SUST3DFASHION MENTORING PLANS

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Interdisciplinary Handbook for Textile & Fashion Industry, and 3D Design & Printing Industry

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SUST3D FASHION

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Acronyms

3D	Three-Dimensional
AI	Artificial Intelligence
CAD	Computer-Aided Design
CLO3D	3D fashion design software for virtual garment simulation
COSME	Programme for the Competitiveness of Enterprises and SMEs
DigComp	Digital Competence Framework for Citizens
EMCC	European Mentoring and Coaching Council
EIT	European Institute of Innovation and Technology
EQAVET	European Quality Assurance in Vocational Education and Training
ERP	Enterprise Resource Planning
ETP	Textile European Technology Platform
EU	European Union
GDPR	General Data Protection Regulation
GreenComp	European Sustainability Competence Framework
MOOC	Massive Open Online Course
NGO	Non-Governmental Organization
R&D	Research and Development
SMP	Single Market Programme
SME	Small and Medium-sized Enterprises
VET	Vocational Education and Training
ZPD	Zone of Proximal Development
EntreComp	European Entrepreneurship Competence Framework

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1. Background and Preparation

1.1 Forewords

1.1.1 Background to the Handbook

This mentoring handbook has been developed within the framework of the Sust3DFashion project, an Erasmus Plus Vocational Education and Training (VET) partnership dedicated to fostering innovation and sustainability in the textile and fashion manufacturing sector. The project responds to the EU's call for sustainable textiles—durable, recyclable, and environmentally friendly by 2030—by equipping both textile and fashion professionals, as well as 3D design and printing experts, with the skills and knowledge to collaborate effectively. By linking these two domains, the project promotes innovation, strengthens sustainability practices, and supports the digital transition of the fashion industry in line with Industry 4.0 and labor market needs.

Mentoring in the Sust3DFashion project is not a unidirectional transfer of expertise, but a reciprocal, interdisciplinary, and innovation-driven process. It addresses the knowledge gap between the traditional fashion and textile sector, rooted in material craftsmanship and design heritage, and the 3D design and printing field, characterized by digital innovation and technological disruption. Traditional labels such as mentor and mentee are used only when necessary to clarify roles and underline the shift from hierarchical models toward more collaborative, mutual forms of mentoring.

This handbook is needed because there is a clear gap between traditional textile and fashion practices and the fast-growing field of 3D design and printing. While 3D technologies offer new opportunities for innovation, sustainability, and competitiveness, many professionals in the textile sector lack the knowledge and tools to apply them effectively. At the same time, 3D printing specialists often do not fully understand the specific needs, processes, and constraints of the textile and fashion industry. The handbook addresses this gap by creating a structured mentoring framework that connects both groups, fosters reciprocal learning, and provides practical activities and tools.

The validity of the handbook was evaluated and assured using clear indicators in line with established EU project quality assurance standards: the European Quality Assurance in Vocational Education and Training (EQAVET) framework, and the Erasmus+ quality guidelines. The evaluation process included achieving at least 80% positive feedback from external stakeholders and experts in both the textile & fashion industry and the 3D design & printing sector. Based on these results, the handbook was validated as practical, innovative, and impactful, becoming a shared resource for the project consortium and external beneficiaries.

1.1.2 Beneficiaries of the Handbook

The end users of this handbook are **professionals/VET learners (mentees)**, primarily working-age adults, who wish to understand how to apply 3D printing in real work situations in the textile and fashion sector. By doing so, the handbook helps learners manage labor market transitions, gain hands-on Work-based Learning (WBL) experiences from prototyping to sustainable production, and connect with new opportunities in a rapidly evolving digitalizing industry.

For **professionals/VET learners** (adult and non-adult) in 3D printing (mentees), the handbook provides opportunities to understand how their technical expertise can be applied to the textile and fashion sector. It enables them to adapt their skills to new contexts, explore interdisciplinary product development, and create business opportunities by collaborating with fashion companies.

Experienced professionals in textile/fashion and 3D printing, as mentors who guide others at early, mid, or advanced career stages, and as mentees in some mentoring types (e.g., peer-to-peer mentoring) who share expertise, also benefit from this handbook, as it offers them structured approaches and new perspectives on how to pass on their expertise effectively within their organizations or to wider audiences. By engaging with diverse mentee groups, mentors refine their own practices, update their knowledge with emerging tools and methods, and gain insights into different challenges faced across the textile, fashion, and 3D printing sectors. In this way, the handbook supports mentors not only as guides but also as continuous learners and innovators.

For **industries**, the handbook encourages stronger collaboration between textile/fashion companies and 3D printing specialists, helping businesses adopt sustainable, innovative practices in line with Industry 4.0 and circular economy principles. It supports SMEs in modernizing their production, developing new product lines, and staying competitive in a digitalized labor market.

For **citizens**, the handbook promotes civic participation by opening access to knowledge and practices normally limited to experts. This allows individuals outside the sector to understand and engage with sustainable technologies, supporting lifelong learning, employability, and greater awareness of how digital innovation transforms everyday products.

For **VET providers**, the handbook serves as a practical resource to enrich their training offers with innovative, interdisciplinary content. It helps them integrate real-world case studies, mentoring frameworks, and WBL activities into their curricula, bridging the gap between traditional textile training and emerging 3D technologies. By using the handbook, VET educators can better align their programs with EU priorities on digitalization, sustainability, and Industry 4.0, while also equipping learners with skills that are directly relevant to the labor market. In this way, the handbook not only supports learners and mentors but also strengthens the capacity of VET institutions to remain competitive, forward-looking, and connected to industry needs.

1.1.3 What You will Find in Later Chapters

In the following chapters, the handbook introduces the main concerns of mentoring in the fashion and textile industry in connection with 3D design and printing. It first defines mentoring in this specific context and clarifies the roles of mentors and mentees, their relationship, and the key content areas for knowledge exchange in both fields. It then explores special concerns for mentors, mentees, and institutions, addressing both challenges and opportunities in interdisciplinary collaboration.

Finally, the handbook provides practical tools, templates, and activity guides tailored to different career stages and learning objectives, supported by a resource library for ongoing use according to the distinct needs of the three mentee groups.

1.2 Definitions

1.2.1 Who is a Mentor? Who is a Mentee?

In educational contexts, the terms "mentor" and "mentee" refer to the relationship dynamics between experienced individuals and those who are seeking guidance, respectively. Mentors typically possess significant expertise and experience in a specific field, which they leverage to support the professional and personal development of mentees. These interactions facilitate learning, skill acquisition, and integration into professional practices.

Mentors serve various functions, including offering personal support, career advice, and role modeling. Their involvement is crucial in helping mentees navigate challenges and enhance their confidence. Effective mentoring relationships are characterized by mutual respect, open communication, and trust, allowing mentees to feel secure in seeking guidance and feedback. The mentor's role extends to providing constructive feedback, thereby assisting mentees in their educational journeys.

Conversely, a mentee is an individual who actively seeks mentorship to enhance their educational experiences and personal development. Mentees are expected to engage in their development, demonstrating a willingness to learn and adapt based on the guidance provided by their mentors. The relationship is characterized by mutual engagement; while both parties benefit, the primary focus remains on the mentee’s development. Effective mentoring entails setting clear expectations and engaging in dialogues that bolster the mentee's learning process.

The mentor-mentee relationship generally evolves through stages, starting with rapport-building and progressing to more structured interactions where goals and objectives are clearly defined. Successful mentoring is associated with positive outcomes for the mentee, including enhanced knowledge retention, confidence, and skill development. Consequently, both mentors and mentees must recognize and adapt to their roles within the mentoring dynamic, facilitating a productive exchange of ideas and resources.

In the context of this Handbook, Mentors and mentees are categorized as shown below:

- **Mentors**:

Group 1. *Early career experts* in fashion & textile who have begun to use 3D printing in a specific product line or have collaborated with companies integrating 3D technologies into textiles (e.g., a young designer experimenting with 3D-printed accessories in apparel).

Group 2. *Mid-career experts* in fashion & textile with broader experience in developing textile products that integrate 3D printing, who have already coordinated projects or supervised junior staff in applying these technologies (e.g., a production manager in a SME developing prototypes with 3D printing).

Group 3. *Advanced experts* in fashion & textile who have consistently worked with 3D printing in textile and fashion over several years, influencing product development, research, or market strategies (e.g., an R&D leader integrating sustainable 3D printing techniques into large-scale textile manufacturing).

Group 4. *Experts (Any career level) in 3D printing* with or without (depending on the type of mentoring) workable experience in the application of 3D printing in Fashion & Textile. Importantly, the model allows for reverse mentoring, where even a junior 3D printing expert may mentor a senior textile professional on specific digital technologies, while simultaneously learning from the textile expert's long-term industry knowledge.

- **Mentees**

First-level mentees: Adult VET learners already working in the textile and fashion sector but beginning to learn how 3D printing can enhance their practice (or have limited knowledge of 3D design and printing).

Second-level mentees: Novice VET learners (in either field), still preparing to enter the textile and fashion, or 3D printing labor market, who wish to gain early exposure to 3D applications in Fashion & Textile.

Third-level mentees: Professionals in either the Fashion & Textile or 3D Design & Printing fields who possess some knowledge and experience in the other area. These individuals are eager to engage in peer-to-peer mentoring, exchanging insights and expertise with professionals from the other field to further complement and expand their skill set.

Fourth-level mentees: Civilians without professional expertise in either domain but motivated to participate and learn to get acquainted with both concepts for future orientation (reinforcing the civic participation dimension of the project.).

1.2.2 Objectives

The main objectives of mentoring in the context of this handbook are to facilitate knowledge transfer, foster innovation, accelerate digital adoption, and support professional development across both domains, while embedding sustainability and inclusiveness in line with EU Green Deal targets and Industry 4.0 transformation agendas.

Within Fashion and textile Field, the handbook is aimed at:

- Integration of digital competences by acquiring hands-on knowledge of 3D modeling, scanning, and printing technologies to complement traditional textile design and production.
- Sustainability-driven innovation by exploring how 3D printing can minimize material waste, create recyclable components, and support the EU vision of climate-neutral and circular textiles by 2030.
- Diversification of products and services by leveraging 3D-printed elements (e.g., accessories, technical components, smart textiles) to expand product portfolios and meet evolving consumer demands.
- Preparing professionals for digital transformation by aligning their practices with Industry 4.0 standards and enhancing their employability in an increasingly digital labor market.

Within 3D design and printing field, the handbook is aimed at:

- Learning how to adapt digital technologies to textiles' flexible, layered, and aesthetic nature.

- Promoting cross-sector innovation via engaging in collaborative projects with designers and producers to develop prototypes that merge digital precision with fashion creativity.
- Developing market orientation such as understanding consumer behavior, sustainability imperatives, and production limitations within fashion to ensure that their solutions are not only technically feasible but also commercially viable.
- Professional Diversification by expanding career opportunities to new domains such as wearable fashion, sustainable accessories, or bespoke product development.

1.2.3 The Expected Outcomes

Mentoring in the Sust3DFashion framework is designed to benefit multiple stakeholders at different levels (See the beneficiaries above) — from individual learners to organizations and wider society. The outcomes reflect both technical upskilling and broader systemic transformation in line with EU priorities on sustainability, digital transition, and inclusion.

- *For VET Learners (Fashion/Textile and 3D Printing)*

VET learners, whether already active in the sector or preparing to enter the labor market, are at the center of the mentoring process. For them, the expected outcomes are:

- Acquisition of New Technical and Digital Skills: Learners gain proficiency in 3D modeling, additive manufacturing, and digital prototyping, combined with traditional textile knowledge.
- Enhanced Creativity and Innovation Capacity: By working across disciplines, learners improve problem-solving skills and experiment with innovative approaches to design and production.
- Increased Employability: Exposure to both fields equips learners with a unique interdisciplinary skillset that is highly valued in modern labor markets. This supports smoother career transitions at early, mid, and advanced stages.
- Reciprocal Learning for Mentors as Well: The framework emphasizes that learners are not only recipients but also contributors — mentors refine and update their knowledge through the mentoring exchange.

- *For Organizations (SMEs, Industry Stakeholders, VET Providers)*

Organizations — including textile/fashion companies, 3D printing firms, and VET providers — benefit from mentoring by strengthening their innovation capacity and competitiveness. Expected outcomes include:

- Development of Collaborative Prototypes and Products: Cross-sector mentoring leads to tangible outputs such as new product designs, sustainable prototypes, and innovative accessories.
- Cross-Sector Collaboration: Stronger partnerships emerge between textile/fashion businesses and 3D specialists, creating new opportunities for interdisciplinary innovation.
- Integration of Digital Tools: Companies and institutions begin bridging the technological gap by embedding digital design and 3D printing into traditional workflows.
- Sustainability and Competitiveness: Businesses adopt eco-friendly and circular practices, aligning with Industry 4.0 requirements and EU sustainability strategies.
- Capacity Building for VET Providers: Training institutions expand their curricula with interdisciplinary content, case studies, and mentoring frameworks, better aligning education with real labor market needs.

- *For Civilians (Non-Professionals, Wider Society)*

The mentoring framework also extends beyond professionals and learners, reaching out to citizens and communities. This reflects the civic participation and lifelong learning dimension of the project. Outcomes for civilians include:

- Increased Awareness of Sustainable Technologies: Citizens gain knowledge of how textiles and 3D printing intersect with sustainability, influencing their consumption choices.
- Access to Lifelong Learning Opportunities: Open workshops, exhibitions, and digital resources provide civilians with entry points into digital literacy and sustainable design.
- Basic Digital Competences: Non-experts develop foundational digital skills by engaging with simple design tools or introductory 3D printing activities.
- Social Inclusion and Civic Engagement: By making advanced knowledge accessible to all, the mentoring process supports the principles of the European Pillar of Social Rights and the Erasmus+ Inclusion and Diversity Strategy (2021).

1.3 Methodology

1.3.1 Mentoring Model Used in the Handbook

The mentoring model applied in this handbook is reciprocal, interdisciplinary, and multi-directional, combining elements of **mutual, peer, reverse, community, AI assisted, and blended mentoring** (a mix of face-to-face and digital formats). This model is particularly appropriate for bridging the fashion/textile and 3D printing sectors, as it allows knowledge to flow in multiple directions: textile and fashion professionals gain exposure to new digital tools, while 3D printing specialists deepen their understanding of textile-specific applications, production constraints, and sustainability practices.

Mutual mentoring: A two-way learning relationship where both mentor and mentee share expertise and benefit from the exchange.
Peer mentoring: A relationship between individuals of similar status or career stage who support one another in professional and personal development.
Reverse mentoring: A model where a junior or less experienced professional mentors a senior colleague, often on new skills or technologies.
Blended mentoring: A mentoring approach that combines face-to-face interaction with digital/online tools to enhance flexibility and access.

In this mentoring plan, the relationship between mentor and mentee was structured according to Vygotsky's sociocultural theory and the concept of the Zone of Proximal Development (ZPD). The ZPD defines the gap between what a learner can achieve independently and what they can achieve with the guidance of a more knowledgeable other. Within this framework, the mentor is not required to be a full expert in 3D design and printing but must always possess knowledge and experience just beyond the mentee's current level. This allows the mentor to provide effective scaffolding, progressive guidance and support that helps the learner advance step by step until they can perform independently.

This approach makes the mentoring plan innovative in two ways. First, it enables differentiated mentoring: mentors and mentees can interact at different levels of expertise in fashion and textiles (early, mid, and advanced career stages), each benefitting from the structured scaffolding process. Second, it ensures interdisciplinary exchange, since textile/fashion experts and 3D printing specialists can mentor and learn from each other depending on the context.

The handbook therefore separates methods, activities, and tools according to the four mentee levels as early-career novice VET learners are supported with more guided, practice-based exercises, while mid- and late-career VET learners engage in reflective, innovation-driven, and collaborative approaches. The details of these methods are presented in the following chapters, ensuring that the mentoring framework remains adaptable, inclusive, and impactful across all levels of expertise.

Table 1.1 Matrix of the mentoring model in this handbook

Mentoring Type	Mentor Levels (Textile/Fashion & 3D Printing)	Mentee Levels (Textile/Fashion & 3D Printing)	Examples of Application
Mutual Mentoring	Early, Mid, Advanced	Early, Mid, Advanced	Textile experts and 3D experts share insights: the textile mentor explains materials, while the 3D mentor teaches software integration.
Peer Mentoring	Same-level mentors (e.g., Early ↔ Early, Mid ↔ Mid)	Same-level mentees	Two early-career VET learners collaborate on a prototype using both textile methods and 3D printing.
Reverse Mentoring	Early-career 3D mentor ↔ Advanced textile mentor	Senior mentees in textile/fashion	A young 3D specialist teaches CAD modeling to a senior textile R&D manager who shares product lifecycle insights in return.
Blended Mentoring	Any level	Any level	Mentoring carried out via online platforms (tutorials, MOOC, webinars) combined with on-site workshops in labs or factories.
Community Mentoring	Any level	General public / civilians (non-professionals, consumers, community groups)	Professionals introduce civilians to sustainable fashion concepts or simple 3D design tools through workshops, exhibitions, or open labs, fostering civic participation, inclusivity, and awareness of circular fashion practices.
AI-Supported / E-Mentoring	Any level higher than the mentees	Early, Mid-level	A fashion design student uploads a digital sketch of a dress to an AI-enabled mentoring platform. The AI pairs her with a 3D-printing engineer who reviews the file and suggests adjustments to the model so it can be printed with flexible materials.

1.3.2 Data Collection Methods

The inputs for this handbook were collected through a combination of research, consultation, and practice-based activities to ensure both academic rigor and industry relevance. The following methods were used:

Literature Review: Analysis of EU policy documents, academic publications, and industry reports on 3D printing, textile/fashion manufacturing, VET practices, and mentoring models, ensuring alignment with European frameworks such as EQAVET and the EU Green Deal.

Surveys: Structured questionnaires distributed to textile/fashion professionals, 3D printing experts, and VET learners to identify current skills gaps, training needs, and expectations for interdisciplinary collaboration.

Expert Interviews: Semi-structured interviews with senior practitioners, VET providers, and innovators in both sectors to gather in-depth insights on practical applications, challenges, and opportunities for mentoring.

Focus Groups: Interactive sessions involving mentors, trainees, and educators from both fields to co-create ideas for mentoring activities and validate the feasibility of proposed approaches.

Case Studies from Partners: Practical examples and pilots contributed by project partners, showcasing how 3D printing was applied in textile/fashion contexts and serving as a foundation for the exercises and mentoring templates included in this handbook.

By combining these methods, the handbook reflects a balance between evidence-based research and practice-driven insights, ensuring that it meets the needs of VET learners, mentors, and industry stakeholders while remaining adaptable to different levels of expertise.

1.3.3 Content Creation Process

The content of the Mentoring Handbook was developed through a structured, collaborative process involving all project partners. First, the task lead partner prepared the mentoring plan guidelines, and together with an experienced partner, defined the roles of mentors and mentees, and outlined the objectives for each chapter. A first draft of Chapter 1 was created and shared with all partners to establish a common understanding of methodology, philosophy, and key concepts. This ensured that everyone worked with unified definitions and a clear framework before beginning their own sections. Each partner was then responsible for specific parts of the handbook using the data collection methods above, working closely with others through meetings and discussions to refine content.
Drafts were compiled, reviewed, and checked against a standard quality checklist to ensure consistency and internal validity. The completed handbook was shared for

internal partner evaluation and finally tested with external experts from both the textile/fashion and 3D printing fields during the project meeting in Athens (November 2025). Their feedback was collected through evaluation checklists and used to make final revisions, resulting in a coherent and validated mentoring handbook.

1.3.4 Ethical Considerations

The development of this handbook followed key ethical practices to ensure that the mentoring model is fair, inclusive, and aligned with European values. Particular attention was given to inclusivity, ensuring equal opportunities for participation regardless of gender, age, ability, discipline, or cultural background. All activities and resources were designed with accessibility in mind, providing open formats and blended tools that accommodate learners with different digital competencies and learning preferences.

The mentoring framework promotes equal participation by recognizing mentors and mentees as co-learners and by valuing knowledge transfer in both directions, thereby reducing hierarchical barriers. In addition, the inclusion of civilians with no prior expertise as potential mentees reflects the principles of civic participation and social inclusion promoted by the European Pillar of Social Rights and the Erasmus+ Inclusion and Diversity Strategy (2021). This approach reinforces lifelong learning opportunities and fosters engagement from a wider segment of society.

From a data protection perspective, all surveys, interviews, and focus groups conducted during the project complied with the General Data Protection Regulation (GDPR, EU 2016/679). Participants were informed about the purpose of data collection, provided with clear consent forms, and assured that their data would remain confidential, anonymized, and used solely for project purposes.

Finally, the handbook upholds ethical use of digital technologies, particularly in relation to sustainability and responsible innovation in line with the EU Green Deal and the Digital Education Action Plan (2021–2027). By combining inclusivity, accessibility, civic participation, and data protection, the handbook ensures a mentoring process that is respectful, transparent, and beneficial to all participants.

2. Mentoring Concerns in the Interdisciplinary ecosystem

2.1 Key Concepts

2.1.1 What is Mentoring?

Mentoring, within the context of **the fashion and textile industry** intersecting with 3D design and printing, is defined as a structured, reciprocal process of guidance, knowledge exchange, and professional development between experienced practitioners and learners at different stages of their career paths. Unlike general teaching, supervision, or traditional apprenticeship models, mentoring in this handbook emphasizes mutual learning, interdisciplinary collaboration, and innovation-driven growth.

Traditional apprenticeships in the textile sector have historically focused on the transmission of practical craft skills from master to apprentice in a largely one-directional flow of knowledge. While this model has been highly effective in developing craftsmanship, it often reinforces hierarchical relationships and prioritizes replication of established methods. In contrast, mentoring as defined here is non-hierarchical, adaptive, and future-oriented, creating opportunities for both parties to learn, co-create, and integrate new knowledge into their practice.

Mentoring in **the 3D design and printing industry**, particularly in the context of interdisciplinary collaboration with fashion and textiles, is a dynamic, symbiotic relationship aimed at bridging the gap between technological possibility and creative application. For a 3D printing expert, mentoring means guiding a fashion mentee not just on how to use a specific software or printer, but why a certain material, printing parameter, or digital workflow is best suited for achieving a specific textile-like behavior, drape, or aesthetic. Mentoring in a tech-fashion context is reciprocal; the 3D printing mentor might guide a designer on digital fabrication, while simultaneously learning about garment construction, material feel, and the nuances of the fashion industry's creative process. Mentoring in this context goes beyond teaching (which implies formal instruction), supervision (which implies control), or apprenticeship (which emphasizes one-way skill transfer).

Mentoring in fashion, textiles, and 3D printing is therefore characterized by several unique dimensions: Interdisciplinarity, Innovation Orientation, Sustainability/Digital Transformation, and Reciprocity in which both mentor and mentee act as co-learners, reflecting the dynamic nature of digital and sustainable innovation, where no single party holds all expertise.

2.1.2 Who is a Mentor in this Context?

In the framework of this handbook, a mentor is not simply an experienced professional who transfers knowledge downward, but a facilitator, guide, and co-learner who helps learners (mentees) navigate the challenges of digital transformation, sustainability, and interdisciplinary collaboration.

Mentors in this handbook are grouped into four groups (See Chapter 1). Mentors in this ecosystem are not passive transmitters of knowledge but active enablers of interdisciplinary collaboration, ensuring that both the fashion-textile sector and the 3D printing field evolve together toward more sustainable, innovative, and digitally advanced futures.

Responsibilities of a mentor based on the needs and types of mentoring (Table 1.1) are to:

- Guide knowledge transfer: Share their expertise in textile design, production, and/or 3D printing processes, while adapting explanations to the mentee's background.
- Support interdisciplinary adaptation: Help mentees understand how digital tools apply to textile realities (e.g., the difference between rigid printed prototypes and flexible fabrics).
- Encourage experimentation: Promote co-creation of prototypes, sustainable materials, or hybrid production techniques, encouraging risk-taking in a safe, supported learning environment.
- Model sustainability practices: Embed principles of circular economy, material efficiency, and environmentally conscious production into mentoring interactions.
- Facilitate connections: Introduce mentees to networks, industry contacts, or real-world case studies that can expand their opportunities.
- Act as co-learners: Remain open to reverse learning, particularly when younger 3D specialists share insights on software or emerging digital practices.
- Skill Translation: Guiding fashion mentees through the functionalities of 3D modeling software (e.g., Blender, Rhino), slicing software, and the operational principles of various 3D printers (FDM, SLA, SLS).
- Material Guidance: Providing expert advice on the properties of different printing filaments and resins (e.g., flexible TPU, durable PETG, biodegradable PLA) and how their characteristics can mimic or enhance traditional textile properties like drape, texture, and flexibility.
- Prototyping Strategy: Helping mentees develop efficient and effective digital-to-physical prototyping workflows, thereby reducing material waste and accelerating the design iteration cycle.
- Innovation Facilitation: Challenging mentees to think beyond conventional applications by introducing them to advanced concepts like parametric design, generative art, and multi-material printing to create novel aesthetics and functionalities.

2.1.3 Who is a Mentee in this Context?

In this handbook, a mentee is a learner, whether already active in the textile/fashion sector, preparing to enter it, or simply interested in the intersection of fashion and digital innovation, who seeks guidance, skills, and perspective from experienced professionals. Unlike in traditional apprenticeship models where mentees often serve as passive recipients of knowledge, mentees here are active co-participants in a reciprocal exchange. They bring curiosity, practical experience, and fresh perspectives into the mentoring process, contributing to innovation while acquiring new competencies.

Mentees are categorized into four main levels (Chapter 1). Each level has distinct roles, expectations, and needs in relation to 3D design and printing.

First-level mentees (Adult VET learners in the textile and fashion sector, beginners in 3D printing): These mentees need foundational knowledge on how 3D printing can be integrated into their existing textile and fashion practices. They require guidance on basic 3D design principles and applications that will enhance their current skill set. This handbook will provide them with step-by-step instructions and clear examples to help them understand the potential of 3D printing in their industry, allowing them to incorporate these new technologies into their work and expand their creative possibilities.

Second-level mentees (Novice VET learners, preparing to enter the textile and fashion or 3D printing labor market): These mentees are seeking early exposure to the intersection of 3D design and Fashion & Textile. Their main need is to gain a solid understanding of 3D applications and how they can be leveraged in both fields. The handbook will serve as an introduction to key concepts, providing them with the necessary background and practical insights to confidently enter the industry with a strong understanding of 3D technologies. This resource will help them bridge the gap between education and industry practice, ensuring they are well-prepared for their future careers.

Third-level mentees (Professionals in either Fashion & Textile or 3D Design & Printing with some knowledge of the other field): These mentees are experienced professionals who already have a foundation in one field and are looking to expand their expertise by integrating knowledge from the other. They will benefit from the handbook's focus on peer-to-peer learning and its advanced insights into the latest 3D design applications. This resource will enable them to exchange ideas, deepen their skills, and foster collaborations across fields, ultimately enriching their professional development and broadening their perspectives.

Fourth-level mentees (Civilians without professional expertise, interested in learning both fields for future orientation): These mentees are individuals without professional expertise in either domain but are motivated to learn and explore the fundamentals of both Fashion & Textile and 3D Design & Printing. Their need is for an accessible introduction to these fields, providing them with a broad overview of the concepts and possibilities. The handbook will offer them a beginner-friendly approach, helping them gain a basic understanding of both areas and guiding them toward potential future career paths or further studies in these industries.

The handbook will not only give them a basic understanding of these areas but also raise awareness about the fashion and clothing they purchase in their daily lives leading to more personal informed decisions. By exploring the intersection of these fields, they will gain a deeper understanding of the environmental and social impacts of the fashion industry, ultimately encouraging more informed choices in the way they approach fashion and sustainability.

2.1.4 Content Areas to Be Mentored

Mentoring in the fashion & textile and 3D printing ecosystem is not limited to the transfer of isolated skills but covers a wide range of interdisciplinary content areas that prepare learners for digital transformation, sustainability, and innovation. The focus is on hands-on, project-based learning, where mentees engage directly with tools, workflows, and real-world challenges under the guidance of mentors.

Thematic areas can be divided into fashion & textile–specific skills, 3D design and printing skills and shared interdisciplinary topics. Each mentee level engages with these content areas differently, according to their prior knowledge, career stage, and professional objectives.

- *Fashion & Textile Core Content Areas of Demand*

- **Digital Design & CAD Tools**: Introduction to software used for 3D fashion applications (e.g., CLO3D, Rhino, Blender).
- **3D Modeling and Prototyping**: Creating models of garments, accessories, or technical components suitable for additive manufacturing.
- **Additive Manufacturing Basics**: Understanding how printers work, material properties (filaments, resins, bio-based materials), and how textiles interact with rigid/flexible printed parts.
- **Integration into Fashion Workflows**: Applying 3D tools in sample development, mold creation, or customization of fashion accessories.

Table 2.1 Content for Interdisciplinary Mentoring (Fashion & Textile) by Mentee Level

Mentee Level	Suggested Content
First-Level Mentees (Adult professionals in fashion/textile adopting 3D as beginners) *These individuals are professionals already in the fashion/textile sector, so the focus here is on practical applications of 3D design and printing for their existing workflow, including prototyping, materials, and sustainability. They'll learn how to integrate 3D technologies to enhance their processes.*	**Basic 3D Design Skills for Fashion**: Introduction to 3D design tools (e.g., Tinker cad, Fusion 360, Rhino) and basic CAD modeling. **3D Printing for Textile Prototyping:** Using 3D printing for sample development, prototyping accessories like buttons, closures, and trims. **Integration of 3D with Fashion Workflow:** Understanding how 3D printing can be incorporated into the fashion production process (e.g., prototyping, rapid manufacturing). **Sustainability through 3D Printing:** Exploring how 3D printing can reduce waste in the design and production processes, including eco-friendly materials and recyclable components.
Second-Level Mentees (Novice VET learners in Fashion & textile entering the labor market) *These are novice learners entering the fashion and 3D printing fields. The content is designed to introduce them to 3D design and printing basics. The focus is on simple design concepts and sustainability, along with hands-on projects to help them develop basic competencies in using 3D tools.*	**Introductory 3D Design and Modeling:** Basic tutorials on 3D software (e.g., Tinker card, Blender) focused on simple fashion-related designs. **Understanding 3D Printing for Fashion:** An overview of 3D printing technologies and how they are used in the fashion industry (e.g., for accessories, textures, and garments). **Sustainability Concepts in Fashion:** Introduction to how 3D printing can contribute to reducing textile waste and promoting sustainability in the fashion industry. **Hands-on Project:** Design and print a simple accessory (e.g., a button, necklace, or small fashion element) to understand the process from design to production.
Third-Level Mentees (Professionals in Fashion & Textile or 3D Design & Printing with some knowledge and experience of 3D design & printing) *These are experienced professionals in fashion who are looking to expand their skills in 3D design.*	**Advanced 3D Modeling for Fashion:** Mastering CAD software for detailed fashion designs, including creating textures, complex shapes, and hybrid designs (e.g., combining textiles and 3D-printed components). **3D Printing Materials in Fashion:** Exploring different 3D printing materials suitable for fashion design (e.g., flexible filaments, metal, biodegradable plastics). **Advanced Prototyping and Customization:**

Mentee Level	Suggested Content
They need advanced techniques in modeling, customization, and cross-disciplinary projects that integrate both fashion and 3D printing, with a focus on sustainability and innovation.	Techniques for creating custom 3D-printed elements for fashion pieces (e.g., bespoke accessories, fabric manipulation with 3D printing). **Sustainable Design with 3D Printing:** Deep dive into circular design principles, sustainable fashion, and how 3D printing can reduce textile waste. **Collaborative and Cross-Disciplinary Projects:** Mentoring and collaboration with 3D printing professionals to develop integrated fashion products, fostering innovation and exchange.
Fourth-Level Mentees (Civilians and non-professionals) *These are non-professional civilians who need basic skills in 3D design and printing, focused on hands-on, beginner-level projects. There's a focus on sustainability and the future of fashion, helping them understand how 3D printing can influence consumer choices and the broader fashion industry.*	**Introduction to 3D Design & Printing:** Basic tutorials on 3D modeling and printing software (e.g., Tinkercad, Blender), focused on creating simple fashion-related objects. **Sustainability Awareness in Fashion:** Understanding how 3D printing can offer solutions for sustainable fashion (e.g., using recycled materials for fashion accessories). **Hands-on 3D Printing Projects:** Creating small fashion-related items like keychains, buttons, and jewelry using beginner-level 3D printing tools. **Consumer Awareness of Fashion and Technology:** Understanding the role of 3D printing in transforming the fashion industry, including its environmental impact and potential for future applications.

- *3D design and Printing Core Content Areas of Demand*

For mentees from the 3D design and printing field, mentoring must focus on bridging their technical proficiency with the nuanced, often tacit, knowledge of the fashion and textile industry. The content should be tailored to immerse them in the creative, material, and commercial realities of fashion, moving them from being skilled operators to insightful collaborators. Key thematic areas for mentoring include:

- **Textile Behavior and Materiality:** This is the most critical area. Mentees need to move beyond the properties of plastic filaments to understand concepts like fabric drape, weight, elasticity, and "hand-feel". Mentoring should cover how to analyze traditional textiles and then translate those characteristics into digital models and printing strategies. For instance, using flexible materials like TPU with specific infill patterns to mimic the stretch of knitwear.

- **Garment Construction and Pattern Making:** A 3D designer may be able to model a complex shape, but without understanding how clothes are constructed to fit the human body, their creations will remain sculptural rather than wearable. Mentoring must cover the principles of 2D pattern making, draping, seam placement, and sizing, and then explore how these can be reinterpreted or even bypassed through 3D printing directly onto a body scan or mannequin form.

- **Design Aesthetics and Fashion Theory:** Technical mentees often approach design from a purely functional or geometric perspective. Mentoring in this area should introduce them to fashion history, design movements, trend cycles, and the role of narrative and emotion in creating a collection. This provides the cultural and artistic context needed to ensure their technical contributions are relevant and meaningful.

Table 2.2 Content for Interdisciplinary Mentoring (3D Design & Printing) by Mentee Level

Mentee Level	3D Design & Printing Content Topics
First-Level Mentees *(3D design adult VET learners at any career level transitioning into fashion/textile)* *These are adult learners who are already skilled in 3D design but are now transitioning into fashion and textile. The focus is on introducing them to fashion design principles, understanding 3D design for fashion accessories, and learning about sustainable fashion practices through 3D printing.*	**Introduction to Fashion & Textile Concepts:** Basic understanding of fashion design principles, garment construction, and textile materials. **3D Design for Fashion Accessories:** Introduction to creating 3D models for fashion-related elements such as buttons, clasps, and small accessories. **Basic 3D Printing Technologies:** Understanding the different types of 3D printing technologies (e.g., FDM, SLA) and how they are used for fashion prototypes. **Sustainability and Circular Design in Fashion:** Exploring how 3D printing can reduce textile waste, and using recycled or sustainable materials for fashion designs. **Hands-on Project:** Design and print a simple fashion accessory (e.g., button, brooch) and learn the basics of 3D printing in a fashion context.
Second-Level Mentees *(Novice VET learners in 3D wishing to enter the fashion labor market)* *These learners are new to 3D design and are entering the fashion sector. They will focus on the foundational skills*	**Basic 3D Design Skills for Fashion:** Introduction to CAD software and simple 3D modeling techniques focused on fashion accessories and textile design. **Introduction to Fashion Design Workflow:** Learn how to incorporate 3D printing into the fashion production process (e.g., prototyping, small-scale production). **3D Printing for Sustainable Fashion:** Introduction to how 3D printing can be used to create eco-friendly

Mentee Level	3D Design & Printing Content Topics
needed to combine 3D printing with fashion design, starting with simple projects that introduce them to the fashion workflow and sustainability.	fashion solutions, including reducing waste in production. **Basic Fashion and Textile Materials:** Overview of different materials used in both 3D printing and fashion, focusing on flexible filaments and sustainable options for accessories and garments. **Hands-on Project:** Create a simple, wearable fashion accessory using 3D printing techniques (e.g., ring, necklace, small garment accessory).
Third-Level Mentees *(Professionals in Fashion & Textile with some knowledge in 3D design)* *These are professionals with experience in either fashion or 3D design but are looking to integrate the two fields. The content focuses on advanced design techniques, such as combining 3D printed elements with textiles, and exploring material science, hybrid fashion items, and collaborative projects.*	**Advanced 3D Fashion Design Techniques:** Mastering CAD for more detailed and complex designs, such as integrating 3D printed elements into garments (e.g., 3D-printed lace, structural elements for clothing). **Material Science for Fashion 3D Printing:** In-depth study of 3D printing materials (e.g., PLA, TPU, nylon) and their application in fashion design, including selecting the right material for fashion accessories or garments. **Hybrid Fashion Items:** Learning how to combine traditional textile materials with 3D printed components to create innovative fashion designs (e.g., 3D-printed fasteners, accessories, or embellishments). **Sustainability in 3D Fashion Design:** Exploring circular design principles and how to integrate eco-friendly 3D printing into fashion collections. **Collaborative Fashion Projects:** Collaborating with fashion designers to create collections that incorporate both traditional textiles and 3D printed elements, fostering innovation. **Hands-on Project:** Develop a fashion prototype that integrates 3D-printed elements with fabrics or other materials and prepare it for small-scale production.
Fourth-Level Mentees *(Civilians or non-professionals wanting to explore fashion and 3D design)* *These are non-professionals or civilians who are new to both fashion and 3D design. The focus is on introducing them to*	**Introduction to Fashion Design and 3D Printing:** Basic understanding of fashion design, textile materials, and how 3D printing can be applied to fashion. **Introductory 3D Modeling for Fashion Accessories:** Learn basic 3D design techniques to create simple fashion items like buttons, small jewelry pieces, and other fashion-related accessories. **Sustainability in Fashion through 3D Printing:** Understanding how 3D printing can contribute to

Mentee Level	3D Design & Printing Content Topics
the basics of both fashion design and 3D printing, along with a hands-on project to help them explore the possibilities of 3D printed fashion accessories.	sustainable fashion practices by reducing waste and promoting the use of recycled materials. **Hands-on Project:** Create and print a simple fashion-related item (e.g., a keychain, button, or small jewelry piece) to explore 3D design and printing in the fashion context. **Exploring Future Trends in Fashion & 3D Printing:** Understanding how 3D printing is shaping the future of fashion, from sustainable design practices to on-demand manufacturing.

- *Shared Interdisciplinary Topics Shared Interdisciplinary Topics*

- **Sustainability**: Exploring how 3D printing reduces material waste, supports circular fashion, and enables recyclable/reusable product designs. This involves discussing the lifecycle of both textiles and 3D printing materials. Content should cover circular design principles, designing for disassembly, and exploring bio-based or recycled filaments. This directly aligns with the development of Green Skills as defined in frameworks like ESCO (European Skills, Competences, Qualifications and Occupations).

- **Product Development Cycles**: Understanding the transition from idea to prototype to production, and how 3D printing accelerates this cycle.

- **Prototyping Workflows**: Applying iterative design thinking and testing products at multiple stages.

- **Co-creation Techniques and Prototyping Workflows:** Mentoring should focus on practical methods for collaboration. This includes using shared digital platforms, establishing clear communication protocols, and developing integrated prototyping workflows where digital simulations and physical 3D prints are used iteratively to refine a design.

2.2 Special Concerns for Mentors

Mentoring in the fashion–textile and 3D printing context (Four groups of mentors in Chapter 1) carries unique challenges and opportunities. While mentors are positioned to support innovation and sustainability, they often encounter gaps in knowledge, mismatched expectations, and resource constraints. This section outlines the main concerns mentors face, and suggests strategies, tools, and activities to tackle them effectively.

Table 2.3 Opportunities and Strengths for Mentors

Opportunity	Strategy	Activity / Resource	Mentor Group
Reverse Learning	Mentors can learn new digital skills and gain insights from digitally native mentees.	**Activities**: Joint tutorials on CAD tools (CLO3D, Rhino, Blender) where mentor and mentee learn side-by-side. **Resources**: Open-source training videos, digital glossaries.	**Group 1-4**: All mentor groups can benefit from learning from digitally native mentees (especially for those from Fashion & Textile).
Professional Visibility	Mentors can position themselves as leaders in sustainable digital innovation.	**Activities**: Create collaborative projects that showcase sustainable fashion designs using 3D printing. **Resources**: Sustainability info packs (EU Green Deal, Circular Economy).	**Group 1-4**: All groups, especially **Group 3 and 4**, can build professional credibility in both sectors.
Networking Growth	Mentors can expand collaborations across disciplines and industries.	**Activities**: Interdisciplinary networking events and joint fashion-3D print challenges. **Resources**: Collaboration platforms like Miro boards, shared drives.	**Group 1-4**: Beneficial for all mentor groups, especially **Group 2 and 3**, as it helps connect tech and fashion professionals.
Innovation Catalysts	Mentors can foster innovation by testing prototypes in a low-risk, mentoring-driven environment.	**Activities**: Prototype design workshops focusing on rapid prototyping with feedback loops. **Resources**: Pre-prepared mentoring toolkits with exercises.	**Group 2-4**: Especially for **Group 3 and 4**, working on collaborative projects to innovate and build prototypes.
Pioneering New Aesthetics	Mentors have the opportunity to co-create entirely new forms of textiles and garments that are impossible to produce with traditional methods.	**Activities**: Mentors and mentees can design new fashion concepts integrating 3D printing techniques. **Resources**: Access to digital 3D printing software, fabric simulation tools.	**Group 2 and 3**: These mentors can leverage their advanced knowledge to work with mentees in both tech and fashion sectors to create innovative designs.

Opportunity	Strategy	Activity / Resource	Mentor Group
Driving Sustainability	Mentors can introduce practices like on-demand manufacturing, zero-waste design, and the use of innovative, sustainable materials.	**Activities**: Develop mentoring projects that focus on sustainability (e.g., using recycled materials for 3D printing). **Resources**: Sustainability guidelines and case studies (e.g., circular fashion).	**Group 3 and 4**: Mentors with deeper industry experience in either fashion or 3D printing can combine expertise to promote sustainability.
Professional Growth	Mentoring fashion professionals forces tech mentors to think more creatively and user-centrically, expanding their skill sets.	**Activities**: Cross-disciplinary workshops where 3D printing experts gain insights into fashion design and vice versa. **Resources**: Reflection guides and cross-industry learning materials.	**Group 4**: Especially for **Group 4** mentors in 3D printing, learning from fashion experts will foster personal growth and broaden their skill set.

Table 2.4 Mentoring Concerns/ Challenges & Solutions

Challenge & Risk	Solution	Strategy	Main Mentor Groups
1.Digital Knowledge Gap: Many fashion/textile experts (especially Group 1 mentors) have limited experience with 3D modeling or additive manufacturing. **Risk**: Mentees with stronger digital skills may reverse the power dynamic, leaving mentors feeling underprepared.	Acknowledge knowledge gaps openly and model lifelong learning. Encourage co-creation by letting mentees lead areas where mentors are less confident.	**Strategy**: Joint tutorials on CAD tools (CLO3D, Rhino, Blender), where mentor and mentee learn side-by-side. **Resources**: Open-source training videos, digital glossaries, and terminology guides.	**Group 1** (Early career fashion mentors) **Group 2** (Mid-career fashion mentors) **Group 4** (3D mentors)
2.Sustainability Integration: Difficulty embedding sustainability into practical mentoring	Frame each project around resource efficiency or recyclability. Use	**Strategy**: Use case studies on eco-friendly filaments and circular product design.	**Group 3** (Advanced fashion mentors)

Challenge & Risk	Solution	Strategy	Main Mentor Groups
sessions despite it being a priority. **Risk**: Discussions may remain abstract, with no tangible eco-friendly outcomes.	real-world examples of eco-friendly materials and sustainable fashion innovations.	**Activity**: Require each mentoring project to highlight a sustainability benefit, such as reducing waste or material reuse.	**Group 4** (3D mentors)
3. Resource Constraints: Limited access to 3D printers, materials, or updated CAD software in many VET and SME environments. **Risk**: Mentoring may stay theoretical, with fewer hands-on results and real-world applications.	Use virtual prototyping and develop low-cost prototyping exercises. Encourage working with recycled materials or smaller print sizes.	**Strategy**: Organize virtual prototyping sessions using CAD software before physical printing. **Resources**: Encourage the use of open labs, fablabs, and university hubs for 3D printing access.	**Group 2** (Mid-career fashion mentors) **Group 4** (3D mentors)
4.Interdisciplinary Communication Barriers: Fashion/textile mentees may struggle with digital terminology, while 3D printing mentees may overlook fabric-specific challenges (e.g., flexibility, drape). **Risk**: Misalignment of expectations, slow project progress, and potential confusion.	Adapt language to bridge fashion and digital terminologies using analogies, visual aids, and prototypes.	**Strategy**: Create joint glossaries during mentoring sessions. **Activity**: Conduct role-reversal workshops where fashion mentees explain textile concepts, and 3D mentees explain modeling techniques.	**Group 1** (Early career fashion mentors) **Group 3** (Advanced fashion mentors) **Group 4** (3D mentors)
5.Time and Workload Pressure: Mentors often manage tight production deadlines or teaching schedules. **Risk**: Inconsistent mentoring engagement or	Plan short, focused mentoring sessions with clear objectives. Use collaborative tools for asynchronous progress tracking.	**Strategy**: Organize mentoring sprints (2–3 focused sessions) around micro-prototypes. **Resources**: Pre-prepared mentoring toolkits with exercises, reading	**Group 2** (Mid-career fashion mentors) **Group 4** (3D mentors)

Challenge & Risk	Solution	Strategy	Main Mentor Groups
"rush" sessions lacking depth.		packs, and templates. Use platforms like Miro boards and shared drives for flexible collaboration.	
6.Communication Gap in Technical Language: 3D printing mentors may struggle to translate complex technical terms into understandable language for fashion designers. **Risk**: Mentors risk creating confusion if they cannot explain 3D terms in ways that are meaningful to fashion mentees.	Develop a shared visual glossary or a "library" of printed swatches, linking technical terms with fashion terminology.	**Strategy**: Co-create a glossary during sessions. Use visual aids, analogies, and prototypes to bridge the gap between digital and fashion languages.	**Group 4** (3D mentors)
7. Lack of Aesthetic Sensibility: 3D printing mentors may lack a trained eye for fashion aesthetics, proportions, and silhouette. **Risk**: The resulting designs may be technically impressive but aesthetically unappealing.	Focus on integrating the mentor's technical expertise with the mentee's fashion knowledge.	**Strategy**: Encourage reverse mentoring: 3D printing mentors can learn fashion design principles from their mentees (e.g., pattern making, silhouette, draping). **Activity**: Conduct hands-on workshops where 3D mentors assist fashion mentees in creating wearable 3D-printed accessories.	**Group 4** (3D mentors)
8.Resistance to Change in Fashion Industry: Fashion professionals may resist the adoption of new technologies like 3D printing, viewing them as "plastic" or inauthentic.	Emphasize the potential for innovation in fashion through 3D printing and its role in sustainability and	**Strategy**: Use case studies of successful 3D-printed fashion lines or accessories. Showcase examples of how 3D printing can solve traditional fashion challenges	**Group 1** (Early career fashion mentors) **Group 2** (Mid-career fashion mentors)

Challenge & Risk	Solution	Strategy	Main Mentor Groups
Risk: Fashion mentees may be hesitant to embrace 3D technologies, slowing the mentoring process.	future fashion trends.	(e.g., waste reduction, customization).	
9. Pace Mismatch: The fast-paced iterative cycle of 3D technology may clash with the slower, longer-term planning cycles of the fashion industry. **Risk**: The mentor-mentee relationship may become strained due to differences in work tempo.	Develop clear timelines that match both fashion design and 3D printing cycles.	**Strategy**: Plan short-term mentoring sprints focused on micro-projects that align with fashion's seasonal cycles. Use digital collaboration platforms to keep mentees aligned with timelines.	**Group 4** (3D mentors)

2.3 Special Concerns for Mentees

The mentee groups in this context (as mentioned in Chapter 1) are: **First-Level Mentees** (Fashion) are adult VET learners with a background in textiles or fashion but limited exposure to 3D printing. **Second-Level Mentees** (Novices) are beginners in both fields, still preparing to enter the labor market and seeking early exposure to 3D applications in fashion and textiles. **Third-Level Mentees** (Community Participants) are professionals with experience in either fashion or 3D printing, eager to expand their knowledge by exchanging insights across both areas. Finally, **Fourth-Level Mentees** (Civilians) are individuals without professional expertise but motivated to explore both fields to better understand their potential career opportunities.

These mentees face both unique challenges and promising opportunities as they bridge two very different worlds. Those coming from the fashion and textile sectors, especially at the first and second levels, often have practical experience with traditional materials, production processes, and design techniques but lack familiarity with the technical side of 3D design and printing. On the other hand, mentees from the 3D printing sector, particularly at the first and second levels, bring strong digital and technical skills but may struggle to apply them effectively within the context of fashion design, where creativity, aesthetics, and material properties play a central role. At the third and fourth levels, professionals and novices alike are eager to expand their knowledge and gain practical exposure to how their respective disciplines can intersect and collaborate.

Mentoring provides these mentees with the **opportunity** to expand their skills across disciplines, learn new techniques, and gain a more comprehensive understanding of both the technical and creative dimensions of their respective fields. First-level mentees from fashion can deepen their understanding of 3D applications in their designs, while second-level mentees, whether from fashion or 3D printing, can explore new career pathways with a broader range of technical and creative tools. Third-level mentees benefit from peer-to-peer learning, sharing expertise in both fields and refining their skills in sustainability, innovation, and interdisciplinary problem-solving. Fourth-level mentees, without professional expertise in either field, can immerse themselves in foundational knowledge, exploring the potential of both fashion and 3D printing to open doors for future careers in these areas.

Table 2.5 Concerns/ Challenges & Solutions for Mentees

Challenge & Risk	Solution	Strategy	Mentee Groups
1. Limited Understanding of Fashion/Textile Contexts *Risk:* 3D-oriented mentees may design digitally appealing objects that fail in real-life usability (too rigid, non-wearable).	Engage directly with fashion environments through observation and co-creation.	**Activity:** Shadow a fashion designer or attend garment construction workshops. **Resource:** Illustrated guides on fabrics and garment behavior. **Task:** Redesign an existing 3D item (e.g., clasp, trim) to improve comfort and wearability.	2nd-level, 3rd-level
2. Underestimating Aesthetic and Functional Requirements *Risk:* Over-focus on technical feasibility leads to prototypes that lack style or consumer relevance.	Combine design thinking with technical prototyping.	**Activity:** Co-create with mentors on accessory or trim designs. **Task:** Produce two prototypes — one prioritizing function, one aesthetics — and evaluate together. **Resource:** Case studies on 3D-printed fashion (e.g., Iris van Herpen).	1st-level, 2nd-level
3. Difficulty Understanding Sustainability in Fashion *Risk:* Mentees may equate "efficiency" with	Introduce sustainability as a design principle, not an afterthought.	**Activity:** Workshop on circular fashion and eco-friendly filaments. **Task:** Create a prototype using biodegradable or recycled	1st-level, 2nd-level, 3rd-level

Challenge & Risk	Solution	Strategy	Mentee Groups
"sustainability," missing broader ecological frameworks.		filament and document its environmental impact. **Resource:** EU Green Deal briefs, Ellen MacArthur Foundation reports.	
4. Communication Barriers Between Disciplines *Risk:* Misunderstandings of fashion or technical jargon lead to confusion and slow progress.	Build shared interdisciplinary language and visual references.	**Activity:** Joint glossary-building with mentors. **Task:** Translate one technical 3D process into fashion language (and vice versa). **Resource:** Shared Miro/Padlet boards for visual cross-references.	2nd-level, 3rd-level, 4th-level
5. Over-Reliance on Technology *Risk:* Assuming 3D printing can replace all traditional processes, leading to poor or wasteful outcomes.	Learn the limits of 3D technology through comparative practice.	**Activity:** Discuss "When not to 3D-print." **Task:** Document cases where sewing or traditional finishing yields better results. **Resource:** Comparative studies on hybrid fashion production.	1st-level, 2nd-level
6. Lack of Material Empathy *Risk:* Failure to grasp tactile, flexible, and sensory aspects of textiles.	Practice "learning by touch."	**Activity:** Handle and compare fabrics in workshops or fabric stores. **Task:** Create a 3D accessory that complements — not replaces — textile softness. **Resource:** Fabric behavior charts and textile samples.	2nd-level, 4th-level
7. Creative Blinders (Technical over Artistic Thinking) *Risk:* Mentees focus on machine capability, not design storytelling or user comfort.	Introduce artistic thinking and user-centered design.	**Activity:** "Think Like a Designer" session — relate every technical choice to a concept or narrative. **Task:** Present design rationale linking aesthetics, comfort, and sustainability.	1st-level, 2nd-level

Challenge & Risk	Solution	Strategy	Mentee Groups
8. Isolation from the Fashion Market *Risk:* Mentees fail to understand trends, target consumers, and commercial feasibility.	Immerse in fashion culture and consumer behavior.	**Activity:** Attend fashion exhibitions, local shows, or online trend webinars. **Task:** Develop a mood board reflecting a fashion season's aesthetic. **Resource:** Trend databases (e.g., WGSN).	1st-level, 3rd-level
9. Difficulty Integrating into Traditional Teams *Risk:* Mentees may clash with design teams unfamiliar with digital workflows.	Foster collaborative and reflective teamwork.	**Activity:** Peer-learning circles to share digital tools with traditional designers. **Task:** Co-present hybrid workflows at mentoring meetings.	1st-level, 3rd-level
10. Misapplication of Skills (Unwearable Designs) *Risk:* Overly complex pieces that look innovative but cannot be worn or produced feasibly.	Test prototypes through embodied practice.	**Activity:** "Wearability Challenge" — wear or test the item for a day. **Task:** Revise design based on comfort and durability feedback. **Resource:** Guides on ergonomics and wearable design.	2nd-level, 3rd-level
11. Risk of Being Pigeonholed as a Technician *Risk:* Mentees seen only as machine operators rather than creative contributors.	Promote creative authorship in projects.	**Activity:** Present design rationale and aesthetic intentions in final showcases. **Task:** Co-sign design files with mentors as "co-creators."	1st-level, 3rd-level
12. Limited Confidence or Intimidation (Especially for Novices & Civilians) *Risk:* Passive learning and dependence on mentors hinder skill growth.	Build confidence through small, guided achievements.	**Activity:** Step-by-step "micro-project" approach (e.g., print a personalized brooch). **Task:** Reflect on learning progress using a self-assessment log.	2nd-level, 4th-level

Challenge & Risk	Solution	Strategy	Mentee Groups
13. Uneven Digital Skills Across Groups *Risk:* Novices and civilians may struggle with CAD tools, slowing project progress.	Scaffold learning using peer-to-peer and mentor support.	**Activity:** Digital skill mini-tutorials co-led by advanced mentees. **Resource:** Open-source software tutorials (Blender, TinkerCAD).	2nd-level, 4th-level
14. Resistance to Experimentation *Risk:* Mentees fear failure or "ruining" materials, limiting creativity.	Normalize experimentation through reflective practice.	**Activity:** "Prototype, Fail, Reflect" sessions. **Task:** Keep a design logbook noting lessons from errors.	1st-level, 2nd-level, 4th-level

2.4 Special Concerns for the Institutions and their Environment

2.4.1 Institutional Challenges and Opportunities for fashion & textile

Mentoring in the fashion and textile sector exists within a complex ecosystem where tradition, creativity, and rapid technological transformation converge. Institutions play a decisive role in shaping how mentorship is structured and how effectively it responds to the evolving needs of students and industry. While artisanal heritage remains a pillar of identity, schools and universities must adapt to the pressures of digitalization, sustainability imperatives, and global market competitiveness. These tensions generate both structural challenges and significant opportunities for mentoring frameworks.

One of the clearest examples is the Institut Français de la Mode (IFM) in Paris. IFM's strengths lie in its proximity to haute couture houses and its recognition as a training ground for elite designers. Students benefit from access to highly skilled trainers and mentors embedded in the luxury ecosystem. Yet, even in such an institution, challenges remain: mentoring is often tied to traditional studio practices, while integration of digital skills such as CLO3D simulation, AI-based trend forecasting, and blockchain for traceability is still uneven. As a result, mentors can sometimes prepare students for craft excellence but leave them less prepared for hybrid roles demanded by global fashion markets.

Another case is Polimoda in Florence, which has actively attempted to bridge this gap. The school has invested in digital labs, collaborative projects with Adobe, and international mentoring exchanges. Trainers receive continuous professional development in emerging tools, ensuring they can mentor students across both traditional and digital domains. Polimoda's model shows how proactive institutional strategy can transform mentoring from an add-on into a structured driver of competitiveness.

Smaller institutions often face sharper constraints. Regional fashion schools in Italy, Spain, or Greece typically operate with outdated equipment, heavy staff workloads, and limited access to international networks. Here, mentoring risks becoming an informal activity squeezed between teaching obligations. Moreover, equity issues are critical: women, students from migrant backgrounds, and first-generation learners often lack access to mentors with industry networks. The absence of structured mentoring programs reinforces inequalities and limits the diversity of voices in the industry. SOFFA in Athens offers a counter-example: by training marginalized groups through mentoring in circular textiles, it demonstrates how equity-focused programs can strengthen both social inclusion and innovation capacity.

The following table (Table 2.6) presents a SWOT analysis outlining the internal and external factors that shape how fashion and textile institutions engage with 3D printing and digital design within their mentoring frameworks. It highlights how traditional strengths—such as artisanal heritage, creative excellence, and strong industry connections—coexist with structural weaknesses like outdated infrastructure, rigid curricula, and limited digital capacity. At the same time, growing opportunities linked to EU funding, sustainability goals, and partnerships with innovation hubs contrast with external threats such as rapid technological change, underinvestment, and talent migration. Together, these dynamics illustrate the complex environment in which institutions must evolve to ensure mentoring remains relevant, inclusive, and future-oriented.

Table 2.6 Institutional SWOT Matrix — Fashion & Textile Mentoring in the 3D Design & Printing Context

INTERNAL FACTORS	**Description / Relevance to 3D Printing & Design Mentoring**
Internal dimension focuses on how *institutions themselves* (schools, VET centers, universities) manage mentoring quality, staff upskilling, and digital readiness.	
Strengths	**Deep artisanal and heritage knowledge**: Fashion schools (e.g., IFM, Polimoda) preserve craft excellence and tacit know-how valuable for translating digital design into tangible garments. **Strong creative identity and cultural capital**: European institutions retain global recognition, giving credibility to mentoring programs integrating new technologies. **Experienced mentors with industry links**: Trainers have established networks that can bridge 3D printing pilots with high-end production partners.

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	Emerging digital initiatives: Leading institutions (e.g., Polimoda's digital labs, CLO3D training) are pioneering blended learning models where traditional couture meets additive manufacturing. **Institutional openness to EU innovation funding**: Participation in Erasmus+, Horizon Europe, and ESF+ projects supports experimentation with 3D design tools, sustainability, and digital pedagogy.
Weaknesses	**Outdated infrastructure in regional schools**: Limited access to 3D printers, CAD licenses, and digital fabrication labs restrict hands-on mentoring possibilities. **Overloaded teaching staff**: High workloads reduce the time available for personalized mentoring and digital skill updating. **Rigid or siloed curricula**: Slow integration of interdisciplinary topics (e.g., digital fabrication, sustainability, data-driven design) limits responsiveness to industry change. **Equity and inclusion gaps**: Marginalized learners often lack mentors with access to tech-based networks, reinforcing social and gender disparities. **Uneven mentor digital literacy**: Many traditional trainers lack confidence with software such as Blender, Rhino, or CLO3D, making 3D mentorship dependent on external experts.
EXTERNAL FACTORS	**Description / Relevance to 3D Printing & Design Mentoring**
External dimension highlights the ecosystem pressures and opportunities emerging from policy, market trends, and global digital transitions.	
Opportunities	**Rising demand for hybrid professional profiles**: The market increasingly seeks designers who merge craftsmanship, digital fluency, and sustainability — directly supporting mentoring reforms. **EU and regional funding for digital and green transitions**: Erasmus+, Horizon Europe, and Creative Europe calls finance institutional mentoring, equipment upgrades, and staff training in 3D innovation. **Partnership potential with fablabs, accelerators, and creative hubs**: Collaboration with entities like TextileLab Amsterdam or Fashion Technology Accelerator Milan expands access to 3D infrastructure and innovation ecosystems. **Sustainability and circular fashion trends**: Institutional alignment with the EU Textile Strategy 2030 can make 3D printing a tool for material efficiency, recycling, and traceability (e.g., blockchain tagging). **Internationalization of mentoring**: Virtual and blended mobility projects facilitate cross-border mentor exchanges and joint digital prototyping.

Threats	**Rapid technological obsolescence**: Constant software and hardware evolution risks leaving institutions behind if continuous investment is lacking. **Underinvestment and budget constraints**: Public and regional schools struggle to finance 3D infrastructure compared to private accelerators or design incubators. **Talent drain to global tech-fashion hubs**: Skilled mentors and students migrate to cities with stronger innovation ecosystems (London, New York, Berlin). **Fragmentation of mentoring quality**: Informal or ad-hoc mentoring persists without institutional frameworks, producing inconsistent learning outcomes. **Commercial competition from private accelerators**: Industry-linked incubators deliver faster, market-driven 3D mentoring models, potentially sidelining academic institutions.

The following table builds on the previous SWOT analysis and translates each dimension—internal and external —into concrete institutional actions aimed at helping fashion and textile schools, VET centers, and universities strengthen their mentoring systems in relation to 3D printing, sustainability, and digital transformation.

Table 2.7 Strategic Adaptation of Fashion & Textile Institutes to 3D Design & Printing.

SWOT Dimension	Institutional Action / Strategic Response	Expected Impact on Mentoring and Learning
Leverage Strengths	-Integrate *heritage craftsmanship* with digital prototyping through "craft–tech" mentoring labs. -Use established industry networks to involve external 3D design experts and sustainable material suppliers as guest mentors. -Promote cross-disciplinary mentoring between traditional ateliers and digital fabrication units. -Investing in trainer upskilling: Mentors need confidence in digital prototyping, AI forecasting, and sustainability frameworks.	-Strengthens hybrid skills and preserves cultural identity while fostering digital fluency. -Expands mentor expertise and relevance to new industry roles.

Address Weaknesses	-Invest in shared 3D printing hubs and open digital labs accessible to smaller institutions. - Introduce digital bootcamps and micro-credentials for staff upskilling (CAD, CLO3D, Rhino, sustainability tools). -Revise curricula to embed mentoring modules that link fashion design, additive manufacturing, and sustainability challenges. -Establish equity-focused mentoring pathways for under-represented learners. - Creating exchange programs: Linking fashion schools with engineering faculties or international hubs enriches mentoring perspectives	-Reduces digital skill gaps among mentors and students. -Makes mentoring more structured, inclusive, and technologically relevant. -Breaking Down Barriers to Technology For disadvantaged groups, access to advanced technologies like 3D printers and design software might be limited due to financial or infrastructural constraints. A structured mentoring program can provide access to necessary tools, training, and knowledge on how to use them effectively, leveling the playing field.
Exploit Opportunities	-Participate in EU innovation partnerships (Erasmus+, Horizon Europe, Interreg) to fund mentoring exchanges and infrastructure. -Formalize collaborations with fablabs, creative hubs, and accelerators to share technology and expertise. -Align mentoring outcomes with EU Textile Strategy 2030 goals—traceability, recyclability, and digital passports for garments. -Create joint mentorship residencies with industry partners for experiential learning. E.g., Developing public-private partnerships: Joint labs financed by municipalities, chambers of commerce, or fashion houses can reduce the burden of infrastructure costs.	-Enhances institutional visibility and competitiveness. -Positions mentoring as a driver of sustainability, innovation, and employability.

Mitigate Threats	-Implement continuous technology scanning and annual reviews to keep pace with 3D innovations. -Diversify funding sources (private sponsorships, innovation vouchers) to counter underinvestment. -Develop talent retention incentives and cross-border mentoring networks to reduce brain drain. -Establish quality assurance frameworks for mentoring that ensure consistency across partner institutions. -Embedding equity into mentoring: Structured schemes for women, migrants, and disadvantaged students expand access and strengthen diversity in the industry.	- Builds long-term institutional resilience. -Prevents obsolescence and ensures quality mentoring aligned with European innovation ecosystems. -Empowerment and Confidence Building -Increased Access and Inclusivity

2.4.2 Institutional Concerns for 3D Design & Printing

Institutions focused on 3D design and digital fabrication occupy a distinctive position within the educational and innovation ecosystem. Often perceived as avant-garde spaces where technology and creativity converge, these labs promise rapid prototyping, experimentation, and interdisciplinarity. Yet beneath their innovative image lie persistent structural and pedagogical challenges that shape how mentoring unfolds.

This institutional context mirrors that of the fashion and textile institutions, which also face challenges in bridging heritage with digital innovation. Both institutional types must overcome resource constraints and pedagogical silos to foster a truly interdisciplinary environment.

Rapid technological change remains one of the central challenges. 3D design tools, hardware, and software evolve quickly, forcing institutions to update equipment and pedagogical practices frequently. Instructors must therefore balance two demanding roles: providing students with practical training on existing tools while keeping themselves abreast of new ones.

Pedagogical imbalances often emerge in this context. Many students excel in operating software and machines but lack soft skills such as communication, critical thinking, or user-centered design. This gap between technical proficiency and market or cultural understanding results in professionals who can execute but not conceptualize—undermining the transformative potential of mentoring.

Exposure to traditional product development workflows is another missing link. Students from engineering or digital fabrication backgrounds often overlook processes central to creative sectors like fashion or crafts. Conversely, design and fashion students rarely gain hands-on mentoring in the technical aspects of production. The result is a fragmented educational experience where the technical and creative dimensions fail to meet. Bridging this divide is crucial for cultivating holistic professional development.

The issue of disciplinary siloing compounds these problems. Engineering labs frequently operate in isolation from art schools or business faculties, limiting opportunities for interdisciplinary mentoring. A student may graduate with impeccable technical mastery but minimal exposure to product development, branding, or material culture. Conversely, fashion or design students may never interact with engineers in structured mentoring environments. Institutions like TextileLab Amsterdam, which deliberately integrate craft traditions with digital fabrication, demonstrate how crossing disciplinary boundaries can create fertile ground for mentoring innovation.

Inclusivity represents another dimension of this challenge. Women and other underrepresented groups remain a minority in technical fields such as engineering, product design, and digital fabrication. Mentoring frameworks must therefore ensure that these groups are actively supported, visible, and empowered. Creating inclusive, gender-aware, and diversity-oriented mentoring ecosystems is essential to sustain innovation that truly reflects society's pluralism.

- *Strategies to Strengthen Mentoring Capacity in 3D Printing Institutions*

1. Build Cross-Disciplinary Partnerships

- **Bridge digital and traditional industries:** Collaborate with sectors such as textiles, ceramics, crafts, and fashion to create shared mentoring pathways that connect physical and digital workflows.

- **Engage business and management faculties:** Link design and engineering programs with entrepreneurship courses so students understand market dynamics, product lifecycles, and commercialization strategies.

- **Encourage joint mentoring sessions:** Adopt the model used by Politecnico di Milano, where engineering and fashion faculties co-mentor students, ensuring both technical and creative feedback.

- **Integrate with fashion institutions:** As seen in the TextileLab Amsterdam approach, combining digital fabrication with traditional craft enhances cultural relevance and interdisciplinary collaboration.

2. Create Inclusive and Diverse Mentoring Environments

- **Promote diversity at all levels:** Include varied genders, nationalities, and professional backgrounds among mentors and students.

- **Ensure equitable mentoring access:** Develop programs and scholarships encouraging women and underrepresented groups to enter technical fields.
- **Mentoring for empowerment:** Use mentoring as a mechanism to promote inclusion, confidence, and long-term career development.

3. Focus on Real-World Problem-Solving

- **Co-create with external stakeholders:** Partner with hospitals, fashion houses, design studios, and sustainability-driven companies to ensure mentoring is rooted in practical, socially relevant challenges.
- **Industry-connected learning:** Encourage live projects such as prototyping medical devices, wearable technology, or 3D-printed textiles, where students receive feedback directly from professionals.
- **Sustainability as a mentoring axis:** Integrate projects that address material waste reduction, circular design, and distributed manufacturing, reinforcing ethical and environmental responsibility.

4. Leverage Open-Source Tools and Knowledge Sharing

- **Use open platforms:** Adopt free slicing software, Git repositories, and parametric modeling toolkits to reduce costs and ensure broad access to learning materials.
- **Support mentorship continuity:** Open-source tools allow effective mentoring even in resource-constrained environments, ensuring scalability and inclusiveness.
- **Encourage collaborative innovation:** Shared repositories and peer-to-peer exchanges help mentors and students co-develop solutions while maintaining transparency and accessibility.

2.4.3 Resources for Institutions

Fashion and textile institutions today operate in an increasingly interconnected ecosystem where tradition, technology, and sustainability converge. To remain competitive and relevant, they must strategically engage with the diverse European and global resources that support mentoring, digital transformation, and cross-disciplinary collaboration. These resources can be grouped into four main categories: funding programs, innovation networks, training platforms, and institutional partnerships.

Funding programs such as Erasmus+, Horizon Europe, and the Single Market Program (SMP) represent the financial backbone of institutional renewal. They support staff training, student mobility, and the establishment of mentoring models that combine craftsmanship, sustainability, and 3D innovation. Through these frameworks, institutions can upgrade laboratories, finance digital equipment, and embed mentoring as a structured component of their educational strategies. Programs like COSME and EIT Manufacturing further strengthen the link between education, research, and enterprise by funding collaborative projects that connect students, mentors, and SMEs within shared innovation ecosystems.

Innovation networks act as catalysts for collaboration and knowledge exchange. Platforms such as EIT Manufacturing, Re-FREAM, WEAR Sustain, and the Textile European Technology Platform (ETP) connect universities, startups, and creative hubs across Europe. Similarly, the Global FabLab Network and Makerspace Europe foster peer-to-peer mentoring and cross-border design exchange, allowing institutions of all sizes to access expertise, prototypes, and best practices in 3D printing and sustainable fashion.

Training platforms and educational toolkits provide essential digital and methodological support. Tools like CLO3D Education, Autodesk Education, and Rhino Academy enable mentors and learners to master digital prototyping and parametric design. Open-source environments such as Blender Cloud and slicing software like Ultimaker Cura or PrusaSlicer democratize access to high-quality design and fabrication tools, while resources like the Circular Design Toolkit and Fashion Revolution materials help integrate sustainability, ethics, and circular economy principles into mentoring practices.

Institutional partnerships—both public and private—reinforce these capacities by linking academia with real-world innovation spaces. Collaborations with fablabs, makerspaces, accelerators (e.g., La Caserne Paris, Fashion Technology Accelerator Milan), and socially oriented organizations like SOFFA Athens provide access to equipment, networks, and inclusive mentoring models. Innovation offices, technology-transfer units, and incubators within universities further support mentors and students in transforming prototypes into viable products and sustainable enterprises.

When these resources are strategically combined, mentoring evolves from an isolated teaching activity into a systemic driver of institutional innovation. Institutions that align funding, networks, tools, and partnerships within coherent strategies will not only produce technically skilled graduates but also nurture creative leaders capable of shaping the sustainable, digitally driven future of fashion and manufacturing in Europe.

2.4.4 Role of Institutions in Supporting Mentorship

The role of institutions is decisive in shaping whether mentoring becomes a transformative practice or remains a sporadic, voluntary activity. Institutions create the conditions under which mentoring can flourish—dedicated time and space, recognition, incentives, and a culture of cross-disciplinary collaboration. In fast-evolving fields like fashion and 3D printing, such institutional commitment is not optional but essential. Successful examples, such as the Institut Français de la Mode, show how embedding mentoring hours within curricula turns it into a structured learning process rather than an informal add-on. Dedicated environments like

TextileLab Amsterdam and digital platforms for remote mentoring reinforce this institutional priority.

Embedding mentoring into professional development is equally crucial. Polimoda's faculty training in digital fashion tools demonstrates how equipping mentors enhances both teaching and mentoring capacity. Reverse mentoring, where younger digital-native students train staff in emerging technologies, further promotes a culture of mutual learning and continuous innovation. Recognition and incentives also play a vital role: the London College of Fashion includes mentoring in performance evaluations, while other institutions offer stipends or public awards to acknowledge this work, ensuring long-term engagement and quality.

Cross-disciplinary collaboration is another cornerstone of effective mentorship. At Politecnico di Milano, joint projects between fashion design and engineering faculties exemplify how hackathons and interdisciplinary labs can unite diverse expertise, fostering creativity and innovation. Case studies such as SOFFA Athens and FabLab Barcelona illustrate how structured mentoring can also drive social and environmental impact—SOFFA by integrating sustainability and inclusion through training for marginalized women in circular textiles, and FabLab Barcelona by merging fashion, architecture, and engineering to address community needs.

In summary, institutions must integrate mentoring into academic schedules, invest in mentor training and reciprocal learning, reward mentoring through formal recognition, and promote interdisciplinary collaboration. When these conditions are in place, mentoring evolves into a strategic institutional asset—aligning education with industry transformation, preparing students for hybrid professional roles, and enabling institutions to lead innovation and equity in the fashion, textile, and 3D printing sectors.

2.4.5. Ethical Concerns Regarding the Mentoring Relationship

Ethical considerations are essential to ensure that mentoring operates within a framework of trust, respect, and professionalism. In line with the principles of the European Mentoring & Coaching Council (EMCC) Code of Ethics, institutions and mentors share responsibility for creating safe and equitable mentoring environments.

1. **Integrity and Professionalism:** Mentors must uphold high standards of integrity and professionalism, acting as role models for their mentees. Increasingly, mentoring schemes emphasize the value of pairing mentees with mentors who can model ethical decision-making and moral awareness.

2. **Respect and Autonomy:** Ethical mentoring is grounded in mutual respect and recognition of the mentee's autonomy. Mentors should support mentees' right to make independent choices about their learning and career paths, maintaining transparency around expectations and boundaries.

3. **Power Dynamics and Disclosures:** Mentoring relationships involve inherent power differences. Ethical mentors remain conscious of this imbalance, avoid

exploitation, and practice appropriate self-disclosure—sharing information that is relevant, respectful, and sensitive to the mentee's context.

4. **Confidentiality and Trust:** Protecting confidentiality is fundamental. Mentors must safeguard private information shared during sessions and ensure that sensitive details are never misused or disclosed without consent.

5. **Cultural Competence and Inclusivity:** Ethical mentoring recognizes diversity in culture, gender, and socioeconomic background. It requires mentors to be self-aware of biases and to foster inclusivity in communication, feedback, and evaluation.

Ultimately, ethical mentoring extends beyond personal conduct—it reflects the institution's commitment to fairness, transparency, and accountability, ensuring that mentoring contributes to both individual growth and collective institutional integrity.

3. Tools, Templates, and Activities

3.1 Overview of Mentoring Types, Activities and Learning Goals

This chapter translates our mentoring framework into practical tools, adaptable templates, and structured activities that connect theory with real-world application. It provides mentors and institutions with a flexible toolkit for planning, delivering, and evaluating mentoring processes across the four mentee levels and career stages.

By organizing tools and activities across mentors, mentees, and mentoring types, the handbook establishes a comprehensive, interoperable system where all actors and methods are connected. This 360-degree approach ensures coherence, flexibility, and inclusivity in mentoring practice. In essence, this categorization turns the mentoring framework into *a living ecosystem*—dynamic, scalable, and self-reinforcing—where every participant contributes to the shared growth of digital, creative, and sustainable competences.

It introduces six mentoring types—Mutual, Peer, Reverse, Blended, Community, and AI-Supported/E-Mentoring—each shaping how knowledge is shared across different levels of experience.

The chapter then presents *Tools and Activities by Mentor Groups (3.2),* detailing for each of the four mentor profiles in Chapter 1 —Early-Career, Mid-Career, Advanced-Career, and 3D Printing Experts—the most suitable mentoring type, compatible mentee level, core methods, activities, and supporting tools.

Next, *Tools and Activities by Mentee Groups (3.3)* aligns learning experiences with the four mentee levels, linking them to European competence frameworks such as DigComp, GreenComp, and EntreComp. Finally, *Tools and Activities by Mentoring*

Type (3.4) shows how each mentoring model can be applied in real settings through printable, digital, and collaborative resources.

3.2 Tools and Activities by Mentor Groups

3.2.1 For Early-Career Mentors Group 1

Early-career mentors in fashion and textiles—often young professionals experimenting with 3D printing in specific product lines—serve as key bridges between traditional craftsmanship and emerging digital practices. Their hybrid perspective allows them to connect innovation with heritage, fostering collaborative environments where creativity, openness, and reflective learning can thrive. Because these mentors are still shaping their own professional identities, mentoring methods should avoid rigid hierarchies and instead emphasize cooperation, dialogue, and shared exploration.

- *The most suitable mentoring type for Group 1 mentors*

For **Group 1 mentors**, the most effective mentoring structure is **Mutual Mentoring**, (Primary type - the most suitable type) complemented by **Peer Mentoring** (Complementary Type) in collaborative learning settings. For Group 1 mentors, the most suitable approach is Mutual Mentoring, which promotes equality, co-learning, and shared problem-solving—ideal for early-career mentors still consolidating their expertise. Peer Mentoring is also effective, fostering trust and collaboration through lab work and co-creation sessions. **Reverse Mentoring** (Occasional Type) may occasionally occur when mentees have stronger digital skills, encouraging reciprocal learning. **Blended Mentoring** (Supportive Format) supports flexibility through online and in-person interaction but mainly defines the delivery format. **Community** and **AI-Supported Mentoring** are less relevant, as early-career mentors benefit most from direct, personal, and relational mentoring experiences.

- *The most compatible mentee level with Group 1 mentors*

The mentoring style of this group works best with **Second-Level (Novice)** and **First-Level (In-Sector Professional)** mentees — those who are curious, developing foundational skills, and benefit from relatable, approachable guidance. This group of mentors is generally not well suited to Fourth-Level Mentees (Civilians or Non-professionals). Although early-career mentors can inspire curiosity through demonstrations, these learners usually need structured, guided instruction from more experienced mentors with teaching or facilitation expertise.

Reminder:

First-level mentees: Adult VET learners already working in the textile and fashion sector but beginning to learn how 3D printing can enhance their practice (or have limited knowledge of 3D design and printing). *Second-level mentees:* Novice VET learners (in either field), still preparing to enter the textile and fashion, or 3D printing labor market, who wish to gain early exposure to 3D applications in Fashion & Textile. *Fourth-level mentees:* Civilians without professional expertise in either domain but motivated to participate and learn to get acquainted with both concepts for future orientation (reinforcing the civic participation dimension of the project.).

- *Core Methods*

Early-career mentors should rely on visual communication, collaborative experimentation, and reflective dialogue as central elements of their mentoring style. Digital tools such as *Miro*, *Google Workspace*, and *Trello* can support documentation and coordination. Each mentoring cycle should end with a brief debrief meeting, where mentor and mentee review outcomes, identify lessons learned, and set short-term goals.

By combining storytelling, peer-sharing, and hands-on experimentation with structured reflection and feedback tools, early-career mentors create a dynamic, inclusive mentoring environment. This approach empowers mentees to explore intersections between fashion, textiles, and 3D design—transforming mentoring into a shared, evolving process of creativity, technical growth, and professional identity formation.

The following tools, methods, and activities are intended as a guide to start for mentors of different groups, helping them understand how to approach mentees at various levels within an interdisciplinary ecosystem that combines fashion, textiles, and 3D design.

Peer-Sharing: Mentors share personal experiences, challenges, and lessons learned to create relatability and encourage mentees to view innovation as a process of continuous improvement. E.g., A mentor explains how a 3D-printed handbag clasp initially failed in stress testing and how iterative redesign led to a successful prototype.

Storytelling: Story-based mentoring turns lived experience into a learning narrative, fostering empathy and context understanding. E.g., A mentor recounts collaborating with a textile company on 3D-printed embellishments—highlighting both creative breakthroughs and production challenges.

Project-Based Learning: Real-world projects encourage mentees to co-develop tangible outcomes, combining creativity and practical application.

E.g., Mentees co-design a small 3D-printed accessory (e.g., belt buckle, brooch, or trim) that complements a fabric garment, with iterative mentor feedback.

- *Activities*

1. **Joint Prototype Labs:**
   Co-creation spaces where mentors and mentees design hybrid prototypes that merge textile and additive-manufacturing techniques. This activity encourages experimentation, feedback, and iteration while strengthening collaboration skills.

2. **Guided Reflection Journals:**
   Mentees record reflections after each session using mentor-provided prompts (e.g., *"What worked well?"*, *"Which step felt unclear?"*, *"What would I try differently next time?"*). Reviewing these journals helps mentors tailor support to individual learning needs.

3. **Micro-Challenge Sessions:**
   Short design sprints (2–3 hours) focused on a single task—such as improving print texture, testing filament flexibility, or redesigning a fastening component. These sessions allow mentees to apply theory immediately and celebrate small wins that build confidence.

4. **Collaborative Mood-Boards:**
   Using digital platforms like *Miro* or *Pinterest*, mentors and mentees co-create visual boards that connect material inspiration, color palettes, and 3D forms. This enhances conceptual alignment and creative communication.

5. **Reverse-Mentoring Exchanges:**
   Mentees with stronger digital skills can briefly guide mentors through a tool or workflow. This reinforces reciprocal learning and models equality in creative dialogue.

6. **Critique Circles:**
   Structured peer-feedback discussions where prototypes are presented, evaluated, and refined collectively. Mentors moderate to maintain constructive and inclusive dialogue, fostering critical reflection.

- *Supporting Tools*

- **Visual Glossaries:** Illustrated guides linking textile terminology (drape, weave, fiber type) with digital equivalents (mesh, topology, extrusion). These promote interdisciplinary understanding and shared language.

- **Skill-Tracking Worksheets:** Templates to monitor progress across technical, creative, and collaborative competencies—such as CAD proficiency, aesthetic judgment, sustainability awareness, and teamwork.

- **Digital Collaboration Boards:** Platforms like *Canva*, *Padlet*, or *Google Jamboard* for documenting iterations, uploading prototype photos, and exchanging feedback asynchronously.

- **Mentoring Canvas:** A one-page template that maps learning goals, milestones, tools used, and reflection outcomes. Both mentor and mentee complete it periodically to visualise growth.

- **Feedback Rubrics:** Clear evaluation grids co-created with mentees to assess prototype quality, originality, usability, and sustainability. They make assessment transparent and formative.

- **Design Diaries or Process Books:** Hybrid sketchbooks—digital or printed—where mentees archive sketches, renders, and reflections. Mentors annotate pages with comments or guiding questions.

3.2.2 For Mid-Career Mentors Group 2

Mid-career experts in fashion & textile with broader experience in developing textile products that integrate 3D printing, who have already coordinated projects or supervised junior staff in applying these technologies.

Mid-career mentors in the fashion and textile industries occupy a pivotal position between emerging and advanced professionals. With established careers and extensive practical experience, they already possess technical mastery and project management skills yet are actively expanding their expertise by integrating new technologies such as 3D printing, digital simulation, and AI-assisted design. At this stage, their mentoring focus shifts from task-based guidance to strategic leadership, helping mentees cultivate independence, self-reflection, intuitive thinking, and collaborative problem-solving. These mentors play a crucial role in transmitting professional ethics, innovation culture, and cross-disciplinary awareness within hybrid creative environments.

- *The most suitable mentoring type for Group 2 mentors*

The most effective **mentoring models** for Group 2 are Work-Based and Blended Mentoring, combining reflective in-person engagement with digital follow-ups and progress tracking. Work-based mentoring refers to mentoring that happens within a real professional or project context, rather than as a classroom or purely educational exercise.

- *Blended Mentoring* (Primary Type of mentoring for this group of mentors) allows mentors to integrate online collaboration platforms for coordination and prototype review while maintaining direct, relational contact in studio-based sessions.

- *Community Mentoring* (Complementary Type) is also relevant at this stage, as mid-career mentors often operate within team or cohort settings where collective mentoring fosters peer support and shared innovation.
- *Mutual Mentoring* (Occasional Type) remains useful for cross-disciplinary exchanges, particularly when mentees bring new technical or sustainability knowledge that complements the mentor's industry expertise.

- *The most compatible mentee level with Group 2 mentors*

Mid-career mentors are best matched with First Level (In-Sector Professionals) and Third-Level (Cross-Professionals) **mentees.**

- *First-Level Mentees*—those already working in fashion or textiles but new to 3D printing—benefit greatly from the mentor's experience in integrating traditional processes with digital methods. Mid-career mentors help these mentees understand how technology reshapes design and production workflows.
- *Third-Level Mentees***,** who already possess professional experience and are seeking to expand their interdisciplinary scope, make ideal partners for collaborative innovation. They can engage in advanced mentoring projects where both mentor and mentee co-develop solutions for industry challenges, exchange perspectives, and test leadership dynamics.

Second-Level (Novice) mentees can also gain valuable exposure in group workshops or design-thinking sessions but may require additional scaffolding from more experienced facilitators. Fourth-Level (Civilians)**,** meanwhile, typically fall outside the ideal scope for this group, as they require more foundational instruction rather than professional mentorship.

The following tools, methods, and activities are designed to guide mid-career mentors in leading effective and sustainable mentoring processes across fashion, textile, and 3D design disciplines.

- *Methods*

Mid-career mentors should balance experience-based authority with creative flexibility. Their mentoring sessions are most effective when structured around reflection, collaboration, and innovation, allowing mentees to explore new technologies without losing sight of professional standards. Integrating real business cases and leadership modelling activities reinforces mentees' capacity to navigate complex interdisciplinary workflows—combining artistry, technology, and management.

Work Counselling: Mid-career mentors draw on professional experience to provide reflective guidance and practical advice related to design, production, and business decisions. Rather than instructing, they use structured dialogue to help mentees evaluate trade-offs and think strategically. For instance, a mentor may advise a mentee on whether to produce a 3D-printed embellishment in-house or outsource it, prompting analysis of cost, scalability, and creative control. This approach cultivates strategic awareness and professional maturity.

Leadership Modelling: Mentors lead by example, demonstrating effective communication, task delegation, and ethical leadership. Mentees learn by observing how mentors manage collaborative projects and creative teams. For example, when overseeing a prototype combining 3D-printed fasteners with woven textiles, the mentor models how to coordinate designers, technicians, and material specialists, showcasing how leadership translates vision into results.

Design-Thinking Workshops: These workshops engage mentees in real-world problem-solving through the classic design-thinking stages: analysis, ideation, prototyping, and feedback. Mentors guide mentees in addressing challenges such as developing sustainable 3D-printed components for apparel, promoting innovation grounded in feasibility and user experience.

- *Activities*

Case Study Reviews: Mentors and mentees jointly examine real-life industry cases, identifying critical factors that influence design, production, and sustainability outcomes. Together, they discuss decision-making processes and alternative strategies, allowing mentees to connect theory with practical insight and develop analytical confidence.

Peer-to-Peer Design Critiques: Mentors facilitate structured critique sessions where mentees present ongoing work and exchange feedback. The mentor's role is to model professional communication, helping mentees learn how to both give and receive constructive criticism. These sessions build confidence, analytical thinking, and respect for diverse perspectives.

Innovation Sprints: Short, time-bound workshops simulate real studio conditions, fostering agility and problem-solving. Mentors coordinate multi-step design exercises—such as developing a rapid prototype for a digitally enhanced textile trim—encouraging mentees to translate ideas into tangible outputs under realistic deadlines. These sprints enhance teamwork and adaptability in high-pressure creative environments.

- *Tools*

Co-Creation Canvases: Visual frameworks for mapping goals, responsibilities, and milestones. Mentors and mentees collaboratively outline project objectives, task distribution, and success indicators. This tool not only strengthens project management capacity but also promotes transparency and accountability.

Dragon Dreaming Project Cycle Sheets: This holistic project management tool guides the mentoring process through four phases—Dreaming, Planning, Doing, and Celebrating—integrating creative ideation with structured execution. It encourages both mentors and mentees to align personal motivation with collective outcomes, reinforcing teamwork and reflection.

Feedback Logs: Structured records that document insights, critiques, and progress during mentoring sessions. Mentors ensure that all feedback is SMART-oriented (Specific, Measurable, Achievable, Relevant, Time-bound), helping mentees focus on actionable improvements and professional growth.

Role Simulation Scenarios: Optional advanced tool where mentors design small-scale simulation exercises—for example, "client briefing" or "supply chain challenge"—to test mentees' decision-making and collaboration under realistic constraints. These scenarios enhance strategic and interpersonal skills simultaneously.

Digital Collaboration Dashboards: Using shared project boards (e.g., *Notion*, or *Miro*), mentors can track team progress, upload reference materials, and align mentoring sessions with project timelines, ensuring continuity and visibility.

3.2.3 Advanced-Career Mentors Group 3

Advanced-career mentors in the fashion and textile sector who have consistently integrated 3D printing into their professional practice occupy a pivotal position within the mentoring framework. These mentors are typically industry leaders, researchers, or innovation managers whose work influences product development, sustainability agendas, and market strategies. Their mentoring goes beyond technical instruction—they cultivate strategic foresight, ethical awareness, and innovation capacity, preparing mentees not only to master current technologies but to anticipate and shape future transformations in the fashion and 3D design ecosystem.

- *The Most Suitable Mentoring Type for Group 3 Mentors*

The most appropriate mentoring types for this group are Community Mentoring, complemented by Blended Mentoring and AI-Supported/E-Mentoring.

Community Mentoring aligns with the leadership role of advanced mentors, allowing them to guide multiple mentees and even fellow mentors simultaneously. Through structured group discussions, mentoring circles, and collaborative foresight exercises, they create spaces for collective reflection and knowledge transfer.

Blended Mentoring supports this process by combining on-site industry sessions with digital platforms for international collaboration, resource sharing, and project monitoring—essential in large-scale, cross-border innovation projects.

AI-Supported/E-Mentoring further enhances their capacity by streamlining mentor–mentee matching, offering data-driven feedback, and documenting progress over time. Technology thus becomes a support mechanism that amplifies their strategic mentoring reach without replacing the human relationship.

- *The Most Compatible Mentee Level with Group 3 Mentors*

Group 3 mentors are most compatible with **Third-Level Mentees (Cross-Professionals)** and **First-Level Mentees (In-Sector Professionals)**.

They are ideally suited to mentor Third-Level Mentees, who already possess solid professional backgrounds in either fashion/textile or 3D design and seek to broaden their interdisciplinary expertise. These mentees can fully engage with complex strategic, sustainability, and innovation discussions led by advanced mentors. First-Level Mentees, already active in the fashion and textile industry but exploring digital transformation, also benefit greatly from these mentors' guidance. Advanced mentors help them translate traditional processes into future-ready, sustainable, and digitally integrated models.

Second-Level (Novice) and Fourth-Level (Civilian) mentees are less compatible with Group 3 mentors, as these groups require foundational guidance rather than strategic, foresight-driven mentoring.

- *Methods*

Strategic Mentoring: Advanced mentors focus on helping mentees align immediate learning with long-term professional goals. They guide mentees to connect design decisions with broader trends—such as supply chain innovation, sustainability regulations, and market shifts. This method develops strategic awareness, ensuring that mentees understand both the operational and systemic implications of their work.

Scenario Planning: Mentors engage mentees in structured foresight exercises to anticipate multiple futures for the fashion and 3D sectors. By analyzing possible scenarios—technological disruptions, new EU sustainability frameworks, or shifts in consumer behavior—mentees learn to make flexible, evidence-based decisions and design resilient business or creative strategies.

Sustainability-Focused Mentoring: Advanced mentors integrate sustainability principles directly into the mentoring process, encouraging mentees to evaluate environmental impact, recyclability, and compliance with circular economy and EU Green Deal goals. They help mentees transform sustainability from an ethical ideal into an operational practice.

Transformational Mentoring: At this level, mentoring also focuses on mindset change. Advanced mentors challenge mentees to move beyond incremental improvement and think disruptively developing vision, ethical leadership, and a holistic understanding of innovation.

- *Activities*

Industry Foresight Workshops: Mentors lead structured sessions on market scanning, policy trends, and material innovation. Mentees identify emerging technologies, sustainability drivers, and social changes that will influence the next generation of fashion and textile production.

Mentoring Circles: Advanced mentors facilitate multi-participant mentoring sessions that include mid-career mentors and professionals from different disciplines. These circles promote peer-to-peer learning and expose mentees to high-level decision-making and interdisciplinary collaboration.

Simulation & Risk Labs: In these labs, mentors guide mentees through simulated industry challenges—such as disruptions in raw material supply, rapid market shifts, or new regulatory requirements. Mentees test prototypes and management responses in real time, improving resilience and strategic thinking.

Innovation Roundtables: Collaborative roundtables connect mentees with external stakeholders such as sustainability officers, R&D specialists, and policy experts. Mentors moderate discussions to align creative innovation with industrial and regulatory realities.

Leadership Reflection Clinics: Advanced mentors hold short, high-impact reflection sessions where mentees evaluate their leadership and decision-making styles, linking self-awareness to professional growth and ethical leadership.

- *Tools*

Risk-Assessment Templates: Structured worksheets used to identify, quantify, and mitigate risks—technical, financial, environmental, or ethical. They train mentees to assess feasibility, sustainability, and long-term value in project planning.

Trend-Mapping Guides: Visual tools that support industry foresight and market analysis. Mentees systematically map innovation drivers, consumer behavior shifts, and policy developments to anticipate future directions in fashion and technology.

Innovation Roadmaps: Strategic planning charts outlining stages from concept ideation to market implementation. They include sustainability milestones, stakeholder engagement checkpoints, and measurable indicators of success.

Foresight Dashboards: Digital tools (e.g., *Notion*, *Miro*..) that centralize data on materials, technologies, and emerging research. Mentors and mentees collaboratively update the dashboard to track macro trends and institutional responses.

Sustainability Assessment Matrices: Frameworks used to evaluate each prototype's environmental and social footprint. They help mentees integrate life-cycle analysis, traceability, and ethical sourcing into design processes.

Strategic Reflection Logs: Structured journals where mentees record strategic insights, long-term goals, and lessons learned from foresight exercises or leadership discussions. Mentors review these logs periodically to track intellectual and professional growth.

3.2.4 3D Printing Experts as Mentors Group 4

Experts (Any career level) in 3D printing with or without (depending on the type of mentoring) workable experience in the application of 3D printing in Fashion & Textile.

3D printing experts, regardless of their career stage, play a pivotal role in the mentoring ecosystem by bridging digital innovation and traditional fashion/textile craftsmanship. Their expertise in CAD modeling, additive manufacturing, and prototyping workflows enable them to translate complex digital processes into practical, creative applications within the fashion and textile industries. What distinguishes this group is the bidirectional nature of their mentoring: even junior 3D specialists can mentor experienced textile professionals on digital tools, while learning from the latter's deep knowledge of fabrics, aesthetics, and sustainability. This reciprocal, interdisciplinary exchange embodies the Sust3DFashion vision—where mentoring is not hierarchical but collaborative, future-oriented, and transformative.

- *The Most Suitable Mentoring Type for Group 4 Mentors*

The dominant mentoring model for Group 4 is Reverse Mentoring, supported by Mutual Mentoring and Blended Mentoring.

Reverse Mentoring defines the essence of Group 4 mentoring. It reverses traditional hierarchies: 3D experts guide fashion and textile professionals in mastering digital tools, additive manufacturing techniques, and prototyping workflows. In return, they learn about material behavior, design context, and sustainability principles. This two-way exchange not only empowers mentees to adopt digital technologies but also enhances mentors' understanding of fashion's tactile and cultural dimensions.

Mutual Mentoring reinforces this process by framing the relationship as one of shared expertise and co-learning. Both mentor and mentee act as contributors to an interdisciplinary creative process.

Blended Mentoring complements these types by providing flexible learning environments that combine online technical sessions (e.g., CAD demonstrations, slicer tutorials) with on-site material testing and prototyping, allowing mentors to engage mentees across different locations and levels of digital readiness.

- *The Most Compatible Mentee Level with Group 4 Mentors*

Group 4 mentors are best matched with First-Level (In-Sector Professionals) and Third-Level (Cross-Professionals) mentees.

- *First-Level Mentees*, already working in the fashion or textile sector, benefit greatly from 3D mentors' ability to translate technology into practical tools for material experimentation and product innovation. Through guided prototyping and technical workshops, they learn how digital processes can enhance traditional craftsmanship.

- *Third-Level Mentees*, professionals who already have some experience in both 3D design and textiles, engage with 3D mentors in deeper, peer-level collaboration—testing hybrid solutions, sharing workflows, and co-developing innovative designs that push creative and industrial boundaries.

Second-Level (Novice) mentees may participate in introductory sessions on CAD basics or sustainability-focused projects, though they typically require more foundational instruction. Fourth-Level (Civilian) mentees are less suited for sustained collaboration but can benefit from short outreach demonstrations or community workshops led by 3D mentors.

- *Methods*

Reverse Mentoring: This is the cornerstone of Group 4 mentoring. 3D printing mentors provide targeted guidance on digital design, slicing software, printer calibration, and parametric modeling. In return, they gain valuable insight into fashion's aesthetics, materials, and consumer expectations. This reciprocal dynamic fosters respect, curiosity, and innovation between disciplines.

Skill-Transmission Workshops: These workshops focus on specific technical competencies—such as 3D scanning, CAD modeling, or generative design for textiles. Mentors adopt a hands-on approach, encouraging mentees to experiment, fail, iterate, and master digital workflows that integrate seamlessly with fabric-based design.

Collaborative Prototyping: Mentors and mentees co-create physical artifacts that merge textile and digital components—for example, 3D-printed clasps, trims, or modular garment panels. This process cultivates interdisciplinary teamwork, problem-solving, and design empathy between technologists and designers.

Demonstration-Based Mentoring: Mentors use live demonstrations to teach both technique and design thinking simultaneously. Showing a real-time modeling-to-print process helps mentees grasp the relationship between digital modeling, material output, and end-user experience.

Micro-Learning Modules: To accommodate different mentee backgrounds, mentors can employ short, topic-specific learning modules—such as *"Introduction to Slicer Settings for Textiles"* or *"Material Compatibility in Additive Manufacturing"*. These structured mini-sessions make complex digital skills digestible and transferable.

- *Activities*

CAD Skill Sessions: Mentors conduct structured sessions introducing mentees to CAD fundamentals, progressing toward advanced modeling for wearable and textile applications. These activities develop confidence and digital fluency.

Cross-Mentoring Labs (Digital Material): Interactive labs where 3D mentors and textile professionals swap expertise—3D experts explain design automation or slicing techniques, while fashion specialists demonstrate draping, fabric flexibility, or finish techniques. This iterative dialogue deepens mutual understanding and cross-disciplinary respect.

Prototype Testing and Iteration Labs: Mentees and mentors co-develop prototypes and conduct wearability or durability tests. Through multiple refinement cycles, mentees learn how digital models translate into functional, aesthetically pleasing products.

Material Innovation Challenges: Short challenges where mentees explore combining recycled or bio-based filaments with natural fibers. Mentors facilitate experimentation and encourage sustainable design thinking aligned with circular economy principles.

Digital Workflow Clinics: Mentors host troubleshooting sessions where mentees bring real project issues—failed prints, poor adhesion, material inconsistencies—and collaboratively identify solutions. These clinics strengthen technical troubleshooting and collaborative problem-solving skills.

Community Open Labs: Public-facing sessions led by 3D mentors, where mentees and wider participants engage in live demonstrations or collaborative mini-projects. These activities extend the impact of mentoring to broader civic audiences.

- *Tools*

CAD Learning Tracks: Structured, modular learning pathways that guide mentees from beginner to advanced proficiency in CAD and 3D modeling software (e.g., *Blender, Rhino, Fusion 360, CLO3D*). Each track includes self-paced tutorials, checkpoint projects, and mentor feedback sessions.

Prototyping Testing Logs: Detailed templates for documenting prototype development, testing results, material combinations, and design adjustments. These logs serve both as reflective learning tools and process documentation for iterative improvement.

Workflow Boards: Digital or physical Kanban-style boards for managing design-to-production workflows. They visualize task progress, assign responsibilities, and make collaboration between fashion and digital teams more transparent.

Material–Print Compatibility Charts: Reference tables mapping various textiles and filament types to compatible printing parameters. These charts help mentees understand how digital choices affect material outcomes.

3D Printing Troubleshooting Library: A shared digital repository of common printing issues, solutions, and visual examples (e.g., layer shifting, stringing, warping). Mentors use this as a live teaching resource during workflow clinics.

Interactive Learning Platforms: Online environments like *Moodle*, *Miro*, or *Notion*, integrated with video tutorials and design repositories, enabling mentees to revisit lessons, upload files, and receive asynchronous mentor feedback.

3.3 Tools and Activities by Mentee Groups

The following table provides an overview of the most suitable activities and tools for each mentee group within our mentoring framework. It aims to help mentors, trainers, and institutions design meaningful learning experiences that reflect each group's level of expertise, motivation, and professional orientation. Activities combine technical experimentation, reflection, and collaboration, while tools provide structure, documentation, and feedback mechanisms.

Each recommendation is linked to practical examples or online keywords that educators can search for further inspiration (e.g., *"3D printing bootcamp curriculum"*, *"Miro storyboard for design thinking"*, *"community open lab model"*).
By aligning with European frameworks such as DigComp, GreenComp, and EntreComp, these mentoring activities ensure that mentees develop transversal competences—digital, green, and entrepreneurial—while learning to connect technology with creativity, sustainability, and social innovation.

Table 3.1 – Tools and Activities by Mentee Groups

Mentee Level	Suitable Activity Types	Why They Are Effective	Recommended Tools	Example Search Keywords
First-Level Mentees (In-Sector Professionals)	**-Job Shadowing** **-Applied Labs** **-Reflective Practice Sessions**, **-Sustainability Hackathons**	These mentees already possess industry knowledge but need to integrate 3D skills into existing practices. Activities connect digital innovation to real workplace challenges and sustainability objectives.	Learning Goals Worksheets, Mentor Feedback Logs, Portfolio Templates, Reflection Journals	"3D printing job shadowing in fashion industry" "circular fashion prototyping labs" "EU DigComp reflective learning templates" "sustainability hackathon toolkit"
Second-Level Mentees (Novice VET Learners)	**Introductory Bootcamps**, **Simulation Games**, **Supervised Workshops**, **Digital Storyboards**	Ideal for confidence building and foundational literacy. Bootcamps provide immersive exposure; games simulate real-world challenges, and workshops introduce structured hands-on learning.	Visual Glossaries, Skill-Checklists, Storyboards for Project Planning, Introductory CAD Modules	"3D printing bootcamp syllabus for beginners" "gamified learning for VET students" "storyboard design thinking Miro" "intro to CAD for textiles online course"
Third-Level Mentees (Cross-Professionals)	**Mentoring Circles**, **Innovation Sprints**, **Cross-Mentoring Labs**,	These mentees are professionals expanding into interdisciplinary areas. Activities promote collaborative innovation, leadership, and strategic	Co-Creation Canvases, Dragon Dreaming Templates, Feedback Logs, Strategic Reflection Sheets	"innovation sprint fashion-tech" "cross-disciplinary mentoring circle format"

Mentee Level	Suitable Activity Types	Why They Are Effective	Recommended Tools	Example Search Keywords
	Leadership Reflection Clinics	reflection within peer networks.		"Dragon Dreaming project cycle PDF" "leadership reflection toolkit EU"
Fourth-Level Mentees (Civilians / Community Participants)	**Open Labs**, **Civic Workshops**, **Exhibitions**, **Gamified Learning**	Designed for accessibility and inclusion. Activities demystify technology, foster sustainability awareness, and promote creativity through collective civic engagement.	Simple User Guides, Community Reflection Templates, Storytelling Cards, Open Resource Hubs	"community open lab model" "civic workshop sustainable fashion" "storytelling cards design education" "makerspace public engagement toolkit"

3.4 Tools and Activities by Mentoring Type

In this section, we will present five main types/Models of mentoring - Mutual, Peer, Reverse, Blended, and Community - together with an additional innovative type, AI-Supported Mentoring (Table 3.2). For each type, we outlined activities (Tables 3.3-3.9) followed by a table including tools and practical exercises to make the approach concrete and applicable (Table 3.10).

By activities we refer to structured interactions, sessions, or tasks that mentors and mentees carry out together to apply the tools in practice and facilitate knowledge exchange. Activities are the general formats of interaction (e.g., workshops, reflection logs, design challenges) that shape how mentoring happens.

By tools we mean the digital platforms, physical resources, or structured frameworks that mentors and mentees can use to support, organize, and enhance the mentoring process.

Finally, practical exercises are the specific, concrete hands-on (task-based) applications of the activities where mentors and mentees collaborate on producing defined outputs or solving real tasks in the fashion & textile and 3D printing sectors.

Table 3.2 Mentoring Types at a Glance: Key Relationships and Application

Mentoring Type	**Definition**	**Mentor-Mentee**	**Knowledge/ Expertise Relationship**	**Example**
Mutual Mentoring	Reciprocal mentoring is between individuals not at a similar level of experience. Both participants act as mentor and mentee at different times depending on the challenge that one of them faces.	For Mutual Mentoring, the most natural fit is where expertise is complementary (not overlapping at the same level).	Not equal levels but complementary; expertise is distributed across disciplines (fashion/textile vs. 3D printing), career stages (early-career vs. mid/advanced), or levels (professional vs. VET learner).	A mid-career fashion designer (Group 2) mentors a first-level VET learner on garment construction and market trends. At the same time, the learner, trained in 3D modeling, shows the designer how to adapt a textile prototype for 3D-printed components. Roles shift as each contributes their expertise.
Peer Mentoring	Collaboration between people at the same or similar level (e.g., two students, two junior designers). They both share the same challenge.	In this type of mentoring we are talking about **two Mentors** interacting **as peers** (not mentor–mentee), since both belong to the *Mentor groups*. Then it's suggested for the following groups in this handbook: Peer Mentoring works best when participants are at a **similar stage of learning or career**, even if they come from different domains.	Equal or near-equal levels of expertise; participants are aligned in terms of career stage or learning phase but may differ in domain focus (fashion/textile vs. 3D printing). This balance allows them to exchange perspectives as equals, building confidence and problem-solvin g capacity. They exchange	Example - A fashion design student and a 3D-printing student — both in their second year — collaborate on a garment with a 3D-printed clasp. They review and refine each other's work, learning across disciplines while remaining equals.

Mentoring Type	Definition	Mentor-Mentee	Knowledge/ Expertise Relationship	Example
		Mentors = Mentees (peer-to-peer)	perspectives as equals on a shared challenge.	
Reverse Mentoring	Reverse Mentoring flips the traditional hierarchy: a junior individual mentors a more senior one, typically in areas where the junior has more up-to-date expertise (e.g., digital tools, emerging technologies, cultural trends). The senior takes the role of learner, benefiting from the junior's knowledge to adapt to new practices.	For Reverse Mentoring, the flow of knowledge is primarily one way (junior → senior).	Hierarchical levels are inverted. The junior mentor contributes specialized knowledge in new digital practices (e.g., 3D modeling, slicing software, AI-driven design), while the senior mentee learns to integrate these innovations into their established expertise. The relationship fosters cross-generational learning, digital transformation, and openness to emerging tools.	A novice Group 4 3D-printing student mentors a Group 2 mid-career fashion designer on how slicing software can optimize the printing of garment accessories. The designer, in turn, applies this digital knowledge to integrate 3D-printed components into their clothing designs. The junior leads with technical expertise, while the senior gains digital production skills to complement their fashion experience.
Blended Mentoring	Mix of online and offline mentoring for flexibility. The mentor retains higher expertise, while the mentee is primarily the	For Blended Mentoring, the structure is flexible and works well across different domains. In this handbook, it is suggested for:	Traditional (mentor = expert, mentee = learner) but enhanced through hybrid learning modes. Knowledge flows primarily	A fashion design student takes an online module on sustainable materials, while a 3D printing student follows a MOOC on filament properties. Later, guided by their mentor, they meet in the lab to combine

Mentoring Type	Definition	Mentor-Mentee	Knowledge/ Expertise Relationship	Example
	learner; however, the key feature is not hierarchy but the **format**—a hybrid model where digital learning complements in-person practice.	**Digital platforms/learning tools:** Act as the connective layer, offering MOOCs, webinars, and forums that extend mentor–mentee interaction beyond face-to-face sessions.	one way, but digital environments also encourage interaction, discussion, and peer exchange. The hybrid design ensures accessibility, continuity, and practical application.	what they learned: the fashion student prototypes an upcycled garment, and the 3D printing student creates recycled PETG accessories to match. The mentor supports them both, blending online learning with hands-on practice.
Community Mentoring	Community Mentoring extends the mentoring relationship from pairs to collective settings, where multiple individuals interact at once.	For Community Mentoring, roles are not confined to one-to-one pairs but involve groups at different levels and domains. **Community participants:** External stakeholders (schools, SMEs, civic associations, sustainability groups) who interact with the mentoring process and become both sources of feedback and co-learners.	Multi-directional and collective. Expertise circulates across different levels and domains: senior experts provide strategic and professional insights, early-career professionals and VET learners contribute fresh skills and creativity, and the community offers real-world validation, feedback, and societal context.	A Group 1 fashion student and a novice Group 4 3D-printing student, under the guidance of a Group 2 mid-career fashion expert, co-organize a sustainability event for the local community. The fashion student designs an eco-fashion awareness kit for schools, while the 3D-printing student produces biodegradable filament prototypes. At the event, they co-present their work, exchange feedback with the community, and learn from each other as well as from mentors and attendees. The process becomes collective, collaborative, and socially impactful.

Mentoring Type	Definition	Mentor-Mentee	Knowledge/ Expertise Relationship	Example
AI-Supported / E-Mentoring	AI-Supported (or E-Mentoring) enhances traditional mentoring by integrating digital platforms and artificial intelligence tools. While mentor–mentee roles remain in their classic structure (mentor = higher expertise, mentee = learner),	For AI-Supported / E-Mentoring, participants are paired through AI-driven systems that ensure complementarity of skills and availability. **AI/Platform role:** Acts as facilitator—matching participants, providing adaptive feedback, and supporting remote or group-based sessions	Traditional hierarchy is preserved (mentor as senior, mentee as learner), but AI bridges knowledge gaps and enables more flexible formats (one-to-one, one-to-many, group). Expertise flows from mentors to mentees while technology enhances accessibility, personalization, and interactivity.	A fashion design student uploads a digital sketch of a dress to an AI-enabled mentoring platform. The AI pairs her with a 3D-printing engineer who reviews the file and suggests adjustments to the model so it can be printed with flexible materials. At the same time, the student explains fashion aesthetics and market trends, helping the engineer understand how technical design choices affect style and wearability. Through AI-facilitated feedback, both refine the prototype into a piece that is technically feasible and fashion-forward.

- *Mutual Mentoring*

Mutual mentoring emphasizes reciprocity in which each participant is simultaneously a mentor and a mentee. There can be people at different levels of knowledge and experience, but each brings unique expertise in each area.

In the context of this handbook, this approach enables textile professionals and 3D printing experts to share expertise in real time while co-developing sustainable prototypes. Mutual mentoring has the advantage of reducing hierarchical barriers and fostering inclusivity. It is particularly suited to interdisciplinary environments where expertise is distributed across domains rather than concentrated in one role. In VET contexts, it encourages mentees to see themselves as active contributors rather than passive recipients of knowledge.

Table 3.3 Mutual Mentoring Activities

Activity	Description	Example in Fashion/Textiles/3D Printing
Material–Technology Swap	Partners introduce materials or technologies from their own field and brainstorm cross-disciplinary applications.	A fashion learner presents smart textiles; a 3D-printing learner shares recycled polymers, and both explore hybrid uses.
Process Walkthrough Exchange	Each partner explains a typical workflow, while the other identifies parallels and divergences.	Pattern making vs. CAD modeling — partners map similarities and differences.
"Translate the Language" Exercise	Participants explain key concepts using their field's jargon, then the other reframes them in their technical terms.	Warp/weft/drape (fashion) translated into layering/infill/extrusion (3D printing).
Cross-Critique Sessions	Partners present a prototype/design, and the other provides feedback as if it were their own field.	A fashion sketch critiqued by a 3D learner; a CAD file critiqued by a textile learner.
Reverse Prototyping	Partners reinterpret each other's objects using their own tools.	A 3D-printing learner reimagines a textile element; a fashion learner reinterprets a 3D-printed part.
Mentoring Journals & Reflection Logs	Shared journals capture weekly challenges, insights, and questions, reinforcing accountability.	Partners co-write a digital log about print errors or textile durability experiments.
Collaborative Micro-Projects	Partners co-design small-scale outputs integrating both fields.	Creating a 3D-printed button to be applied on a sustainable textile garment.
"Failure Swap" Storytelling	Each partner shares a failure; the other proposes solutions from their discipline.	A textile durability failure explored through 3D reinforcement; a misprinted piece rethought with fabric alternatives.
Shadowing & Observation	Partners observe each other's tasks to identify transferable practices.	Watching printer calibration vs. observing pattern cutting.
Scenario-Based Role Play	Partners role-play designer/technologist in a given challenge, then switch roles to broaden perspective.	Designing a sustainable fashion line with 3D-printed accessories.

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- ***Peer mentoring***

Peer mentoring involves individuals of similar status or career stages supporting each other's growth. In VET, peer mentoring is especially relevant for early-career learners navigating new technologies or professional transitions. The absence of hierarchical dynamics fosters trust, relatability, and openness, encouraging participants to experiment, fail safely, and reflect together.

Table 3.4 Peer Mentoring Activities

Activity	Description	Example in Fashion/Textiles/3D Printing
Paired Skill Demonstrations	Peers teach each other a practical skill, reinforcing mutual learning.	One learner demonstrates sewing techniques; the other explains slicing and setting parameters for a 3D print.
Peer Prototype Review	Exchange prototypes and provide constructive critique using agreed criteria.	A fashion student reviews a 3D-printed clasp; a 3D student critiques a garment mock-up.
Reflection Circles	Small groups meet regularly to share challenges, failures, and solutions.	Learners discuss failed fabric tests or broken 3D prints, reflecting on what to adjust.
Collaborative Troubleshooting	Pairs or groups solve a technical/design issue together without a "hierarchical expert."	Learners jointly debug printer calibration or test sustainable textile blends.
Peer Shadowing	Observe each other's workflow, then exchange insights and alternatives.	One learner shadows a peer preparing textile samples; later the peer observes printer setup.
Role-Switch Design Challenge	Swap professional roles to build empathy and cross-disciplinary insight.	A textile student plays "3D printing technician," while the printer student acts as "fashion designer."
Peer Learning Journals	Maintain journals and share entries for discussion and feedback.	Weekly logs documenting experiments with fabric finishing or print parameters are exchanged and critiqued.
Critical Friend Approach	Partners act as "critical friends," offering structured constructive critique.	A peer reviews the sustainability claims of a fashion project, another questions durability of a printed part.
Co-Creation Sprints	Pairs co-design a small project blending both disciplines.	Learners design a hybrid textile–3D printed accessory (e.g., a smart bracelet).

Activity	Description	Example in Fashion/Textiles/3D Printing
Peer Mentoring Pods	Small rotating groups where learners shift roles (designer, critic, observer).	In one cycle, a learner is "designer" of a 3D-textile prototype, next cycle becomes "critic."

- ***Reverse mentoring***

Reverse mentoring disrupts traditional hierarchies by positioning younger or less senior professionals as mentors to senior colleagues, particularly on emerging technologies and digital skills. In the Sust3DFashion context, this model is highly relevant: young 3D printing experts can guide senior textile managers through software applications, additive manufacturing techniques, or digital sustainability tools.

Table 3.5 Reverse Mentoring Activities

Activity	Description	Example in Fashion/Textiles/3D Printing
Tech-Onboarding Sessions	Younger mentors introduce senior colleagues to key digital tools, platforms, or software relevant to design and manufacturing.	A 3D-printing expert guides a textile manager through Blender or Cura slicer for fashion prototyping.
Digital Sustainability Workshops	Reverse mentors teach the use of apps and platforms that track resource efficiency or environmental impact.	A young specialist shows how to simulate the carbon footprint of textile vs. printed prototypes.
Social media Trend Analysis	Junior mentors explain how digital culture and consumer behavior affect fashion innovation.	A young designer explains how TikTok trends influence demand for modular 3D-printed accessories.
Hands-On Printer Labs	Senior staff shadow younger experts as they calibrate and operate 3D printers, learning step-by-step.	A 3D learner demonstrates troubleshooting nozzle clogging, while the senior manager takes notes.
Reverse Case Study Sessions	Younger mentors present successful fashion-tech case studies, with seniors reflecting on how they might adapt them in practice.	A junior introduces Adidas' 3D-printed midsoles, sparking discussion with textile veterans.

Activity	Description	Example in Fashion/Textiles/3D Printing
Digital Workflow Mapping	Reverse mentors help senior colleagues redesign workflows to integrate digital tools.	A young technologist maps how ERP and CAD files can feed directly into textile production planning.
Innovation Clinics	Short, focused meetings where younger mentors showcase one emerging tool or trend per session.	A junior introduces AI-powered generative design for textile patterns.
Co-Presenting at Meetings	Mentor–mentee pairs jointly present at internal or external events, blending expertise.	A textile manager explains supply-chain needs, while a junior shows how 3D printing addresses them.
Shadow-the-Young Expert	Seniors follow juniors during a digital design sprint to see new methods in action.	A senior observes a junior using parametric modeling to generate fashion accessories.
Feedback Reversal Sessions	Seniors present traditional practices, while juniors critique them with fresh digital insights.	A textile veteran shows fabric-testing routines, and a junior suggests integrating 3D scanning tools.

- ***Blended mentoring***

Blended mentoring combines online and offline tools for maximum flexibility and engagement. Within this model, MOOC-based modules on platforms like edX or Coursera can provide foundational theory on sustainability and 3D printing, while webinar + workshop packages allow participants to immediately apply this knowledge in practical tasks. For instance, participants can complete an online module on circular economy principles and then engage in an in-person workshop to prototype fashion accessories using recycled filaments. Online discussion boards or moderated forums provide a space for asynchronous peer-to-peer exchange, troubleshooting, and resource sharing. Activities may include interactive simulations where mentees can virtually test production scenarios, followed by live debriefing sessions with mentors. This hybrid model maximizes accessibility while preserving the personal touch of face-to-face interaction, making it especially relevant for geographically dispersed networks (Single & Single, 2005).

Table 3.6 Blended Mentoring Activities Table

Activity	Description	Example in Fashion/Textiles/3D Printing
MOOC + Workshop Packages	Learners acquire theoretical foundations online, then apply them in practice through in-person sessions.	Complete an online module on circular economy, then prototype fashion accessories with recycled 3D filaments in a workshop.
Webinar + Live Q&A	Online lectures are followed by live sessions for clarifications, case discussions, and feedback.	Webinar on 3D printing for sustainable fashion, followed by live Q&A with designers and technicians.
Discussion Forums & Peer Exchange	Online boards or moderated groups foster asynchronous collaboration, sharing resources and troubleshooting.	Learners post issues with print failures or textile sourcing in a shared forum, receiving peer advice.
Interactive Simulations	Virtual tools let learners test scenarios before trying them physically.	Simulate the impact of different material choices (PLA, recycled polyester) on cost and sustainability before producing samples.
Blended Design Challenges	A task is launched online with resources, then completed in person under mentor supervision.	Online assignment: design a modular accessory. In-person: 3D print the prototype and test wearability with textiles.
Recorded Demonstrations + Hands-On Labs	Learners review digital tutorials at their own pace, then replicate skills offline.	Watch a recorded video on pattern-to-print workflow, then recreate it in the lab using textile and 3D printing software.
Hybrid Mentoring Circles	Mixed online/offline groups engage in cyclical mentoring exchanges.	Online reflection circle on sustainability in design → in-person session to co-create a hybrid fashion piece.
Online Resource Library + Offline Application	Access curated e-learning content, then apply knowledge directly in workshops.	Download guidelines on recycled filaments, then test tensile strength of prints in class.
Virtual Studio Tours + Physical Prototyping	Remote visits to labs or factories provide exposure, followed by on-site practice.	Virtual tour of an advanced 3D printing hub → local workshop on adapting techniques for fashion textiles.
Blended Hackathons	Online preparation (teams form, share ideas) combined with in-person prototyping.	Teams collaborate online to plan designs, then meet face-to-face to

Activity	Description	Example in Fashion/Textiles/3D Printing
		produce a capsule collection with 3D-printed components.

- ***Community mentoring***

Community mentoring expands the mentor-mentee relationship into broader civic and collective contexts. Tools and activities here often emphasize collective action and social engagement. For example, civic participation workshops can connect fashion and 3D-printing learners with local sustainability initiatives, such as textile recycling drives or makerspace open days. Sustainability awareness kits—developed collaboratively by mentors and mentees—can be distributed to schools or community centers, spreading the impact beyond the immediate participants. Another innovative activity is staging interactive exhibitions where mentees present prototypes (eco-fashion garments, 3D-printed sustainable accessories) to the community, receiving direct feedback from stakeholders and end users. This expands accountability and real-world validation. Community mentoring aligns well with sustainability principles, as it bridges personal growth with societal impact, ensuring the knowledge generated is not confined to project partners but benefits the wider ecosystem (Jacobi, 1991).

Table 3.7 Community Mentoring Activities Table

Activity	Description	Example in Fashion/Textiles/3D Printing
Civic Participation Workshops	Learners and mentors engage with local initiatives to connect technical skills with civic impact.	Collaborate with municipal recycling programs to explore textile reuse or 3D-printed upcycled accessories.
Sustainability Awareness Kits	Co-created toolkits or guides are distributed in the community to promote awareness and behavior change.	Fashion and 3D-printing learners design educational kits for schools on circular economy and sustainable materials.
Interactive Exhibitions	Learners showcase prototypes to local communities, gaining real-world validation and feedback.	Public exhibition where learners present eco-fashion garments or 3D-printed accessories to end users.
Community Co-Design Labs	Local residents are invited to co-create with mentors and	A makerspace event where citizens propose sustainability challenges and learners co-develop solutions.

Activity	Description	Example in Fashion/Textiles/3D Printing
	learners, fostering participatory design.	
Service-Learning Projects	Projects explicitly tie learning outcomes to community benefit.	Partner with NGOs to design low-cost 3D-printed textile repair tools for underserved groups.
Pop-Up Sustainability Fairs	Short-term community events showcase sustainable practices, bridging education and outreach.	Learners run stands on fabric upcycling, filament recycling, and live 3D-printing demos at local fairs.
Mentoring-for-Policy Dialogues	Learners and mentors engage policymakers and stakeholders in discussions about sustainability.	Present outcomes of prototyping labs to local government to inform circular fashion policy.
Community Hackathons	Local actors (students, makers, SMEs, NGOs) collaborate on intensive design challenges.	A 48-hour event to co-create a capsule collection integrating recycled textiles and 3D printing.
Storytelling & Public Campaigns	Learners transform technical knowledge into accessible narratives for the wider community.	Produce short videos on how recycled filaments reduce waste, shared via community channels.
Impact Showcases	Events that highlight long-term results of mentoring partnerships in civic contexts.	Exhibition of garments and 3D-printed objects co-developed over the project, with testimonials from community users.

- ***AI-Supported / E-Mentoring***

AI-Supported / E-Mentoring integrates digital platforms and artificial intelligence into traditional mentoring structures, preserving the mentor–mentee hierarchy while enhancing accessibility, personalization, and scalability. In this model, mentors (mid- to senior-level fashion, textile, and 3D-printing experts) share their expertise with early-career professionals and VET learners, while AI acts as a facilitator—matching participants, tracking progress, and providing adaptive feedback. This approach enables flexible formats (one-to-one, one-to-many, or group sessions) and supports geographically dispersed networks, ensuring that knowledge transfer is both efficient and tailored to individual needs.

Table 3.8 AI-Supported Mentoring Activities

Activity	Description	Example in Fashion/Textiles/3D Printing
AI-Driven Design Suggestions	Use generative AI tools to propose design variations or material applications, sparking discussion between mentoring partners.	An AI generates alternative garment patterns or 3D-print geometries, which partners critique together.
Chatbot-Based Q&A Support	AI chatbots provide instant responses to technical or conceptual questions, supplementing mentor guidance.	A learner asks a chatbot how to fix warping in 3D prints or how to optimize fabric drape for sustainability.
Automated Feedback on Assignments	AI tools assess prototypes or written reflections, giving preliminary feedback before human mentors step in.	Uploading CAD files or garment sketches to receive AI-driven analysis of structure or sustainability choices.
Learning Analytics Dashboards	AI tracks learner progress, highlighting strengths, gaps, and trends for mentors and mentees.	A dashboard shows how many successful prints a learner has completed vs. failed attempts, guiding discussion.
Virtual Co-Design Environments	AI-enhanced platforms allow multiple users to collaborate on designs remotely.	A mentor and learner co-develop a hybrid textile–3D accessory using AI-assisted CAD software.
Adaptive Learning Pathways	AI personalizes learning sequences based on user performance and preferences.	A fashion learner weak in CAD receives extra modules on 3D modeling, while a 3D learner gets content on textiles.
Simulation & Scenario Testing	AI-powered simulations let learners test "what-if" scenarios safely before physical prototyping.	Simulating the durability of recycled filament prints or the lifecycle of sustainable textiles.
Natural Language Processing for Reflection	AI analyzes journals or discussion logs to extract themes, sentiment, or recurring challenges.	AI highlights that many learners struggle with calibration or fabric resilience, prompting targeted mentoring sessions.
AI-Mediated Peer Matching	Algorithms suggest mentor/mentee pairings based on skills, goals, and project needs.	Matching a textile designer with a 3D-printing expert who has complementary sustainability goals.
Multilingual Mentoring Support	AI translation and transcription tools bridge language gaps in international networks.	Italian and Croatian partners collaborate seamlessly on

Activity	Description	Example in Fashion/Textiles/3D Printing
		sustainable fashion projects using AI-powered translation.

Table 3.9 Flexible Mentoring Activities (Applicable Across All Mentoring Models)

Activity	Why It's Flexible	Possible Adaptations Across Models
Cross-Critique / Peer Prototype Review	Feedback is universal; every model can adapt critique for learning.	Mutual: partners critique across disciplines. Peer: equal-stage learners exchange reviews. Reverse: juniors critique seniors' workflows. Blended: combine online/offline critiques. Community: open exhibitions with public critique.
Collaborative Micro-Projects / Co-Creation Sprints	Small projects are adaptable regardless of hierarchy or format.	Mutual: pairs design hybrid outputs. Peer: learners co-develop prototypes. Reverse: juniors guide seniors on tech integration. Blended: online prep + in-person building. Community: local hackathons or civic projects.
Scenario-Based Role Play / Role-Switch Design Challenge	Role play supports empathy and perspective-taking in all mentoring types.	Mutual: switch designer/technologist roles. Peer: swap novice/expert perspectives. Reverse: juniors role-play as leaders, seniors adapt. Blended: run online simulations, then debrief in person. Community: community members added into role play (e.g., NGO, policymaker).
Mentoring Journals & Reflection Logs / Peer Learning Journals	Reflection builds accountability and works in any mentoring relationship.	Mutual: shared logs between disciplines. Peer: logs exchanged between equals. Reverse: seniors reflect on digital lessons, juniors reflect on leadership. Blended: online collaborative journals. Community: reflections collected to share with civic stakeholders.
Failure Swap / Reflection Circles	Sharing challenges is effective in every mentoring type.	Mutual: cross-field solutions to failures. Peer: normalize experimentation. Reverse: juniors critique seniors' traditional methods. Blended: online forums for troubleshooting. Community: failures presented publicly to show transparency and resilience.
Shadowing & Observation / Peer Shadowing	Observing workflows is useful at all levels and models.	Mutual: partners shadow cross-field tasks. Peer: equal learners observe and reflect. Reverse: seniors shadow juniors during tech tasks. Blended: virtual shadowing (recorded demos).

Activity	Why It's Flexible	Possible Adaptations Across Models
		Community: public observation in makerspaces or open days.
Workshops (In-person or Hybrid)	Hands-on practice bridges theory and application across contexts.	Mutual: discipline-specific exchange. Peer: joint labs to learn together. Reverse: juniors lead digital workshops for seniors. Blended: combine MOOC + workshop. Community: civic participation workshops.
Exhibitions / Public Showcases	Presenting outputs creates accountability and visibility.	Mutual: partners co-present prototypes. Peer: peers present collaborative projects. Reverse: juniors introduce digital tools in joint presentations. Blended: hybrid online/offline showcase. Community: public exhibitions or fairs.

Table 3.10 Mentoring Models: Tools & Practical Exercises

Mentoring Type	Tools	Practical Exercise (hands-on task)
Mutual Mentoring	· Shared online whiteboards (Miro, MURAL) · Joint project journals (Google Docs, Notion) · Material libraries (fabric swatches, filament samples)	**Cross-Prototype Swap**: Each partner brings a prototype (sketch or 3D model). They exchange and modify it using their own disciplinary methods (fashion modifies CAD file; 3D modifies textile sketch).
Peer Mentoring	· Peer review templates/checklists · Collaborative platforms (Padlet, Trello) · Shared reflection diaries	**Paired Micro-Tutorials**: Each peer teaches the other a short skill (e.g., sewing technique, slicer setup), then documents learning with photos/videos for shared review.
Reverse Mentoring	· Video-conferencing with screen-sharing · Digital learning apps (CAD software, slicers, sustainability calculators) · AI chatbots for Q&A	**Digital Tool Walkthrough**: A younger 3D-printing expert mentors a senior textile manager through slicing and preparing a fashion accessory prototype, ending with a test print.

Mentoring Type	**Tools**	**Practical Exercise (hands-on task)**
Blended Mentoring	• MOOCs (edX, Coursera) • Webinar platforms (Zoom, Teams) • Makerspaces or FabLabs for offline prototyping	**MOOC-to-Makerspace Sprint**: Complete an online module on circular economy → meet in person to co-create an accessory from recycled textile + filament.
Community Mentoring	• Civic platforms (Slack/Discord for community exchange) • Exhibition spaces / makerspaces • Awareness kits and visual communication tools (Canva, posters, brochures)	**Community Exhibition Challenge**: Mentors and mentees co-design a sustainable fashion/3D object, then present it at a local fair or makerspace open day, collecting live feedback from the community.
AI-Supported Mentoring	• AI-powered matching platforms • Learning analytics dashboards • Generative design tools (MidJourney, CLO3D, Fusion 360 with AI plugins)	**AI-Enhanced Design Sprint**: Mentor and mentee upload a garment/3D design idea to an AI tool; the AI generates alternatives, which are critiqued and refined collaboratively, leading to a prototype.

4. References

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