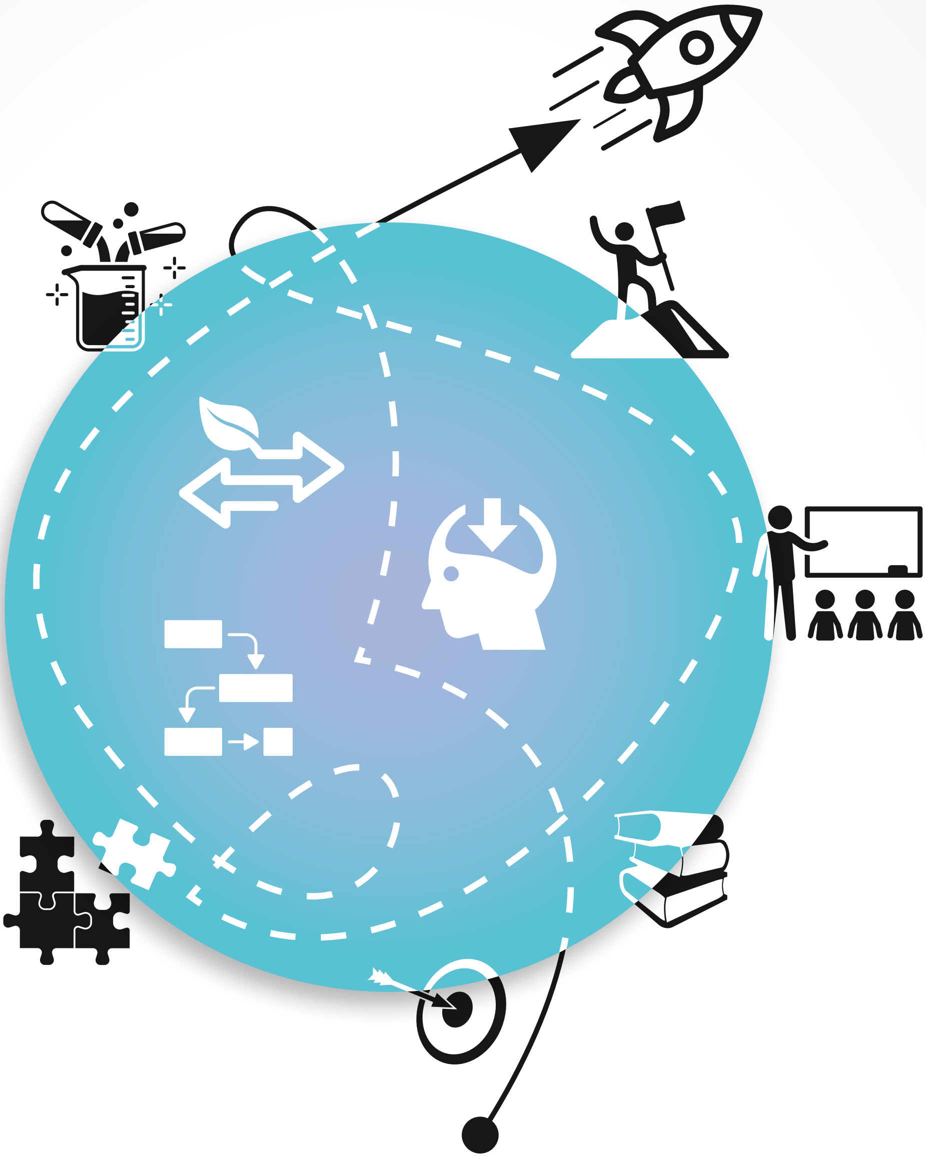

PEDAGOGICAL SHORT GUIDE

FOR THE USE OF EXPERIMENTS AS METHODOLOGICAL-DIDACTIC MATERIAL

Co-funded by the European Union

CONTENT

A

CONTEXT AND OBJECTIVES

This guide is based on the development and piloting of practice-oriented STEM experiments along the textile value chain. The testing was carried out in different educational settings with a total of 81 learners from various age groups, as well as participating teachers.

The aim of this guide is to provide teachers with a structured, transferable, and practice-tested framework to flexibly integrate the developed experiments into both formal and non-formal learning environments. The focus is on fostering STEM competences, sustainability awareness, and career orientation.

The results demonstrate that the combination of fashion, technology, and sustainability offers a particularly effective approach to engaging learners with complex societal challenges and promoting active learning.

B

PEDAGOGICAL APPROACH

The approach is based on four central didactic principles:

Learning by doing

The experiments enable hands-on learning. Through measuring, observing, designing, and experimenting, abstract concepts become tangible. For example, when comparing natural and synthetic fibres, theoretical knowledge is deepened through direct measurement and analysis.

Relevance to learners' everyday lives

Fashion is an integral part of learners' daily reality. Topics such as consumption, sustainability, and digital technologies create a strong connection and foster intrinsic motivation.

Interdisciplinarity

The experiments combine scientific, technological, mathematical, and creative perspectives. For instance, physical properties of materials are linked with design decisions and sustainability-related questions.

Reflective competence development

In addition to subject knowledge, learners are encouraged to critically reflect on societal issues, take responsibility, and develop their own courses of action.

C

DIDACTIC AND METHODOLOGICAL STRUCTURE

A clear lesson structure has proven effective
for implementing the experiments:

Introduction

A short, activating impulse introduces the topic. This can include images, real-life examples, or guiding questions. The aim is to spark interest and activate prior knowledge.

Exploration phase

Learners work in small groups to carry out the experiments. Clear instructions and well-prepared materials are essential for a smooth process.

Deepening

Results are analysed, compared, and placed into a broader context. This stage encourages initial subject-related discussions.

Reflection

The reflection phase is a central element. Guiding questions support engagement with ecological, social, and technological dimensions.

Conclusion and transfer

Results are presented and transferred to real-life contexts, such as consumption behaviour or career perspectives.

D

PRACTICAL IMPLEMENTATION IN THE CLASSROOM

Organisation and preparation

Careful preparation of materials is essential for success. Workstations should be clearly structured to ensure a smooth workflow. Safety aspects must be considered, especially in experiments involving water, heat, or tools.

Time management

Pilot results show that sufficient time for hands-on activities is crucial. At the same time, theoretical introductions should be kept concise, particularly for younger learners. More complex experiments can be divided into multiple phases.

Group work

Small groups support exchange, responsibility, and peer learning. Assigning roles within groups helps ensure active participation of all learners.

Differentiation

The experiments are designed to be adaptable to different levels. Teachers can differentiate through additional questions or extended tasks.

E

DIDACTIC USE OF EXPERIMENT FORMATS

The developed experiments address different learning approaches:

Analytical experiments

These promote scientific thinking, for example through measuring and comparing material properties. One example is analysing the water absorption of fibres and interpreting quantitative results.

Craft-based practical experiments

Activities such as weaving, braiding, or upcycling help learners understand material properties, processing techniques, and the value of textiles.

Technology-oriented experiments

Topics such as artificial intelligence or digital tools highlight future developments in the industry and foster technological understanding.

Creative experiments

Activities such as natural dyeing or product development combine creativity with sustainability and promote problem-solving skills.

F

LEARNING EFFECTIVENESS AND COMPETENCE DEVELOPMENT

The pilot phase shows high learning effectiveness across several dimensions, directly linked to the experiments conducted along the textile value chain. Competences are developed in an integrated and application-oriented way.

Subject competence

Learners acquire a solid understanding of key processes in the fashion and textile industry. This includes the properties and differences between natural and synthetic fibres, their transformation into yarns and textiles, and functional finishing processes. Experiments such as fibre comparison, burn tests, or analysing water absorption and abrasion provide deeper insights into material science. In addition, learners engage with technological developments such as artificial intelligence in design, digital tools, and innovative materials like e-textiles. Systemic aspects, such as environmental impacts of global production chains and recycling processes, are also explored.

Methodological competence

Through experimental work, learners develop fundamental scientific skills. They observe systematically, conduct measurements, document results, and evaluate findings. In experiments involving fibre analysis, material testing, or dyeing processes, learners apply basic empirical methods and learn to interpret and critically reflect on results. They also develop skills in data handling, research, and presentation. Open-ended tasks, for example in AI or design contexts, further promote problem-solving and creative thinking.

Social competence

Working in small groups supports the development of collaborative skills. Learners plan steps together, distribute tasks, and coordinate during the experiments. They learn to consider different perspectives, make joint decisions, and discuss results. Especially in more complex tasks, such as developing product ideas or technological solutions, collaboration becomes a key element of the learning process.

Personal competence

The experiments encourage reflection on personal behaviour and the role as consumers. Topics such as overconsumption, environmental pollution, microplastics, or working conditions in global production lead to critical engagement with learners' own realities. Learners develop a stronger sense of responsibility and recognise the impact of individual actions on ecological and social systems. At the same time, practical success experiences strengthen self-efficacy and motivation to engage with sustainable solutions.

Career orientation

The experiments provide insights into current and future professions in the fashion and textile sector. In addition to traditional craft-based roles, learners discover technological and interdisciplinary career paths, such as material research, sustainable product development, digital design, or AI-supported processes. The combination of practice, technology, and societal issues creates a realistic and broadened understanding of the industry and supports career orientation.

G

KEY SUCCESS FACTORS

The pilot phase highlights several key success factors:

Strong practical and hands-on elements

Relevant and real-life topics

Connection between theory and practice

Open-ended questions and space for creativity

Clear structure and understandable materials

H

CHALLENGES AND SOLUTIONS

Limited attention span

Keep introductions short and move quickly into practical activities

Time constraints

Focus on fewer experiments with greater depth

Heterogeneous groups

Use flexible tasks and peer learning

Complexity of content

Support understanding through visualisation and concrete examples

I

TRANSFER AND SUSTAINABILITY

The experiments are designed to be flexible and can be integrated into various educational formats without requiring strict curricular alignment.

In project weeks focusing on education for sustainable development,

they enable learners to explore complex topics such as resource use, circular economy, and global production systems in a hands-on and interdisciplinary way. The combination of experimentation, reflection, and discussion fosters a deeper understanding of sustainable practices.

In the context of career guidance,

the experiments offer insights into a wide range of professions within the fashion and textile sector, particularly those linked to technological innovation, material development, and sustainability. Learners gain a broader understanding of career opportunities beyond traditional roles.

In subject teaching,

such as science, technology, or design, the experiments can be used to deepen curricular content. They support understanding of material properties, physical and chemical processes, as well as design and construction principles, while promoting experimental and analytical thinking.

In non-formal education settings,

such as workshops or youth programmes, the experiments are highly effective due to their hands-on approach. They address different learning styles and provide accessible entry points to complex topics.

A particular added value lies in the possibility of combining the experiments along the entire textile value chain. From fibre production through processing, design, use, and recycling, learners develop a holistic understanding of the industry and its challenges. This perspective supports systems thinking and helps learners understand the impact of decisions on environmental, social, and economic levels.

J

CONCLUSION AND OUTLOOK

The developed STEM experiments offer an innovative, interdisciplinary, and practice-oriented approach to addressing current societal and technological challenges. They enable teachers to integrate sustainability, digitalisation, and career orientation into a coherent learning framework.

The pilot results demonstrate that the approach is both pedagogically effective and highly transferable. With further refinement, particularly in terms of time structure and depth of content, the approach can be strengthened and sustainably embedded in educational practice.

CAREER GUIDANCE:
STEM IS IN VOGUE

Promoting sustainability in the textile and
fashion industry through STEM careers.

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