radical ideas
- To create a new design / product by applying design led innovation to take weighted decisions and succeed into the market.

Categories

Design Process

Business & Marketing

Product Design

References

- Athuraliya, A. (2021, September). The Ultimate List of Visual Creative Thinking Techniques for Your Next Great Idea. Creately. Retrieved 2021, from https://creately.com/blog/diagrams/creative-thinking-techniques/
- Lebrecht, T. (2016). Art Thinking or The Importance of Inventing Point B. https://medium.com/
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- Whitaker, A. (2016). Art Thinking—How to Carve Out Creative Space in a World of Schedules, Budgets and Bosses (1st ed.). Harper Collins: New York.
- Saso, K. (2017).Mind-set and skills to navigate through today's dynamic and uncertain world. Kyoto University of Art and Design.
- Jacobs,J.(2018).Intersections in Design Thinking and Art Thinking: Towards Interdisciplinary Innovation. Creativity. Theories – Research - Applications, 5(1) 4-25. https://doi.org/10.1515/ctra-2018-0001
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Support material

- OER
- Summary presentation
- Templates for six thinking hats and SCAMPER techniques

Equipment

- Meaningful pictures activating the design challenge
- Post-its
- Poster / Lego blocks / other materials to assembly for the prototype
- Computer

A.

Visualize your own vision taking into consideration the existing gap with the current reality

1.
Define a design challenge related to technical textile new applications and distribute to the students some meaningful pictures

2.
Looking at the pictures students write down on post-it thoughts, feelings, considerations that come from their own life experiences

3.
Each student is asked to identify their "What if..." key questions related to the pre-assignment

4.
Students are put in pair and engaged in peer interviews using the defined questions. Responses are reported on post-it as well

5.
Students will remain in pairs and will organise their post-it using the six thinking hats (template to provide) method

6.
Each pair of students visualise their combined board sketching out one vision

7.
Students are invited to brainstorm "How might we..." questions in relation to their vision in order to see problems that lie within the gap between the current reality and their vision, visualizing possible solutions

Around half a day

Individual
Small Group

Discover & Define

B.

Prototype your vision

1.
Starting from the vision defined during the previous exercise, students are asked to research for existing services / products that could be competing with their own solution ideas

2.
List the features of these competing services / products, split them in different categories and imagine what the world would need in each category in the future (things that could be considered normal in the future but are not part of the current normal yet).

3.
Use SCAMPER technique (template to provide) to help ideate a new product/design. During this phase clearly establish key technical textile aspects i.e.: materials selection; technology; production techniques; functionalities; properties.

4.
Students are asked to prototype their ideas using 2D (i.e. Collage poster) or 3D (i.e. Lego blocks / materials assembly) techniques

5.
Each group will present their work to the others opening a peer discussion

Around half a day

Small Group
Discussion

Develop & Deliver

SIX THINKING HATS

FACTS

What do you already know or need to find out?

BENEFITS

What are the positives, values and benefits?

CAUTIONS

What might go wrong?

FEELINGS

How does it make you feel? Consider fears, likes and dislikes.

CREATIVITY

What are the possibilities and alternatives?

PROCESS

Usually the session leader wears this hat and is responsible for organizing the process.

SCAMPER TECHNIQUE

S	**SUBSTITUTE**
C	**COMBINE**
A	**ADAPT**
M	**MODIFY/ MAGNIFY**
P	**PURPOSE**
E	**ELIMINATE**
R	**REARRANGE/ REVERSE**

INSTEAD OF CREATING, HOW ABOUT RECREATING?

OER: UPCYCLING AND SUSTAINABLE BASED THINKING

Objective & Scope

- Introduce to upcycling and sustainable-based thinking
- Highlight the potentials of waste as resource for new products
- Application of upcycling methods in regard to in-house fashion waste to better understand potentials of waste as a resource within the fashion sector

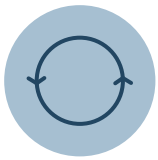
Activity Question

How could your in-house waste become a resource for a new product?

Learning Goals

- Get acquainted with the scope of upcycling
- Develop practical skills for upcycling
- Improving teamwork abilities among the scholars

Categories



Sustainability

Design Process

Product Design

Support material

- OER
- Summary presentation

Equipment

- Personal material (garments, accessories, discarded items, etc.)

A.

Analyzing your Wardrobe and Identifying Waste/ or Non-used items

1.
Choose (or think about) 5 pieces from your garments or textiles or accessories which you do not use anymore, or wish to give away

2.
If needed (and if possible) you can disassemble some of them to get to know them better

3.
Make a checklist of the selected products

4.
Write down all the possible utilities that the selected products have for you

5.
Make a checklist with all the needs these products cover for you

6.
Come together into groups and compare the analysis

Around half a day

Individual
Small Group

Discover &
Define

B.

Upcycling Waste towards new Products

1.
Divide into groups

2.
Each group selects a specific garment, textile or accessory

3.
Discuss and write down the possibilities for reusing the chosen item

4.
Create together a new product based on the chosen item using a design software or other tools

5.
Prepare a PowerPoint presentation

Around half a day
A day or more than a day

Individual
Small Group
Discussion

Develop & Deliver

LOOKING INTO COMPANY'S WORK WITH SUSTAINABILITY IN TEXTILE PRODUCT DESIGN

OER: CONTEXTUALIZING SUSTAINABLE TEXTILE PRODUCT DESIGN

Objective & Scope

The learning activity serves to explore and identify approaches to sustainability in design using the Sustainable Design Cards and Material Pathways as a methodical framing for looking into companies' business models. The learning activity has been motivated by a wish to make students aware of the diversity of directions to take when working with sustainability in design and thereby to be able to understand potentials and limitations in a textile product design context.

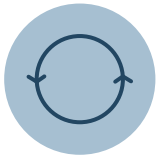
Activity Question

Which approaches to sustainability can be identified for a company and how can these be further developed to support a company's business?

Learning Goals

- Be able to identify approaches and question a company's efforts on sustainability in textile product design
- Be able to propose alternative sustainability approaches to a company's business strategy
- Be able to develop informed sustainable textile product concepts

Categories



Sustainability

Design Process

Product Design

References

- Hasling, K. M., & Ræbild, U. (2021). Using Material Pathways to build Sustainable Material Narratives. Proceedings of the International Conference on Engineering and Product Design Education, Herning, Denmark.
- Hasling, K. M., & Ræbild, U. (2017). Sustainability Cards: Design for Longevity. Proceedings of PLATE 2017 – Product Lifetimes and the Environment, 166–170.
- Ræbild, U., & Hasling, K. M. (2018). Sustainable Design Cards: A Learning Tool for Supporting Sustainable Design Strategies. In K. Niinimäki (Ed.), Sustainable Fashion in a Circular Economy (pp. 128–151). Aalto University.

Support material

- Sustainable Design Cards and Material Pathways, either as printed decks, as PDFs or on the webpages (www.sustainabledesigncards.dk, www. materialpathways.dk)
- Product Lifecycle templates, A3
- OER
- Summary presentation

Equipment

Pencils, board and table

A.

How does a textile product you own relate to sustainability approaches?

As preparation for the learning, students have been provided with the cards, either as printed decks, as PDFs or digitally on the webpage.

Students:

1.
Choose a textile product in your proximity. This can be a garment, furniture or other. The activity is easier if you know the company behind.

2.
Go through the deck and identify relevant approaches. You can do this based on physical examination of the textile product, prior knowledge of the company and desktop research.

3.
Which approaches (max. 3) are the most important? – which ones are secondary?

Tutor:
Ask selected students to present their analysis in class.

Less than or around an hour

Individual

Discover & Define

B.

How do companies within textile product design work with sustainability through design?

For the sub-activity, groups are provided with A3 templates with a product lifecycle.

Students:

1.
Identify a company that makes textile products. This can be a company known for working with sustainability or a company that is not.

2.
Go through the deck and identify relevant approaches for the company. Each group can do this based on prior knowledge of the company and desktop research.

- Which approaches (max. 3) are the most important? Which ones are secondary?
- Where in the product lifecycle are the approaches positioned? (use the provided template)

3.
If the company was to further develop their sustainability endeavors, identify relevant approaches and elaborate why these are relevant and how they could be implemented.

4.
Prepare a short oral presentation (app. 5 minutes) of the company and their sustainability efforts based on the above questions. The presentation can be supported by 3-5 slides.

Tutor:
Have selected groups present their findings for the class.

Around half a day

Small Group Discussion

Discover & Define

C.

How does a textile product you own relate to sustainability approaches?

In the following, it is expected that students have prior experience with the Sustainable Design Cards and Material Pathways.

Students:
Select 2-4 cards and use these to frame a design concept. Dependent on the level of complexity and the time available, the concept can contain one product or be a collection of styles. The design concept can be developed through e.g. moodboarding, sketching and prototyping.

- How are the cards working together and overlapping?
- How are the cards covering different aspects?

Prepare 3-5 slides to support an oral presentation in class

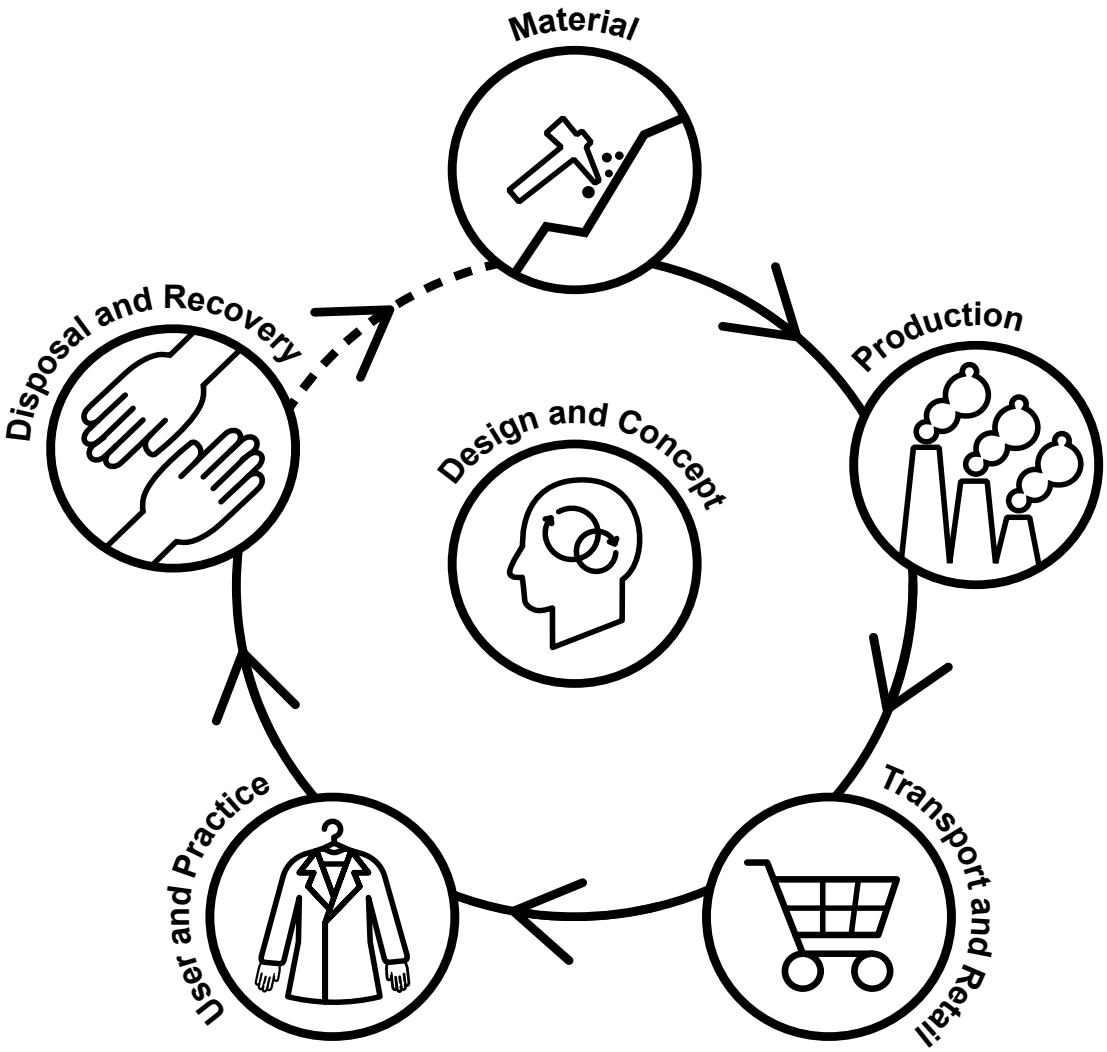
Tutor:
Ask selected group to present their work in class. Allow time for comments and questions from the audience.

A day or more than a day

Small Group Discussion

Develop & Deliver

PRODUCT LIFECYCLE TEMPLATE



MATERIAL MAPPING & SCOUTING

OER: REDUCED ENVIRONMENTAL IMPACT FIBRES

Objective & Scope

In order to reduce the textile industry's environmental impact, a variety of aspects has to be carefully considered and efforts should be aimed at implementing or increasing recycled contents and/or biobased contents from easily and sustainably renewable resources, implementing or improving sorting and recycling technologies and processes. The objective is to select some commercially available textile materials as a sustainable alternative to current (unsustainable) fibres. After the selection there will be a collective discussion on the choices made where students conceptualise and contextualise the materials. Students should explore the meaning of sustainable textiles and, into their normal design process, include the choice of sustainable fibres.

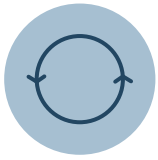
Activity Question

How could you use sustainable textiles in your design process?

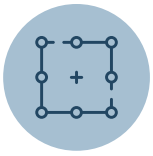
Learning Goals

- Materials mapping: commercially available textile materials, unsustainable
- Material scouting
- Material analysis (physical and performance properties, sustainability, processing)
- Potential application

Categories



Sustainability



Advanced Textile Technology

References

- Material Connexion. (n.d.). Material Connexion. Retrieved 2021, from https://materialconnexion.com/
- Textile Label. (n.d.). Your Europe. Retrieved 2021, from https://europa.eu/youreurope/business/product-requirements/labels-markings/textile-label/index_en.htm
- Circle Economy. (2018). Clothing Labels: Accurate or Not? THE SUSTAINABLE FASHION TOOLKIT. Retrieved 2021, from https://sustainablefashiontoolkit.com/resource/clothing-labels-accurate-or-not/

Support material

- Miro (prepared previously) and Jamboard
- OER
- Summary presentation

Equipment

Computer or tablet

A.

Materials mapping

1. Know what fibers your clothes are made of: Composition claims on labels
This phase aims to show what fibers our clothes are made of. The discussion is collective starting from a board of Miro (prepared previously). Times: 15 minutes
Today, the textile industry is one of the most polluting industries globally and there is increasing awareness of its negative impacts on the environment. Besides generating air pollution throughout the whole value chain, the textile industry is known to be a water intensive sector producing high amounts of polluted wastewater. The volume and composition of the wastewater depend mainly on the used raw material and the textile production process. A way to minimise the environmental footprint of the current textile production, is to reconsider the raw materials used in the first place.

2. Fibres mapping
This phase aims to map the fibres currently applied in textiles products.
The main fibres currently applied in textiles are fossil-based synthetic fibres, followed by cotton fibres. The third largest share of fibres used in the textile industry are the so called man-made cellulosic fibres, which include wood-based textile fibres. Students will be divided into groups (3/4 people) and will use Miro to collect the information.

3. Collective discussion
Several drawbacks of using fossil-based synthetic fibres are nowadays well-known and pushed researchers to look for more sustainable alternatives. This phase aims to introduce the urgency of replacing current unsustainable materials with more sustainable alternative.

Less than or around an hour

Individual Discussion

Define

B.

Material Scouting

1. Scouting of materials (physical or virtual samples)
Research of material (individual activity):
Online research:

Websites
- https://www.itmc2021.com/
- https://asknature.org/?s=&p=0&hFR%5Bpost_type_label%5D%5B0%5D=Innovations&dFR%5Btaxonomies.sector%5D%5B0%5D=Materials%20
- https://web.mit.edu/
- https://www.designboom.com/

Material libraries
- https://www.materialconnexion.online/database/customer/account/login
- https://materialdistrict.com/

Physical research at the Materially Library

2. Analysis and selection of searched materials
1.) Collective discussion on selected materials (entire class, tool: e.g. Miro)

2.)Select the most interesting materials. Selection criteria: sustainability and

3.)Cluster of selected materials into sustainability areas:
- biobased
- biodegradable
- recycled content
- pre or post consumer
- compostable
- waste material content

3. Discussion and potential application
This phase aims to describe one or two applications and prepare a short presentation.

(small groups, tool: e.g. Jamboard, outcome: short presentation)

Less than or around an hour

Individual Small Group Discussion

Develop

MATERIALS SCENARIO

OER: TEXTILE RECYCLING TECHNOLOGIES

Objective & Scope

The objective of this activity is to define a scenario, starting from a research of signals & drivers. The topic of research is the future of textile recycling materials and technologies. The main thing to explore is the material and technological scenarios of the future (10 years from now). This activity can offer the students tools and methods to help with this, it might offer us a new way of seeing the world that we design for. Envisioning sustainability and recycling practices/ visions/aesthetics starting from current trends, to imagine how the world will be and the future of textile recycling materials and technologies.

Signals: A signal of change is anything that is already happening today, that could be a clue to the future. A signal might be a new invention, product, business or behaviour. A signal could be the first successful demonstration of a new technology, or the first major breakdown of an old technology.
Drivers: Drivers are the forces of change that move us toward particular futures. Behind every signal, there is at least one driver. Looking at multiple related signals can help you spot the drivers.
Scenario: A scenario is a specific story set in a future. A scenario describes the future as if it were already real.

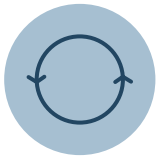
Activity Question

How will be the world of textile recycling materials and technologies in 10 years?

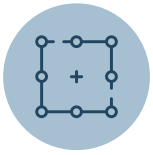
Learning Goals

- Provide students knowledge about advanced textile recycling technologies.
- Search signals and drivers (topic: textile recycling materials and technologies).
- Ability to construct scenarios and make choices to satisfy future goals.

Categories



Sustainability



Advanced Textile Technology

References

- Making the Future with Foresight. (n.d.). Institute for the Future. Retrieved 2021, from https://www.iftf.org/home/

Support material

- OER
- Summary presentation

Platform for emerging technology:
- https://viz.envisioning.io/neuromancer/
- https://techdetector.de/radar
- https://www.envisioning.io

Platform for trends:
- https://www.wgsn.com/en/
- https://www.trendhunter.com/
- https://intelligence.wundermanthompson.com/
- https://projects.qz.com/is/what-happens-next-2/
- https://www.thefuturelaboratory.com/reports
- https://www.homeof2030.com/
- https://futuretodayinstitute.com/ https://futuretodayinstitute.com/trends/
- https://trendwatching.com/

Equipment

Computer or tablet, sheets of paper A2 size, pen, markers, post-it

A.

Textile recycling: materials and technologies: identify signal and drivers

1. Provide students knowledge about advanced textile recycling technologies.
This phase aims are to provide students knowledge about advanced textile recycling technologies. In order to illustrate the state of the art of chemical textile recycling technologies, a selection of case studies of commercially available products and processes has been evaluated.

Small group, tool: e.g. Miro pre-designed board.

2.Research Signals and Drivers
This phase aims are to search signals. The research will focus on advanced textile recycling technologies and materials.

Research of material:
- Online research

*Support material
Small group (4/5 students)

3. Discussion, starting from the signal and drivers researched, on the future of textile technologies and materials (focus on sustainability)
Group (entire class)

Less than or around an hour

Small Group Discussion

Define

B.

Scenario on textile technologies and (textile) materials

1.
Define trends
This phase aims are to define trends starting from signals (defined in the previous activity). Students can use keywords and images to describe trends (1 to 3).
Time: 15 minutes.
Small Group
Tool: Miro

2.
Define scenario
This phase aims are to define scenario starting from signals (defined in the previous activity). Students can use keywords and images to describe.
Time: 30 minutes.
Small Group
Tool: Miro

3.
Discussion
Discussion, starting from the scenarios, on the future of textile technologies and materials (focus on sustainability).
Time: 10 minutes. Group (entire class)

Less than or around an hour

Small Group Discussion

Develop

PLASMA TREATMENT IN TEXTILE INDUSTRY

OER: PLASMA TREATMENT IN TEXTILE INDUSTRY

Objective & Scope

- Introduce plasma Ecotechnology and its types to scholars
- Highlight the potential of plasma as a dry and resource-efficient method in surface modifications of textiles, the different mechanisms of their interactions and its main applications
- Application of plasma as a dry method to treat textiles by developing modified samples with different properties via plasma treatment to practically apply a theoretical part of related OER

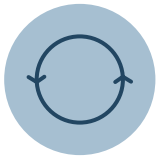
Activity Question

How can we contribute to sustainability in textile industry via plasma?

Learning Goals

- Developing practical skills
- Improving team-work abilities among the scholars
- Developing scientific reasoning abilities

Categories



Sustainability

Textile Technology

Textile Surfacing and Printing

References

- Quiz Maker. (n.d.). Quiz Maker. Retrieved 2021, from https://www.quiz-maker.com/

Support material

- OER
- Summary presentation

Equipment

- Plasma instrument
- Polyester textile
- Pipette for water drop test

A.

How can we change the properties of textile surface with no water or chemicals via plasma?

1.
Pre-session: home reading of related OER

2.
Conduct a quiz online [1] (20 mins)

3.
Discussion in groups of 4 about the answers of the quiz (20 mins)

4.
Questions from participants (10 mins)

5.
3-min paper at the end of the session, describing the main points that are learned from this session about plasma in textile industry and its contribution to sustainability

Less than or around an hour

Individual Small Group Discussion

Discover & Define

B.

How can we make hydrophilic polyester fabric with no added chemicals and no waste?

1.
Quick introduction to plasma instrument in location and safety measures (10 mins)

2.
Explain the hydrophobic property of polyester and the mechanism to modify it (10 mins)

3.
Put water droplet on fabric to show lack of absorbency

4.
Introduce the sample into the plasma instrument and adjust the setting and gas used (proposed atmospheric /O2 plasma)

5.
Apply the treatment for 5 mins

6.
Remove sample from treatment chamber

7.
Put water droplet on the treated sample to show the changes in wettability

8.
Explain the changes that have occurred and how we can customize treatment according to required result

9.
If instrument is not available in location, use pre-recorded video from HB labs conducting this process

Less than or around an hour

Small Group Discussion

Develop

PUTTING SCALING TEXTILES INTO PRACTICE

OER: SCALING TEXTILES

Objective & Scope

While the OER through de-contextualisation aims to provide students with a better understanding of textile techniques, their aesthetic expressions, structural properties and application possibilities, the students apply this knowledgein the learning activity within a specific context of application: Furniture design–developing a design of a chair.

Activity Question

How could the logics of weaving become a central design parameter of a chair?

Learning Goals

- Be able to understand textile properties, techniques and logics and how the interplay of these influence the conceptualisation of and design with textiles, combining function, form and aesthetic expression
- Be able to understand the potentials and limitations of textile logic within furniture design
- Transfer textile concepts, procedures and methods to a specific context of use: furnituredesign-developing a design of a chair
- Be able to analyse a textile structure and to transfer textile logics to another material or scale
- Be able to analyse a textile structure and to transfer textile logics to another material or scale
- Learn how to transfer doing and thinking from one discipline to another to foster cross-disciplinary cooperation

Categories

Textile Technology

Product Design

References

For how textile thinking and making has inspired practioners and theorists beyond the textile field, e.g. architects, engineers, material scientists and artists:

- Garcia, M. (2006). Architecture + Textiles = Architextiles, Architectural Design, 76 (6), pp. 5–11.
- Quinn, B. (2010). Textile Futures: Fashion, Design and Technology. Berg Publishers, pp. 184-200.

A case on how textile techniques have inspired architects:

- Ramsgaard Thomsen, M.; Bech, K. & Sigurðardóttir; K. (2012). Textile Logics in a Digital Architecture.eCAADe 30 -Volume 2 -New Design

Support material

- OER
- Summary presentation

Equipment

- Laptop with access to a drawing program, such as Rhino and Adobe Illustrator
- Tools and materials for modelmaking

A.

How have the logics of textile inspired others within furniture and interior design?

We advise this activity to be done in groups of 2-4 students

1. Pre-session: home reading of the corresponding OER and literature. See References and Support Material

2. Identify inspirational cases to support the synthesis section. Students are asked to do a desk research, and then collectively return a selection of minimum 6 case studies of textile logics (weaving, braiding, knitting etc.) and their strength in terms of functionality and aesthetics.

3. Plenary presentations of cases and feedback

Less than or around an hour

Small group Discussion

Discover & Define

B.

Imagine a woven chair. How can the logics of one of the weave bindings from the OER be operationalised in the design of a chair?

We advise this activity to be done in groups of 2-4 students

1. Choose one of the three weaving techniques (plain/ panama or twill weave) for your design.

2. Develop a chair design using the chosen weaving technique.
When developing your design, consider what kind of surface qualities you would like to achieve.
Consider its:

- Openness/closeness
- Density/transparency
- Thickness
- Visual qualities and associations

Consider also its tactile experience by means of e.g.:

- Softness/hardness
- Strength/fragility
- Tactile qualities and associations

Finally consider whether the chair has a supporting sub-structure such as the Bertjan Pot design of the Big String Sofa (Quinn, B. (2010). Textile Futures –fashion, design and technology: Berg Publishers, p. 189) or whether the textile becomes “tectonic”, merging surface and supporting structure, such as in Marcel Wanders designs KnottedChair and Fishnet chair (Quinn, B. (2010). Textile Futures –fashion, design and technology: Berg Publishers, pp. 185-6).

3. Develop your design through drawings and models (scaled models, 3D and 2D drawings, sketches and 1:1 proto-types of textile structures)

A day or more than a day

Small group Discussion

Develop & Deliver

STORYTELLING FOR UNDERSTANDING THE USER

OER: STORYTELLING FOR UNDERSTANDING THE USER

Objective & Scope

In any research phase of a design process is essential to implement speciffic tools that allow a deeper understanding of the potential users, trought strategies of representation and visualization that will impact directly in the user experience with the product or service.
The Persona Map i s a fictional character created to represent a user or customer type. The persona puts a potential new solution (e.g. a website, a brand, a product, or a service) into the context of the respective needs and the jobs to be done. A User or Customer Journey Map provides a representation, vivid visualization and a structured storytelling of how the user experiences interact with a product or service through a specific journey. The resulting map is a visual depiction of what users need and what steps they take to fulfill those needs as they interact with a product.

Activity Question

Do you know your user and how he interacts with a product or service?

Learning Goals

- Be able to use stories to communicate and connect emotionally with stakeholders and users while working collaboratively within multidisciplinary teams.
- Be able to craft stories for research, empathize with people needs, ideate scenarios, and prototype solutions.
- Be able to communicate with empathy and create impact.
- Be able to apply critical thinking to map out key information and solve problems creatively.

Categories

Design Process

References

- Lewrick M., Link P., Leifer L. (2020). The Design Thinking Toolbox: A guide to Mastering the Most popular and Valuable Innovation Methods. Hoboken, New Jersey. John Wiley & Sons, Inc.
- Still B, Crane K. (2016). Fundamentals of User-Centered Design: A Practical Approach. Taylor & Francis Group.

Support material

- A Persona Map template or a structure drawn in a whiteboard or flipchart
- A completed Journey Map
- OER
- Summary presentation

Equipment

- Sticky notes, post-its, pens and markers.
- Photos from observations of potential users in their natural environment.
- Pens and colour markers.
- Large wall or whiteboard where to hang up and display all the pictures, persona map and Journey Map template

A.

PERSONA MAP

The Persona Map is a fictional character created to represent a user or customer type. The persona puts a potential new solution (e.g. a website, a brand, a product, or a service) into the context of the respective needs and the jobs to be done.

Step 1: Persona description
Describe the persona. Start by giving the persona a name, gender and age. Add additional demographic information such as social milieu, family, hobbies and general interests.

Step 2: Persona visualization
Visualize the user "character" with a drawing, sketch, photo, a mood-board or a collage composition made with magazine clippings and images. Represent it visually in order to know how it looks.

Step 3: User tasks /jobs to be done
Identify the user's tasks and jobs the user does and think where can he/she be helped?

Step 4: Use cases
Describe all use cases in the context of the design challenge and problem statement (Where? What? How?). Where does the user makes use of our innovation offering? What happens before and after? How does s/he do it and interact?

Step 5: Problems /Pains
Empathize with the persona "character", put in his/her shoes and recognize what are the biggest difficulties and problems the user has. They can be unsolved problems or difficulties the user has with existing products and offers.

Step 6: Gains
Now determine the gains that are the possibilities and benefits the user might deserve to obtain in order to overcome the previous pain and problem.

Step 7: Influencers
Identify who are the key persons who have the influence on the user persona, like family members, friends, stakeholders, work colleagues or even public personalities. They can all impact users' behavior.

Step 8: Trends
Define current mega trends, market trends, environmental, technology or social trends that can impact and influence the persona.

Step 9: Final Discussion & analysis of the work.

Less than or around an hour

Small group Discussion

Discover

B.

CUSTOMER JOURNEY MAP

The Journey Map will help to specify user requirements or user goals that must be met for the product to be successful. A User or Customer Journey Map provides a representation, vivid visualization and a structured storytelling of how the user experiences interacting with a product or service through a specific journey.

Step 1: Persona and user profile
Identify a persona for whom the journey will be created. Share the story of the persona with the design team. Use the key information displayed at the Persona Map to create a compelling storytelling.
Step 2: Experience Scenario
Describe the scenario where the experience takes place or the job to be done. What does the persona do and what is the context? It can be an end-to-end experience or a specific part of it.
Step 3: Timeline and stages
Define at least 5 moments in the journey. That includes what happens BEFORE, DURING, and AFTER the actual experience to be sure that the most important steps are included. Take into consideration the following questions: What is the time span? What is the step-by-step experience? How much time has passed in the journey?

Step 4: Touchpoints
Identify the physical touch points where users interact with the product or service. These can be from personal face to face contact between individuals, to virtual interactions with a website or physical application of the product.
Step 5: Interactions Storytelling
Describe which actions and stories take place on each stage and which interaction should be assigned where and how. Include in the story what the user thinks while the persona is interacting. Discuss or brainstorm, within the group and map them out on post-its.
Step 6: User Emotion and satisfaction
What is the user mood at every interaction? Are they happy, frustrated, angry? Capture the emotional status with glue dots or emoticons.
Step 7: Opportunities
Identify potential areas of improvement by analysing each stage's stories.
Step 8: Area of responsibility/process owner
Define the people responsible for the action / process within the organization. As a result of previous steps, a customer journey mapping activity should provide a high-level overview of all activities and factors that influence the user experience.
Step 9: Final Discussion & analysis of the work

Less than or around an hour

Small group Discussion

Discover

TECHNOLOGICAL WATCH: HOW TO DO TECHNOLOGICAL WATCH, TOOLS AND REFERENCES ON ADVANCED TEXTILE MATERIALS

OER: TECHNOLOGICAL WATCH: HOW TO DO TECHNOLOGICAL WATCH, TOOLS AND REFERENCES ON ADVANCED TEXTILE MATERIALS

Objective & Scope

Technological watch is the process of capturing, analyzing and disseminating information related to a specific technology area. It can support a company's competitive intelligence team in achieving key business goals and gain a distinctive advantage. Do a small practice about technological watch, understanding the process from within. Share the results with the group, give the information found to the other students (all can learn about their particular research). Practice in making summaries and explaining important information in a short time.

Activity Question

How does a technological watch process work? How would you prepare an example of a technological watch process, in a small scale?

Learning Goals

- Information search and filtration
- Synthetize

Categories

Business and Marketing

Product Design

Support material

- OER
- Summary presentation

Equipment

- Computer with internet access
- Free online digital tools, e.g. Canva o Miro

A.

Smart textiles technological watch practice

Regarding a specific topic related to smart textiles, search information about it (activity that focus) and share it to the group (activity that resumes). The topic the students must work in is smart textiles monitoring.

1.
The lecturer announces the topic.

2.
The students are divided in groups, and each one choose a country.

3.
All the groups search information about the topic in the patent database (links at the OER PDF). They must find the main authors that work in this field, companies, and concrete applications for a specific country (aprox 1h 30min).

4.
Each group prepare a summary with the information they have found (aprox. 45min).

Around half a day

Small group

Discover

B.

Pitch about the results on technological watch

Once the students have finished the first activity, they explain what they have found to the other groups in one minute, using the “elevator pitch” strategy.

In order to present the findings, a free online digital tool such as Canva or Miro can be used.

Less than or around an hour

Discussion

Define

TINKERING WITH AND FOR BIO AND SMART TEXTILES: PRODUCE AND EXPLORE A BIO-YARN

OER: TINKERING WITH AND FOR ADVANCED TEXTILES. MATERIAL TINKERING AS A SOURCE FOR THE CREATIVE PRACTICE

Objective & Scope

Material tinkering is an informal way of learning based on creative and experimental manipulation of material ingredients and processes. It aims to explore (novel) materials from a performative and expressive-sensorial standpoint (tinkering with materials) and understand design opportunities developing further versions of the material (tinkering for materials).

The proposed exercise aims to experiment with and develop a Do-It-Yourself bio-based yarn made of sodium alginate and calcium chloride, as an alternative organic and biodegradable material for textile in clothing or other applications coming from renewable resources. Smart and conductive materials can be added in the process. In addition, the activity focuses on acquiring sensory sensitivity by exploring the qualities and characteristics of the resulting resources through senses, e.g., visual and tactile exploration.

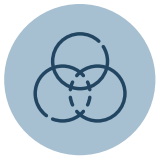
Activity Question

Which qualities can we obtain applying experimental and low-tech material tinkering to basic bio-based ingredients for a more sustainable textile design?

Learning Goals

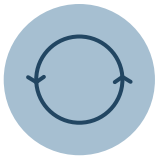
- Learn how to put in practice Material Tinkering for textiles and fibres' exploration and development
- Be able to practice sensorial and performative understanding and description of material qualities
- Learn alternative and creative approaches to materials exploration and development (Material Tinkering) allowing to discover and valorise unconventional bio-based and smart resources for textile.

Categories



Design Process

Smart Textiles



Sustainability

References

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- Create Bio-yarn. (n.d.). Instructables Craft. Retrieved 2021, from https://www.instructables.com/Create-Bio-yarn/
- Bogers, L. (2020). ALGINATE STRINGS. Textile Academy. Retrieved 2021, from https://class.textile-academy.org/2020/loes.bogers/files/recipes/alginatestring/

Support material

- Step by step instruction and recipes + references for inspiration
- Canvas as a support for sensorial exploration (see visual below, inspired by Elvin Karana's sensory scale, 2009)
- Tangible logbook and stationery (owned by the students) or virtual logbook on student's laptop
- **OER**
- **Summary presentation**

Equipment

- Ingredients: sodium alginate, calcium chloride, chitosan (optional), active charcoal (optional) or smart pigments (e.g., thermochromic) (optional), pigments (spirulina, turmeric, etc.) (optional). Quantity of the ingredients to define.
- Equipment: syringes, bowls or glass jars, knitting needles, scales, spoons.
- About quantities: we will prepare indication for individual experimentation, small group (5 students) in the case of satellite summer school, and big group (20 students) for full on-site summer school.
- Facilities for the presentation and exercise: a projector, teaching staff laptop, university space equipped with tables, seats, wi-fi, electrical outlets.

A.

Tinkering with and for bio and smart textiles: produce and explore a bio-yarn

1.
Introduction: the activity is introduced by teaching staff using a short presentation (summary presentation) (10 minutes)

2.
Tutorial: the teaching staff presents the starting ingredients and demonstrates the process using equipment and ingredients (20 minutes)

3.
Collect tools and ingredients): each group of students (small group 4 students) is given ingredients and equipment: sodium alginate, calcium chloride, chitosan (optional), a syringe, water, bowls or glass jars, knitting needles, active charcoal (optional) or smart pigments (e.g. thermochromic) (optional), pigments (spirulina, turmeric, etc.) (optional), scale, spoon; recipes and references are provided to each team. Students decide how to plan the next step experimentation, e.g. which ingredients to use (15 minutes).

4.
First experiments: iterative approach): 1) Preparation: weight ingredients according to the recipe; mix the ingredients in water to create a solution; 2) Extrude: use the syringe to extrude the solution; 3) Knit: use the knitting needles to create a textile from your bio-yarn. 4) Cure: leave it dry for a few days to cure it and stabilize it. In this phase, the teaching staff is available for feedback and support. Besides curing, one iteration will take approx. 20 minutes.

5.
Document: during the process, document everything about the ingredients, processes, results' qualities and characteristics. Use a logbook, a diary, an abacus, videos, and pictures. Teaching staff will be available to support students struggling with the documentation.

6.
After the first iterations: Use your senses to explore the results from a sensorial and performative standpoint. Do tactile exploration to understand the mechanical characteristics and touch qualities of the resource (e.g., flexibility, weight, tensile strength, texture, etc.). Do visual exploration to understand the visual qualities of the resource (e.g., translucency, colours, patterns, etc.). Explore the materials even with other senses, e.g. olfactory qualities. A 'scale' tool can be used to support the activity. Ask: What is their potentials for the textile sector? This activity can be performed anytime to explore results of the following activities. Teaching staff will be available to facilitate this activity.

7.
Experiment and Tinker (iterative approach): in any phase, experiment with the ingredients or the process and create different variation starting from a basic recipe. In this phase, the teaching staff is available for feedback and support.

8.
Search for other resources (Optional):
1) make field research: explore your proximate surrounding environment (your home, your school, your district), searching for potential alternative resources (focusing on fibres, powders and inks) to be used or re-used in combination with the bio-yarn. They can be organic or synthetic material resources coming from waste, vegetables and fruits peels, etc.
2) Collect those resources and tinker with them adding them to the bio-yarn

9.
Discussion. Discussion about the results to share ideas and opinions and see the different variations and experimenta-tions. This phase can be done at the end or in intermediate phases (for example right after 5). Teaching staff will facilitate the discussion.

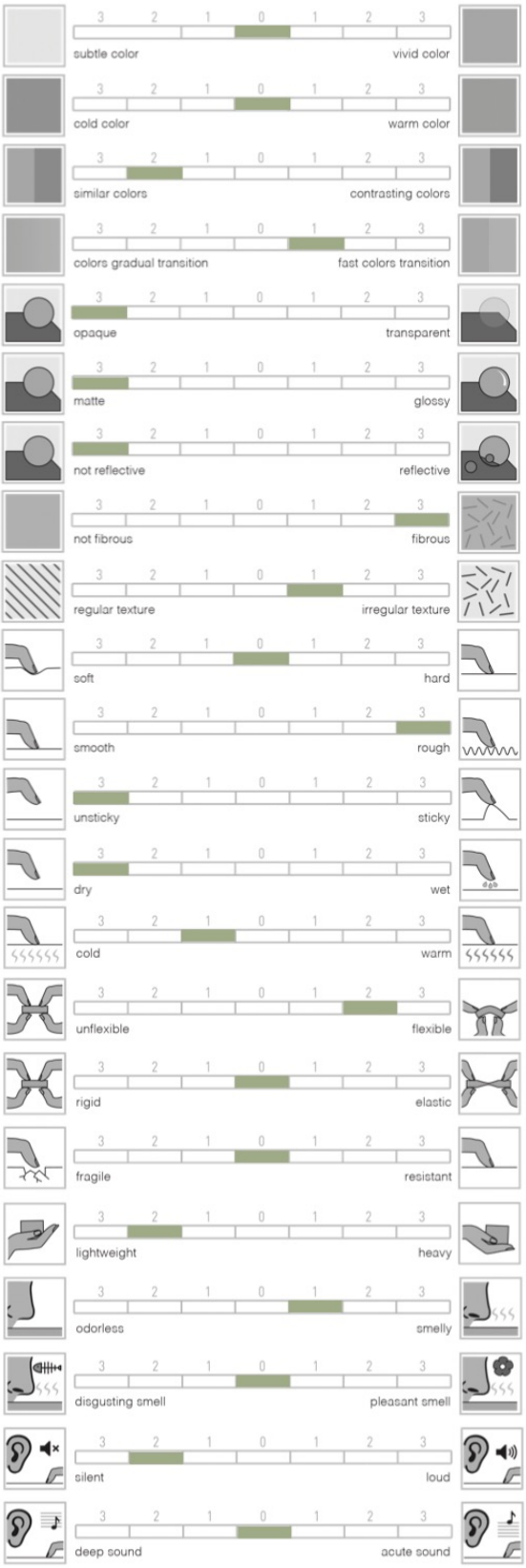
10.
As a further step of the activity, you can observe how the material vary change time

Around half a day
A day or more than a day

Small group
Discussion

Discover, Define
& Develop

SUPPORT FOR SENSORIAL EXPLORATION (AFTER KARANA'S SENSORY SCALE, 2009)



GLASS NOODLE
15% Sodium Alginate
$NaC_6H_7O_6$
20% Calcium Chloride
CACl

Ø 3mm, l. 3.60m, w. 40gr

THERMOCROMIC INK NOODLE
20% Sodium Alginate $NaC_6H_7O_6$
20% Calcium Chloride $CACl_2$
1,5g Sweet Paprika Powder

Ø 5mm, l. 1.90m, w. 35gr

RIBES TEA & PAPRIKA NOODLE
15% Sodium Alginate $NaC_6H_7O_6$
20% Calcium Chloride $CACl_2$
1,5g Sweet Paprika Powder

Ø 3mm, l. 3.07m, w. 54gr

CONDUCTIVE NOODLE
15% Sodium Alginate $NaC_6H_7O_6$
20% Calcium Chloride $CACl_2$
15g Active Carbon

Ø 3mm, l. 3.30m, w. 40gr, r. 150-200 Ω

TOOLKIT (MATERIALS)

OER: SPECIALTY TEXTILE PRODUCTS

Objective & Scope

The objective is to select specialty textile products, and design a toolkit for future designers. The main aim is to transfer knowledge about specialty textile products. The creation of a toolkit presenting several materials as case study to explain the speciality textile products. During the creation of the toolkits the designers will learn to select and know the most interesting materials. The aim of these material kits is to be used as a tool to facilitate the understanding and application potentials of textile products. The toolkit is a collection of material samples illustrating their physical properties, technical features and possible application areas through descriptive datasheets, graphs etc. This activity can offer students tools and methods to develop toolkits that will support designers.

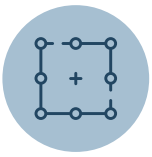
Activity Question

What are the physical properties, technical features and possible application areas of specialty textile products?

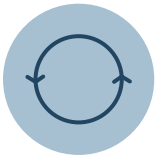
Learning Goals

- Scouting of speciality textile products (empower, connect, shape)
- Discussion on the selected materials
- Mapping and selection of the most interesting material categories, understanding the technological and commercial advantages of specialty textiles
- Awareness of the broadness of the application potentials of textile materials

Categories



Advanced Textile Technology



Sustainability

References

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- IDEO. (n.d.). Toolkit. Retrieved 2021, from https://www.ideo.com/search?q=toolkit
- Understanding emerging materials and technologies: the Datemats EM&T toolkit. (2020, September). Datemats. Retrieved 2021, from https://www.datemats.eu/2020/09/28/understanding-emerging-materials-and-technologies-the-datemats-emt-toolkit-version-1/

Support material

- Miro and Jamboard
- OER
- Summary presentation

Equipment

- Computer or tablet

A.

Scouting of materials (materials toolkit)

1.
Scouting of materials (physical or virtual samples)

Research of material:
- Online research

Websites, e.g.:
- https://www.itmc2021.com/
- https://asknature.org
- https://web.mit.edu/
- https://www.designboom.com/

Material libraries:
- https://www.materialconnexion.online
- https://materialdistrict.com/

Physical research at the Materially Library

2.
Selection of materials
- Collective discussion on selected materials
- Select the most interesting materials. Selection criteria: advanced technology, sustainability, level of innovation
- Cluster of selected materials into areas (tools: MIRO https://miro.com/login/)

3.
Case study research
Search for other toolkits like:
- https://www.datemats.eu/resources/#oer (Report of the EM&T transfer toolkit version 1: pilot materials boxes)
- http://materialsexperiencelab.com/ma2e4-toolkit-experiential-characterization-of-materials
- https://www.ideo.com/post/design-kit

Around half a day

Small Group Discussion

Discover

B.

Design toolkit (materials toolkit)

1.
Design toolkit (materials toolkit)
Students will be divided into groups. This phase aims to generate ideas, using brain-storming.
Tool: Miro.

2.
Concept
This phase aims to develop one or two concept and prepare a short presentation (1/2 slides for each concept). Within the presentation there will be sketches, key words and descriptive texts.
Tool: Jamboard.

3.
Usage guidelines
This phase aims to develop guidelines for using the toolkits: descriptive datasheets, graphs etc.
Tools: Jamboard or Miro.

Less than or around an hour

Small Group Discussion

Develop

VISUAL THINKING TO FIND BUSINESS OPPORTUNITIES

OER: VISUAL THINKING TO FIND BUSINESS OPPORTUNITIES

Objective & Scope

Trough Visual Thinking principles and techniques is possible to map-out ideas and explore solutions. Working creatively with visual representation tools and methodologies help designers to visualize, explore, identify and materialize business opportunities for textile innovations and beyond.
The Context analysis map has the goal of bringing information, awareness and knowledge that allows an organization or group to make decisions of a business idea. Materializing and implementing business opportunities implies bringing ideas into action through a business plan. The Business Model Canvas is a visual tool that structures the key information that should be considered for describing, analysing and designing business models.

Activity Question

Do you understand the context of your business/idea?
Do you know the necessary steps and actors to make it work?

Learning Goals

- Ability to communicate and express business ideas visually with simple sketches and drawing gestures.
- Develop visual meetings with visual tools such as templates and sticky notes to work business challenges and solve problems creatively in a structured way.
- Learn creative and innovative ways to envision new business opportunities.
- Acquire critical thinking and problem-solving abilities through visualizations.

Categories

Business and Marketing

Design Process

References

- Arnheim, R. (1969/1997): Visual Thinking. University of California Press.
- IDEO (2009). Human Centered Design: Toolkit & Human Centered Design: Field Guide. 2nd ed.

Support material

- Context Analysis Map template
- Business Model Canvas template
- OER
- Summary presentation

Equipment

- Black and color markers with different line weights.
- White papers, squared paper or sketchbooks
- Drawing templates
- Sticky notes, post-its, pens and markers
- Movable walls or whiteboard where to stick up and display all the material
- All collection of documents and material that is related to internal and external environment analysis (i.e. news clippings, photos of possible customers, trend reports, competitor's websites, industry statistics, regulations, industry magazines, etc.)
- A tablet (optional)

A.

CONTEXT ANALYSIS MAP

Finding business opportunities starts with observing and understanding business context. The Context Analysis Maphelps to study the context and analyse it by visualizing and mapping out the business design space with key specific and general environment factors to take into consideration.

Step 1. Visualize your business idea
Let's think about a business idea that will be placed in the center of the template. If you are working within a project that is developing an innovation offering within your industry, this effort can become a business opportunity. If you don't have a business idea yet, think about the latest trends, challenges, or a problem that you will love to solve with all your passion.

Step 2: Explore the General Environment
External environment refers to forces and Image institutions outside the organisation that potentially affects the organization's performance and decision making. Those factors are: Political, Environmental, Social, Technological, Legal and Economic.

Task 1: Write down on a sticky note: environmental and ecological trends or aspects such as doing business ethical as an ethical and sustainable company, carbon footprint, climate change or any environmental restriction and regulation that can affect your industry or have an impact on your innovation offering.

Task 2: Repeating the same procedure, continue with demographic trends of society. Social norms and pressures are key to determining consumer behaviour. Factors to be considered are: Cultural Aspects & Perception/ Health Consciousness/ Population Growth Rates/ Age Distribution/ Income Distribution. Evaluate if there is any inspiration or a new insight about who you want to consider as a potential client? Discuss with your peers.

Task 3: Continue mapping the general environment by identifying Technological Trends and International Influences as part of Technological factors analysis. These factors are related to innovations and industry automation. In addition, it includes the following: R&D Activity/Automation/ Technological Incentives/ Tech Transfer.Think about technological factors as a resource for innovation and new business opportunities.

Task 4: Following the template order, analyse Legal Factors that include any legal forces that define what a business can or cannot do, such as the following: Industry Regulations/ Regional Laws/ Licenses and Permits/ Intellectual Property. Interpret how local laws and regulation impact your innovation offering. How are they impacting? By bringing new opportunities or create constraints to new business ideas?

Task 5: Interpret Economic Factors to find opportunities that boost business ideas. Write down on sticky notes the various economic indicators that can generate tangible data. Economic Factors include the following: Economic Growth Rates/ Interest Rates/ Exchange Rates/ Inflation/ Unemployment Rates. Evaluate if your new business idea can be purchased by your consumers or could possibly change demand/supply models in the economy. This information will also affect the pricing process for new products and services.

Task 6: Political Factors sometimes intersect with Legal Factors. These factors are related to how government policy and actions impact the economy and affect business. These include: Government Stability/ Tax Policy/ Trade restrictions/ Tariffs/ Bureaucracy. Similar to other factors, evaluate if there are policies that can impact negatively any business operation or new business launching.
Now that General Environment Analysis is completed, take a moment and discuss the general picture with your peers.

Step 3: Evaluate the Specific Environment for your business idea
Specific Environment Analysis helps to study how an innovation offering that exist or could exist perform in the market and take into account elements such as existing or potential clients, suppliers and competitors.

Task 1: Taking into account your initial business idea or innovation offering, involve team members to discuss and define who are the potential clients, customers or buyers in your industry. Write it down on a sticky note, and, if you feel confident, represent it with a drawing. Ask how much control customers have in dictating the kinds of products and services available in the industry. How much influence do customers have in pricing or other attributes of the offering?

Task 2: Investigate who are or who can be your competitors. Is there another entrepreneur or company who has the same or similar innovation offering? How many competitors did you estimate? Search through their websites and investigate how they present their innovation offering to potential customers. Display key information on template.

Task 3: Think about who are key suppliers in your industry. How does your business idea need or will need their services and strategic partnership to deliver your innovation offering? How much control do suppliers have in determining the kinds of products and services the industry produces? Write down your findings. Take a general overview to your Context Analysis Map.

Evaluate your innovation offering, reframe the initial business idea statement, if needed, or think about what are the innovative business opportunities you have and the new role you want to play as an entrepreneur or organisation.

Less than or around an hour

Small Group Discussion

Define

B.

BUSINESS MODEL CANVAS

Materializing and implementing business opportunities implies bringing ideas into action through a business plan. In order to simplify this process, the Business Model Canvas is a visual tool that structures the key information that should be taken into account for describing, analysing and designing business models.

The 4 main questions will help to link up the building blocks in a way that we can consider simultaneously what is your value proposition, for whom are you designing and preparing an innovation offering, how are you going to produce it, and how much will it cost in order to get revenue streams and make money.

Step 1: Customer Segments
List the top three segments. Look for the segments that provide the most revenue. For whom are you creating value? Who are your most important customers?

Step 2: Value Proposition
What value do you deliver to the customer? What are your products and services? What is the job you get done for your customer? Which problem are you solving with your business idea solution or innovation offering? Which customer needs are you satisfying?

Step 3: Customer Relationships
How does this show up and how do you maintain the relationship? How are they integrated into the rest of your business model?

Step 4: Channels
How do you communicate with your customer? How do you deliver the value proposition? How are your channels integrated?

Channel phases are:
1) Awareness is related to how to raise awareness about your products and services;
2) Evaluation means how you help customers evaluate your value proposition;
3) Purchase is how your customers purchase your products;
4) Delivery is how do you deliver your value proposition and
5) After sales is how you provide post-purchase customer support.

Step 5: Key Activities
Think about what you will need to do on a daily basis to run your business model. What key activities does your value proposition require? And your Distribution Channels, Customer Relationships, and Revenue Streams?

Step 6: Key Resources
List all the assets that can be required to offer and deliver your value proposal. List the people, knowledge and money that you will need as part of your business. Include, if necessary, intellectual resources, such as brand patents, copyrights and key data.

Step 7: Key Partners
List the partners that you can't do business without. Some motivations for partnerships are: 1) Optimization and economy, 2) Reduction of risk and uncertainty and 3) The acquisition of particular resources and activities

Step 8: Cost Structure
List your top costs by looking at key activities and resources.

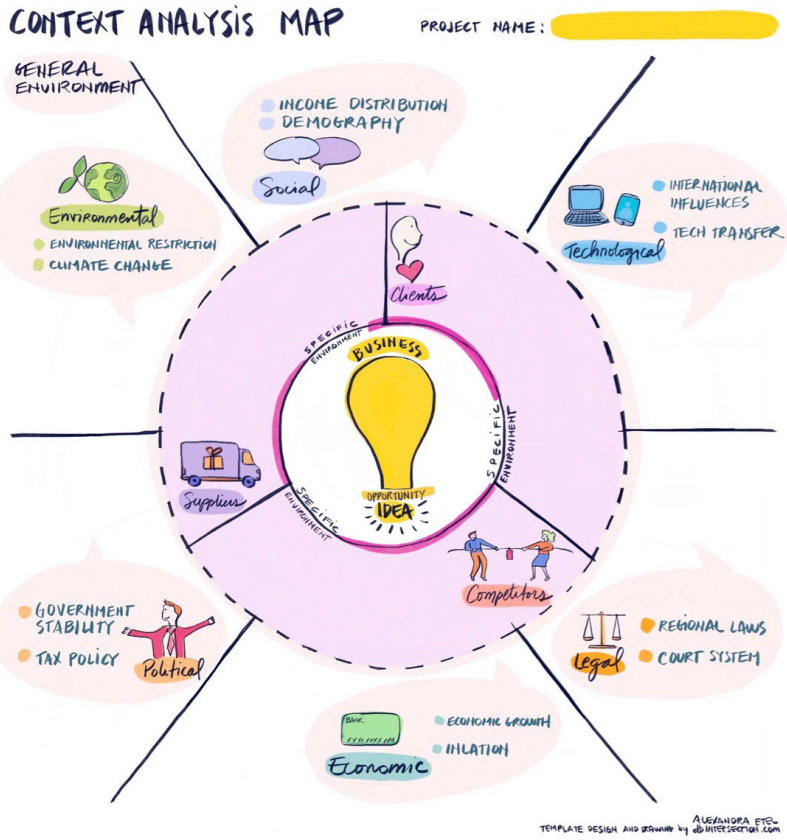
Step 9: Revenue Streams
Indicate your top three revenue streams. If you do things for free add them here too. To conclude, the canvas's main objective is to help companies and entrepreneurs move beyond product-centric thinking towards business model thinking.

Less than or around an hour

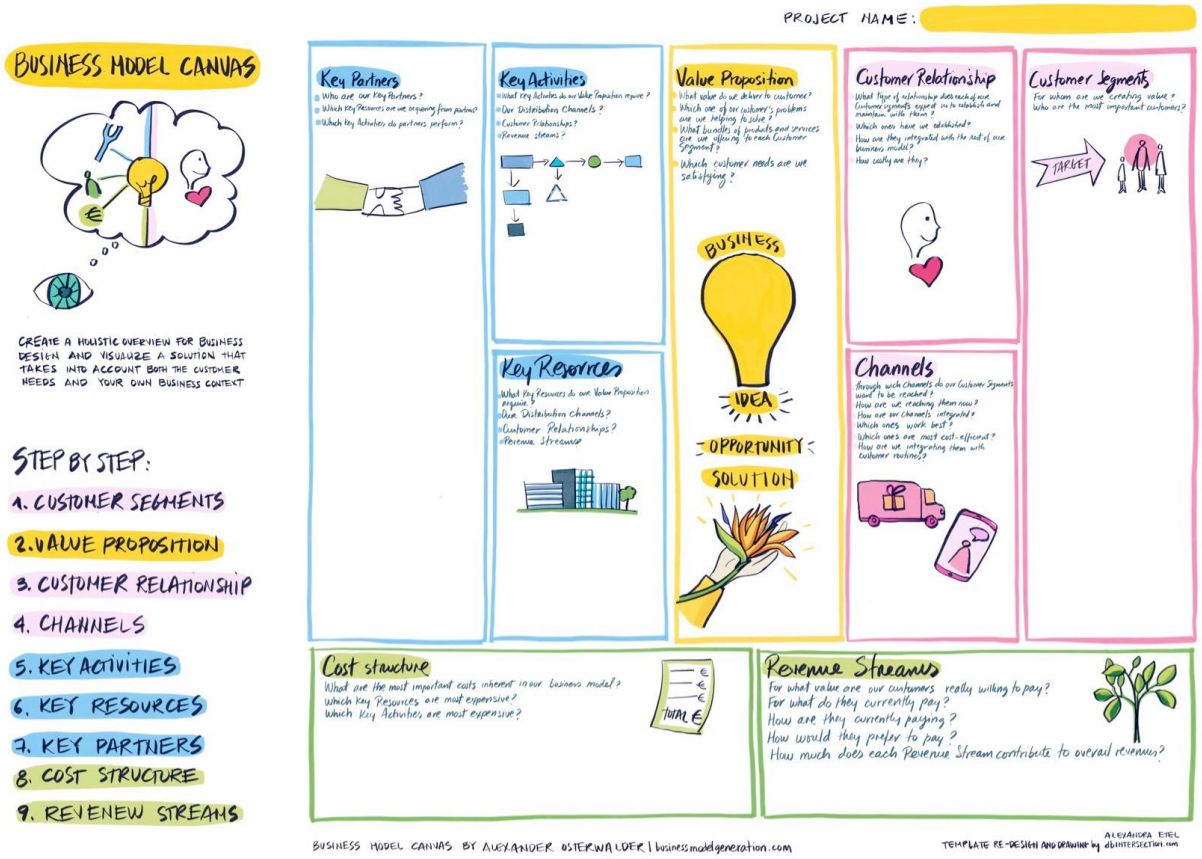
Small Group Discussion

Define

TEMPLATE: CONTEXT ANALYSIS MAP



TEMPLATE: BUSINESS MODEL CANVAS



WEARABLE TEXTILE SYSTEM. DESIGN LAYERED INTELLIGENT MATERIALS

OER: WEARABLE TEXTILE SYSTEM. DESIGN LAYERED INTELLIGENT MATERIALS

Objective & Scope

Placed in between the digital and human world wearables have the potentialities to change the way we live and interact with each other's thanks to the enhanced functionality of sensing, reacting, and/or adapting to stimuli in the environments to which they are exposed.
Wearables fall in many different categories: glasses, jewellers, headgear, belts, arm wear, wrist wear, leg wear and footwear are taking on new forms and functions but also skin patches and e-textiles.
Understanding where and how to place electronics/hard components by incorporating the 'wearer' into the design. Design a Wearable textile systems exploiting smart textile in the field of sports. Wearable a technology deal with systems worn as unobtrusively as clothing. As such, wearables further effect the person's interaction with the world and his interaction with his own body. If the wearable won't be in accordance with wearer's needs, it will not be an ideal solution to be worn.

Activity Question

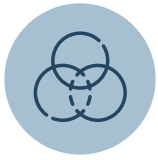
How can we design more human friendly interfaces and products around the body using smart textile?

Learning Goals

- Understand where to place the wearable shape and the unobtrusive shapes.
- Shape smart textile into a clothing/wearable by considering user perspective.
- Design smart "wearable" textiles using a layered system material as platform that embraces the electronics features.

Categories

Smart Textiles



Design Process

Product Design

Textile Technology

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Support material

- Material samples
- If online activity: link with the sources
- OER
- Summary presentation

Equipment

Laptop

A.

Design around the body: The form follows the function

1. Make smart textile research:
build a shared knowledge repository of existing smart textiles but also proof of concept to identify the most relevant features potentialities for your project.

2. Chose the what and the where:
·What: Prevention, Self-motivated, Keeping Fit for Autonomy, Keeping Fit for Thriving, Competition, Self-improvement, Social, Physical Progress
·Where: Motorcycle, Cycling, Running, Hockey, Dancing, Skiing

3. Set the counter brief.
Example: Design a smart shirt device able to detect the he-art rate and sensing the Co2 in the air. The system informs the user about the high heart rate using light; it lights up when there is pollution in the air.

4. Design around the body
Use the langer lines and Wearability parameters to design the item. The Institute for Complex Engineered Systems (ICES) developed a study about this topic, "Design for Wearability", by outlining a design guideline for wearable products. The wearability parameters developed by the ICES are:

- Attachment: the way the different forms are fixed to the body
- Size: cross section variation of human body
- Human movement: the way the form of body changes whit simple motion
- Unobtrusivity: body areas less obtrusive for wearable products
- Body motion: body areas with low movement/flexibility

5. Develop
a prototype (not functional) to verify the correctness of the designed shape

Procedure:
1.
Introduction: the activity is introduced by teaching staff using a short presentation (condensation of OER, 10 slides) – 10 minutes.

2.
Supporting Tool: the teaching staff provide the format for performing the repository – 1 hour activity by the students

3.
The teaching staff will provide a list of possible functionality and context for the perimeter of the project. Based on the activity n°1 each group will decide the what and the where of the project– 15 minutes.

4.
Each group will translate the findings of the repository in a design brief with the support of the teaching staff through reviews. - 30 Minutes

5.
The teaching staff will provide the tools for designing correctly around the body and place the "electronics" in a proper way. The groups will work to the ideation of the project – 4 hours

6.
Provide a presentation with the overall project by providing a prototype (also a dirty mock-up) to prove their project.

7.
Discussion: Discussion about the results to share ideas and opinions and see the different variations and experi-mentations. Teaching staff will facilitate the discussion.

A day or mroe than a day

Small Group Discussion

Discover, Define, Develop & Deliver

TEMPLATE FOR RESEARCH

DESTEX
Summer School

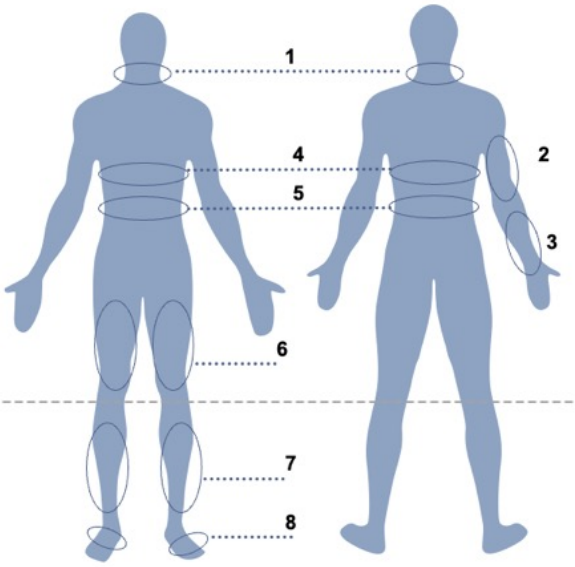
Case study template

Case study (both existing materials and research) *Name:* *Company (if applicable):*	*Website:*
Main description *(Please describe if is a passive or an active smart material)* **Describe the properties** ***Field of Application*** *(if described by the company or into the resource)* ***Main user(s) or item(s)*** *(Please, describe what type of user or items the material is aimed at)* Sources used:	

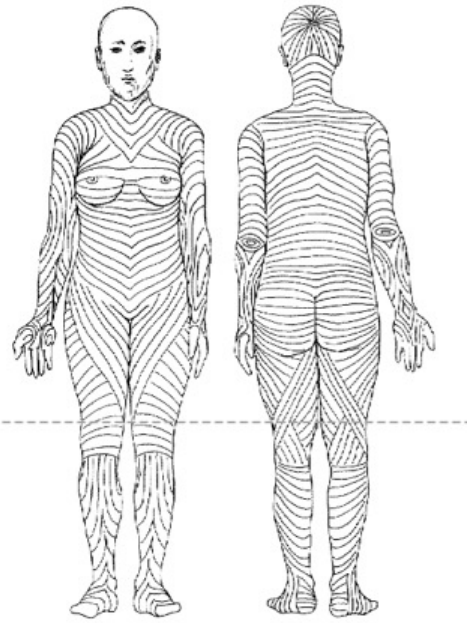
DESIGN AROUND THE BODY

The most unobtrusive areas for wearable objects:

1. collar area,
2. rear of the upper arm,
3. forearm,
4. rear, side, and front ribcage,
5. waist and hips,
6. thigh,
7. shin,
8. top of the foot



A Langer line, called also *cleavage lines*, is a term used in medical field to define the direction within the human skin along which the skin has the least flexibility. The direction of these lines is very important for surgical operations.



3D PRINTING ON TEXTILES

OER: 3D PRINTING ON TEXTILES

Objective & Scope

- Introduce 3D printing on textiles technology to scholars
- Highlight the potential of 3D printing as a resource-efficient method in functional and smart textile development
- Application of 3D printing as resource-efficient method to functionalize textiles to better understand the theoretical part mentioned in OER, and implementation potential of this technology

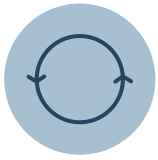
Activity Question

How could 3D printing be applied as a method for production of functional and smart textiles?

Learning Goals

- Develop practical skills
- Enhance mastery of 3D printing technology
- Improve team-work abilities among the scholars

Categories



Sustainability

Textile Technology

Textile Surfacing and Printing

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Support material

- OER
- Summary presentation

Equipment

3D printer, electrically conductive 3D printer filament, cotton fabric, Movesense accessory (sensor), Movesense app in iPhone

A.

Why do we need to consider 3D printing on textiles as a new method for functional and smart textiles development?

1.
Pre-session home reading of related OER and other references

2.
Buzz groups (3 max) activity comparing conventional screen printing and 3D printing technologies (pros and cons) (20 mins).

3.
Snowballing discussion (2 buzz groups) about the applications and possibilities of using 3D printing in industry (20 mins).

4.
Use post-it stickers on the board to organize the main ideas that resulted from the discussion.

5.
Questions from participants (10 mins).

6.
3-min paper at the end of the session, describing the main points that are learned from this session about 3D printing in textile industry and its contribution to sustainability.].

Less than or around an hour

Individual Small Group Discussion

Discover & Define

B.

How can we print an electrode on a piece of fabric?

1.
Quick introduction to 3D printing instrument in location and safety measures (10 mins)

2.
Design the needed electrode in a 3D software like Rhino

3.
Quick introduction to 3D printer software (Simplify 3D)

4.
Insert the electrode design to the software of the instrument

5.
Introduce the fabric into the instrument platforms

6.
Conduct the printing process

7.
Remove sample after printing

8.
Measuring ECG with the help of Movsense accessory and app on iPhone.

9.
If instrument is not available in location, use pre-recorded video from HB labs conducting this process

Less than or around an hour

Small Group Discussion

Develop

3.2 LEARNING ACTIVITIES LISTED AFTER TIME SPANS AND CATEGORIES

	Less or around an hour	Around half a day	A day or more than a day
Card toolkit with innovative sustainability strategies	A + B		
Define a new product brand identity	A	A + B	
Define new product design strategies for market success	A + B	A	
Delving into the latest trends in the technical textiles sector	B	A	
Digital inkjet printing in textile industry	A + B		
Expand your knowledge on the textile materials		A + B	
Hands on Digital Fabrication Technologies		A	B
How to affect the production processes		A + B	
How to contribute in making a more sustainable supply chain process		A + B	A + B
Ideate a new product / design from one's own vision		A + B	
Instead of creating, how about recreating?		A + B	B
Looking into company's work with sustainability in textile product design	A + B		C
Material Mapping & Scouting	A + B		
Materials scenario	A + B		
Plasma treatment in textile industry	A + B		
Putting scaling textiles into practice	A		B
Storytelling for understanding the user	A + B		
Technological watch process practice: How to do technological watch, tools and references on advanced textile materials	B	A	
Tinkering with and for bio and smart textiles: produce and explore a bio-yarn		A + B	A + B
Toolkit (materials)	B	A	
Visual Thinking to find Business Opportunities	A + B		
Wearable Textile System. Design layered intelligent materials			A + B
3D printing on textiles	A + B		

Textile Technology	Advanced Textile Technology	Textile Surfacing and Printing	Smart Textiles	Design Process	Product Design	Sustainability	Business and Marketing
				●		●	
				●			●
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4. HOW TO USE

The learning activities are developed to be applied in varying course settings and can be seen as and applied as single units or be combined into entire course modules. Thus, they can be used as input in existing course modules or inform the development and design of new course modules.

On the following pages, we exemplify, how the learning activities can be applied in a course module, here using the Destex summer school as a case.

4.1 BUILDING A COURSE MODULE

There are multiple ways to put together a course module and thus how to strategically thinking in and combining learning activities as part of the course design process.

Relevant parameters could be:

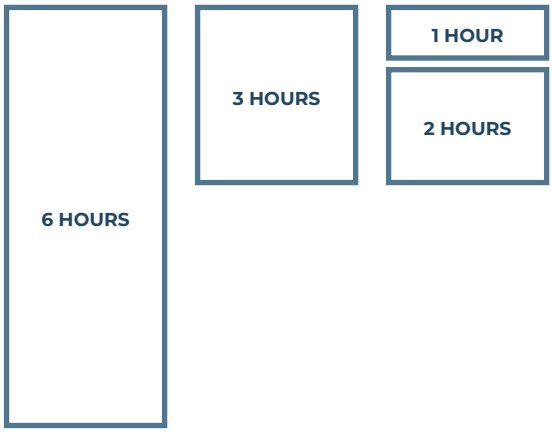
- Objective and scope
- Activity format
- Course intensity
- Available time (hours as well as duration)
- Equipment
- Wish for activated learning modes
- Experience level of learners

The following example builds around an intensive one-week course module, but the logics of the course design can easily scaled to run several weeks or even months.

A full day equals (more or less) 6 hours of teaching. There could be 4 different lengths of modules:

- 1 hour module
- 2 hours module
- 3 hours module
- 6 hours module

These can then be combined by different means to fill the days.

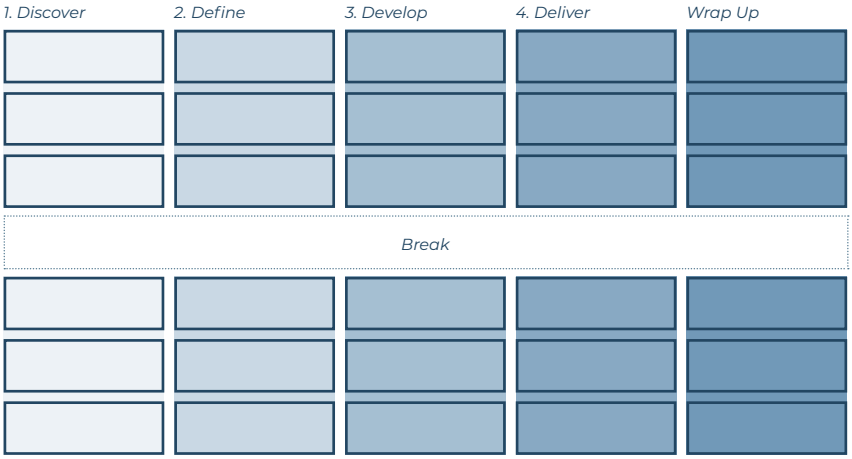


In the below case, the week has been structured with one learning mode per day and a day in the end for wrap up and reflection.

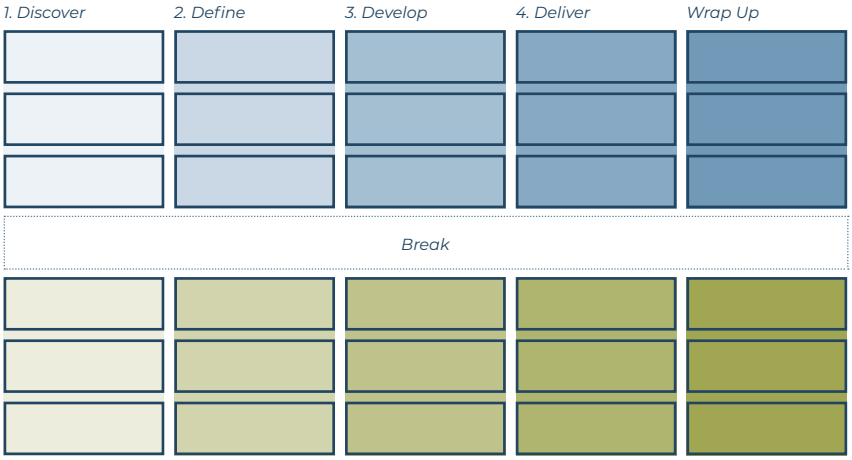
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1. Discover	*2. Define*	*3. Develop*	*4. Deliver*	*Wrap Up*
Break				

The days can e.g. comprise of whole day modules (scenario 1), half-day modules (scenario 2) or 1 hour modules (scenario 3) or a combination of module topologies (not illustrated).

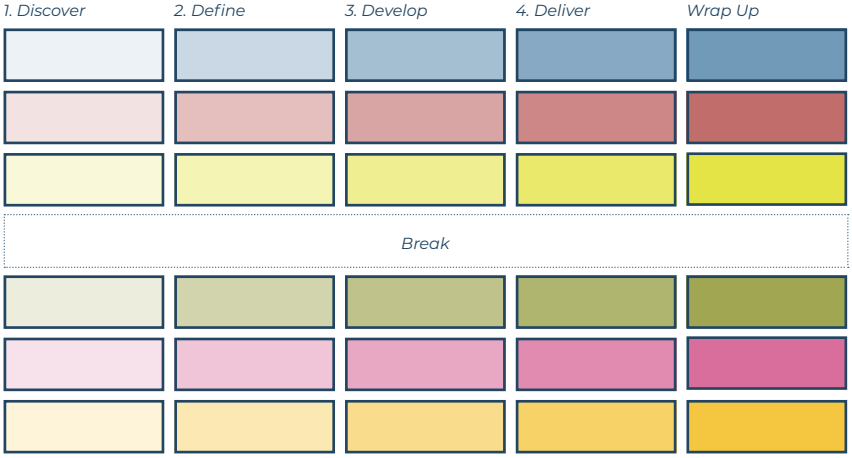
SCENARIO 1: WHOLE DAY MODULES (6 HOURS PER MODULE)



SCENARIO 2: HALF-DAY MODULES (3 HOURS PER MODULE)



SCENARIO 3: 1 HOURS MODULES



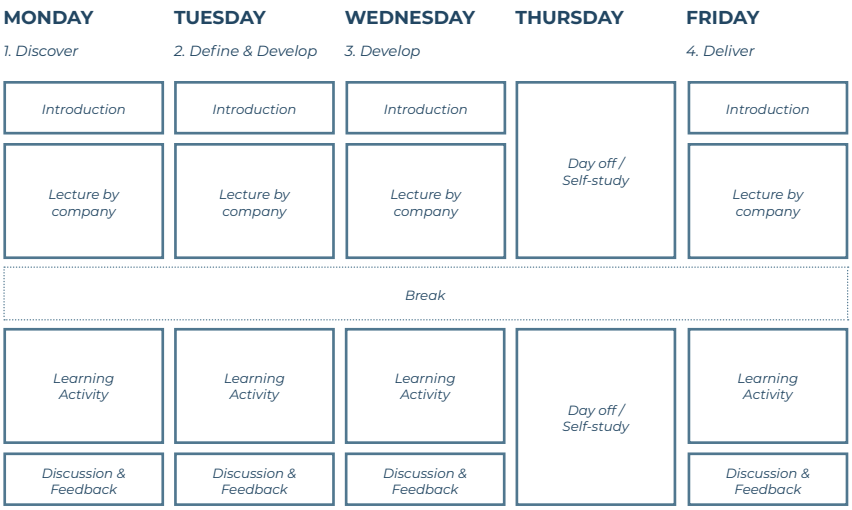
4.2 A CASE EXAMPLE: THE DESTEX SUMMER SCHOOL

The Destex project hosted an intensive one-week online summer school in June 2021 organised by the four HEI partners of the project.

The schedule for the week was based on the four learning modes and a progressive transition between these. A self-study day was also included.

Each day had a thematic focus and included a short introduction to the day, a lecture by a company, a learning activity and discussion and feedback. The learning activity focused on group work and transdisciplinary knowledge creation as each participating institution was represented in each group of students.

The graphic below is a representative scheme to show how a one-week course setting can be set up.



4.3 REFLECTION

The Destex summer school was initially planned to take place at Politecnino di Milano in Milan, Italy. However, due to Covid-19, it was decided to reorganize and adapt the summer school into a hybrid setting, where all four partnering universities were hosting the summer school as satellite stations that were at all times connected via a video call. This meant that the summer school was converted from being centred on Politecnico di Milano and their facilities, to being de-centralised with all four partnering universities contributing equally.

Content of the summer school
All eight main topics identified as relevant to structure the learning activities of this training were intended to be covered during the week of summer school. Each day had a main emphasis, for example on Monday, the focus was sustainability within the textile sector while on Friday, it was on advanced textile technology combined with textile surfacing and printing. The different activities covered topics well and were supplemented by companies' guest lectures and presentations that were regarded as great contributions to describe and demonstrate topics applied in a business context. The distribution of topics each day allowed for a concrete progression as well as the coverage of numerous topics.

The most valuable input for the students was:

- to get enriching insights into the various industries that were connected to new technologies for textile manufacturing,
- to attend companies' lectures and the opportunity to ask many questions,
- to see the labs and to experience them virtually,
- to work with new technology such as 3D printing and laser cutting and
- finally to work in cross-cultural groups that enriched their soft skills and communication abilities.

Hybrid teaching
According to the students' feedback, the biggest challenge was the hybrid mode, especially when conducting activities that required collaborations between the students. The student working groups remained the same during the whole week with the aim that a workflow would build up leading to a more successful collaboration. In each team, a student from each university was represented.

The organisers' and facilitator's feedback also emphasize that the great challenges that the hybrid setup revealed were intense to tackle along the way. Even though everyone was used to online teaching due to Covid-19 measures, running an event such as the summer school put online teaching on a different scale. For a teacher, online teaching usually takes place together with his/her 'own' students, but in a virtual video call, where the teacher knows the students and the students know each other.

Nevertheless, all required educational content was covered and conveyed. The positive feedback confirmed the intended structure of the event to have successfully contributed to the knowledge exchange and acquisition. Furthermore, all involved persons experienced that it is possible to run an event like this online even though it meant a higher level of complexity. The Destex project and the planning of the training book began before we knew and could ever imagine the reality, we now live in.