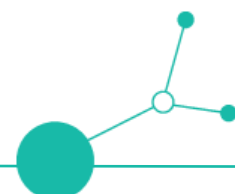


RE/UPskilling Program LP1

D 2.1.1

DME - Digital manufacturing engineering





General introduction

Re/UpSkilling programs are a part of Digital Skills Transformation Toolkit DiSTT. The “Toolkit” is defined by project proposal as a comprehensive solution to address the skills gaps and support the digital fabrication skills transformation process to foster labour market workforce. It consists of re/upskilling programs, designed by each DiSTT partner to meet the needs of target groups and to fill identified skillGaps in the regions.

The target is to enable educators (typically Fab Labs and Makerspaces) to offer structured, high-quality training inspiration and resources, which leads to the fostering innovation, bridging the gap between education and industry, and preparing individuals for the challenges of an evolving technological world. This educational program is designed by LP1, strojLAB team from Brno University of Technology.

This educational program is designed for industry stakeholders and focuses on **upskilling company employees** who wish to expand their expertise in digital technologies and engineering, as well as on **reskilling individuals** within the framework of lifelong learning – for instance, those transitioning to new careers or adapting to labor market changes driven by emerging technologies and the decline of older ones.

The **expected outcome** of the program is the **award of micro-certificates** to successful participants. These certificates provide credible recognition of newly acquired skills, helping to reduce skill gaps in the labor market and improve the alignment between workforce competences and industry needs. At present, the acquired skills and learning outcomes are recognized at the **national level** in the Czech Republic. However, with ongoing legislative developments, these **micro-certificates are expected to gain international (European) recognition**, enabling participants to validate and demonstrate their competencies across sectors and countries within the broader European education and labor market framework.

SkillNest.app as a platform for uptake Toolkit by others

SkillNest.app is web based platform designed to deliver DiSTT outputs to the wider audience. Currently it consists of Pilot RUN browser and skill expert list. Later it will provide whole RE/UP programs and other features to be discussed also with “uptakers” and stakeholders. The primary reason for it is to offer inspiration for other educators and to provide useful content for wider positive impact to the labour markets beyond the DiSTT project.

The Toolkit defined by Strategy document

To ensure consistency across outputs of the DiSTT project we provide summary of the key decisions valid for designing Re/Up programs - the core of the project

Conclusion for the Toolkit (sum-up)

The DiSTT Toolkit will be WEB based HUB, portal or application which will not be just a set of learning materials, but a **comprehensive framework for digital skills transformation** that:

- bridges hands-on learning with labor market needs,
- supports long-term sustainability of FabLabs as educational hubs,
- ensures transferability, openness, and scalability across Europe.

Key Components of the Toolkit defined in the Strategy document



1. Modular Educational Programs

examples:

- “**Learn-it!**” - technical and theoretical preparation
- “**Make-it!**” - hands-on workshops and project-based learning
- Ready-to-use curricula and learning units for different levels
- Localization options to suit regional contexts

2. Assessment and Feedback Tools

examples:

- Pre- and post-module self-assessment questionnaires
- Continuous formative evaluation by facilitators
- Criteria for evaluating prototypes, projects, and teamwork
- Recommendations for informal certification or skill recognition

3. Implementation & Methodological Guide

examples:

- Guidelines for program deployment in FabLabs
- Role of the facilitator and design of the learning environment
- Tips for cooperation with schools, industry, and local partners
- Best practice examples and sustainable operational models

4. Communication and Outreach Materials

examples:

- Templates for promoting training programs
- Messaging strategies for schools and companies
- Tools for community building and sharing results

5. Open Platform / Repository

examples:

- Online access to all materials (e.g., Moodle, Git, website)
- Possibility to adapt and contribute content
- Open licensing to support widespread adoption



LP1 RE/UPskilling program

title of the RE/UP program:

Digital manufacturing engineering

Target group:

The target group of people to be trained by this Reskilling program will be mainly employees of industrial partners or freelancers who want to catch up with current trends in digital manufacturing.

LP1 pedagogical approaches to the Re/Up program

Plan of LP1 to the pedagogical approach with focus on industrial partners and their employees.

- **Project-Based Learning (PBL)** FME BUT uses Project-Based Learning to cultivate critical thinking and problem-solving by engaging students in collaborative, real-world engineering projects.
- **Hands-On Experience and Maker Culture** FME BUT integrates maker culture by providing access to advanced labs and workshops like strojLAB, equipped with tools like 3D printers and CNC machines, enabling hands-on prototyping and practical skill development.
- **Design Thinking** methodology is actively integrated into education to foster creativity, user-centered problem-solving, and rapid prototyping skills among students. It is particularly emphasized in project-based courses, innovation labs and cooperation with industry partners.

LP1 program main stakeholders

1. Technical Universities to uptake approaches to the education in the STEM fields
2. Educators (individualities, international educators for mobilities)
3. Industrial partners
4. international students (for mobility programs)

LP1 main purpose of the program

- skill-building (REskilling, expected some other expertise and knowledge from previous work life of participant),
- industry related innovation and collaboration

LP1 clear learning outcomes

- **Applied knowledge** (using gained knowledge practically)
- **Problem oriented thinking** (going straight to the core of the problem, ability to find it, solve it and demonstrate prototyped solution).
- **Proactive attitude in the innovation ecosystem** (working in the teams and interact with external mentors)
- **Learning by failing** (don't worry to fail, rather accept failures in the iteration process)



LP1 target competencies

- **problem solving (design thinking)** (ability to act realistically to the problem and what is needed for the solution, to take in to the account level of the skills of individual, teams,)
- **digital fabrication skills** (to understand what technology can realistically can produce and how to produce/manufacture/fabricate)
- **CAD/CAM** (fabrication aware methodologies of designing parts for digital fabrication)
- **code electronics (microcontrollers)** (ability to electrically “revive” machines e. g. with arduino and servo drives)
- inspection of parts

General Skill List (According to the Blueprint)

3D Printing / Additive Manufacturing	Operating 3D printers 3D modeling and slicing software, additive rules Maintenance and troubleshooting of 3D printers
Laser cutting (CNC cutting)	Operating laser cutters Vector graphic design for laser cutting Material selection and settings adjustment
CNC Machining	Operating CNC machines (e.g., routers, mills) CAM software (e.g., Fusion 360, RhinoCAM, SprutCAM) Toolpath generation and machine setup
3D scanning	Operating 3D Scanners Scanning Techniques Post-Processing Scans Integration with CAD Applications of 3D Scanning
2D & 3D design (and computer simulation)	2D and 3D CAD software (e.g., AutoCAD, SolidWorks, Tinkercad) Parametric design, Algorithmic design Technical drawing and blueprint creation
Robotics & Automation	Basic robotics concepts and design Assembling and programming robots Integration of sensors and actuators Understanding of automation systems PLC programming



	Integration of automation components
Makers soft skills	Effective communication of ideas and concepts Prototype iteration and improvement Documentation and presentation skills Teamwork and collaboration Design thinking

LP1 developed Program Curricula

Curriculum development: Based on the needs confirmation performed in A1.1, create a modular and flexible curriculum for each target group that covers needed digital fabrication skills. The curriculum will follow the structure defined by Activity A1.3 in the project proposal.

LP1 relevant format with curricula example

Thematic Studio

Structure:

- 26-hours structure with an intensive or weekly theme
- Short lectures + lab or FabLab session
- Final open exhibition or pitch

Pedagogy: Blended learning, constructivist design

Assessment:

- Ongoing peer feedback
- Reflective logs
- Instructor formative feedback on each milestone

Inspired by: weekly thematic studio

Workshop title	Metal powder additive manufacturing skills for engineering applications
Target audience	Companies/employees
Prerequisites	None



Purpose & Learning Outcomes	Knowledge of modern additive manufacturing technologies for fabrication of metallic components, understanding of material properties and typical material defects, initial material characteristics, design rules for metal additive Manufacturing using powder bed fusion technologies, Practical skills in preparing digital models and prototype optimisation, Fabrication process, post-processing and validation methods.
Program Format	Context/structure: Theoretical lessons supported with self-study materials and practical activities using strojLAB facilities, Duration: twenty-six learning hours distributed over a few weeks Delivery mode: in person, powerpoint output, physical prototype
Skill Gaps	Operating 3D printers, 3D modeling and slicing software, additive rules Maintenance and troubleshooting of 3D printers
Learning Activities	lectures, self-study, laboratories and consultations
Assessment	Pre-workshop self-assessment (confidence, familiarity, expectations) - Post-workshop self-assessment (learning gains, perceived growth) and End-of-session surveys (content quality, experience, suggestions) Practical outputs (prototype, presentation describing prototype design, fabrication and post-process quality)
Roles & Support	Facilitator: BUT educator/lecturer from strojLAB Evaluator: university lecturer (class leader)
Feedback	Quick survey at the end of course
Showcase or Closure	Final presentation of fabricated and post-processed prototypes
Documents, support materials	Presentation in powerpoint (incl. goals, timeline, knowledge base) Instructions and guide for laboratory equipment Self-study materials.
Language:	Czech/English (based on the audience, no baseline requirements needed)

LP1 developed Instructional Design tools

As part of the pilot runs, we prepared a variety of teaching materials—most commonly presentations, printed manuals, and assignments—while focusing primarily on a *hands-on* learning approach. At Brno University of Technology (BUT), these materials are made available to students through the university's e-learning platform for each accredited course.

Within the **strojTALK** lecture series, we have increased the involvement of guest lecturers who present specific skills (e.g. large-format 3D printing, Design Thinking) from the perspective of their inspiring professional practice. This approach helps students better recognize the real-world applications of the skills being taught. The recorded talks are also available on the **FME BUT YouTube** channel.



Workshop materials and tools:

- power point presentation with instructions and visualisations (all pilot RUNs)
- video (usually as part of presentations or comparative assessment - strojLAB challenge)
- laptops (for example Pilot RUN: Generative Design in Practice by V. Florián)
- Flipchart templates (for teams during Design Thinking workshops)

LP1 developed Assessment tools

General principles of the Assessment

The core approach is focussed on self-assessment before and after the workshops to estimate the impact of the workshops. Other approaches are individual for each RE/UPskilling program (each DiSTT project partner and their target group). Generally we can distinguish between following:

Assessment of the trainee

- self (central pre/after assessment through skillNest) (subjective)
- by authority (for LP1 only with hackathons or bigger events) (subjective - credible)
- by exact values to be reached (for example correct or incorrect answers in the test)

Assessment of the pilot/workshop

- by trainee (optional on the skillNest - post-assessment)
- by external authority (not planned or to be discussed in person with authorities)

Structure of the skillNest assessment surveys

As general principle for each partner: to provide a common base for the assessment by the participants first 3-6 questions mandatory regarding selected skillGaps to be covered by PilotRUN/workshop. Next questions will be prepared by the lecturer through application. The currently planned app is called FormBrick, which can be implemented into the skillNest and in the range of currently planned purposes in the DiSTT it is for free.

pict: appearance of the pre/after assessment form implemented in the skillNest



LP1 - Assessment Approach defined in the Blueprint

In the DiSTT framework, student assessment combines traditional academic standards with innovative, practice-oriented evaluation methods. While the ECTS grading scale remains in use—particularly within LP1 courses that are formally integrated into accredited study programs—the overall assessment philosophy expands far beyond conventional grading. The focus is on evaluating the quality and functionality of real-world outcomes such as prototypes, design solutions, and projects developed during hackathons, workshops, and collaborative assignments.

This approach emphasizes **formative feedback**, **self-assessment**, and **guided reflection**, enabling students to actively monitor their own progress in digital skills, creative problem-solving, and teamwork. Rather than measuring success solely through grades, DiSTT prioritizes indicators of **creativity**, **initiative**, and **practical competence** that align closely with the expectations of modern industry.

An essential aspect of the DiSTT assessment culture is the personal development of each participant. The process encourages learners to understand and articulate their own perception of the skills they have acquired, fostering self-confidence and a sense of ownership over their learning journey. Whenever possible, direct person-to-person feedback is integrated into the process, often involving **external experts**, **mentors**, or **representatives from industrial partners**, who provide valuable insights from real professional contexts.

By combining formal evaluation with authentic, experience-based feedback, DiSTT ensures that participants not only meet academic requirements but also gain tangible, transferable skills and a realistic understanding of their role within the future workforce.