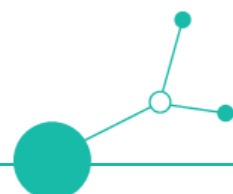


Re/Upskilling Program PP3

D 2.1.1





General Introduction

This deliverable presents the PP3 re/upskilling program Digital Tools in Vocational Training: **Empowering Tomorrow's Workforce**, developed within Activity 2.1. PP3 targets apprentices and craftsmen lacking digital fabrication skills. This document outlines the PP3 program design, ensuring transferability and compatibility within the Digital Skills Transformation Toolkit.

The program addresses the skills gap in digital fabrication among apprentices and craftsmen by providing a three-day, hands-on workshop. Participants gain practical experience in CAD design, 3D printing, laser cutting, and robotics using Calliope mini microcontrollers. The program strengthens digital literacy, creativity, and teamwork while promoting employability in an evolving labour market. The workshop design includes curriculum, instructional approach, assessment methodology, stakeholder involvement, and certification. Practical considerations such as GDPR-compliant consent for minors are also integrated.

igned with the project's transnational goals, the PP3 program is built to be transferable and adaptable, enriching the DiSTT Toolkit while serving as a scalable model for Makerspaces and innovation-driven learning institutions across Europe.



PP3 UPskilling program

Title of the program:

Digital Tools in Vocational Training: Empowering Tomorrow's Workforce

Program Rationale

The increasing digitalization of vocational sectors demands that apprentices acquire digital fabrication skills at an early stage of their training. Many craftsmen and apprentices lack access to such skills within their traditional training environments. PP3's program provides an accessible entry point to digital tools and methods, bridging the skills gap and equipping participants with competences highly valued in the labour market. By combining technical training with transversal skills such as teamwork and problem-solving, the program ensures relevance both to individual learners and to companies.

A deliberate design choice was made to focus on developing a single, intensive workshop format rather than a wide range of modules. This compact three-day program is intended as a transferability testbed: it is run with apprentices from very different backgrounds, such as carpentry, mechatronics, and business administration to observe how one workshop structure can be adapted and applied across diverse vocational contexts. For example:

- **Mechatronics apprentices** can take the course at the beginning of their training, gaining an overview of digital manufacturing technologies before studying them in depth.
- **Apprentices from other disciplines** get valuable exposure to tools and methods they might not otherwise encounter, broadening their digital skill set and professional perspective.

Discussions with companies confirmed that a compact three-day format is especially suitable, as it can be integrated into everyday work schedules without causing major disruptions. This makes the program highly compatible with vocational training frameworks and company operations.

In this way, the program does not only teach digital fabrication skills but also generates valuable insights about the adaptability and flexibility of the learning design itself. The findings will inform later scaling and adaptation, providing evidence on how a cross-cutting program can be integrated into multiple vocational pathways and professions.

Program Overview

The program **Digital Tools in Vocational Training: Empowering Tomorrow's Workforce** is a three-day, 20-hour intensive workshop held in a makerspace environment. The workshop is delivered in German and is designed for beginners without formal prerequisites. Each group consists of 6-8 participants, guided by one trainer with expertise in CAD design, 3D printing, laser cutting, robotics, and basic programming. The makerspace must provide access to 3D printers, a laser cutter, Calliope mini microcontrollers with Movement Sets, and general workshop facilities. Material costs are estimated at approximately €100 per participant.



The workshop combines technical and creative learning, enabling participants to design, build, and code their own robotic prototypes. Through project-based collaboration, learners develop both technical know-how and confidence in using digital tools.

Pedagogical Approach

The program is based on three complementary pedagogical principles:

- **Project-Based Learning (PBL):** Participants work in teams on a concrete robotics challenge and present tangible prototypes at the end.
- **Experiential Learning:** The focus is on hands-on exploration and reflection on tools, processes, and problem-solving.
- **Formative Assessment:** Trainers provide continuous feedback, complemented by self-assessment and peer evaluation to measure progress.

Curriculum Structure

Workshop title	Digital Tools in Vocational Training: Empowering Tomorrow's Workforce
Target audience	Apprentices from all vocational fields (e.g., carpentry, mechatronics, business)
Prerequisites	No formal requirements; basic technical knowledge helpful
Purpose & Learning Outcomes	Practical skills in CAD, 3D printing, laser cutting, and robotics; strengthened teamwork, problem-solving, presentation, and design thinking
Program Format	3-day compact in-person workshop (20 hours) at Happylab Vienna; 1 trainer per 6-8 learners
Skill Gaps	Limited digital fabrication and CAD experience; low coding/electronics confidence; need for teamwork and problem-solving competences
Learning Activities	Hands-on CAD design, 3D printing, laser cutting, robotics programming, team projects
Assessment	Pre/post surveys, continuous formative feedback, final prototype demonstration, certificate
Roles & Support	Trainers skilled in CAD, digital fabrication, robotics, and coding basics
Feedback	Formative feedback during activities, final survey, trainer debriefs
Showcase or Closure	Team presentations of functioning robot prototypes; certificates awarded
Documents, support materials	CAD software, 3D printers, laser cutter, Calliope mini kits with Movement Sets, guides and tutorials
Language:	German (adaptable to other languages)



Workshop Overview

Day 1 - Foundations

- Welcome, organization, questionnaire.
- CAD design and introduction to 3D printing.
- Laser cutting chassis and name tags.

Day 2 - Digital Fabrication & Robotics

- 3D printing connectors and continued laser cutting.
- Programming basics with Calliope (loops, conditions).
- Assembling robots, wiring, decorating.

Day 3 - Robotics Challenge

- Robot programming: subprograms, variables, testing.
- Robo Challenges (drive set distances, draw shapes, transport objects).
- Team presentations and feedback session.

Detailed Workshop Activities

- **Laser cutting the chassis:** Participants receive a short introduction to the laser cutter. Each group individualizes the robot template and cuts it. (2-3h)
- **3D printing connectors:** Either a short introduction to slicing and printing is given and parts are printed, or pre-produced parts are provided. (time flexible)
- **TinkerCAD name tags:** Short exercise to design and print personalized name tags.
- **Programming with Calliope:** Introduction to physical computing, loops, and conditions. Simple algorithms are created, such as button-activated sounds, dice simulations, or a step counter. Advanced participants can try building a piano, using distance sensors, or testing motors. (2-3h)
- **Assembling the robot:** Following instructions, wiring, screwing, and decorating. If time allows, sensors (line sensor, ultrasonic sensor) are integrated. (1-2h)
- **Programming the robot:** Integrating extensions and learning to control movement. First challenge: drive around a stool and return to the starting point. (1h)
- **Robo Challenges:** Participants solve tasks such as:
 - Drive 500 mm and stop before 600 mm.
 - Navigate a curve and stop in a marked goal area.
 - Enter a goal area, turn, and return to the start line.
 - Draw a circle, rectangle, or triangle with a pen fixed to the robot.
 - Transport a ball from A to B.
 - Perform the same tasks in reverse driving.
 - Optional wireless challenges: one robot controls another, robots respond to shaking, or directional input.

Instructional Design and Materials

The instructional design combines short presentations, demonstrations, and guided tutorials with hands-on exercises. Participants use CAD software, 3D printers, laser cutters, and Calliope kits with Movement Sets.



Learning materials include printed guides, video tutorials, and step-by-step exercises. The modular structure allows adaptation to varying skill levels and supports different learning preferences.

To support an engaging and accessible learning experience, PP3 has prepared a compact package of instructional resources tailored to the objectives of the workshop. This includes:

- Slide decks with essential visual content and step guidance for instructors.
- Printed worksheets and short handouts to accompany in-session exercises.
- Starter files and example code (CAD templates, Calliope sketches) directly usable by learners.

The approach is intentionally practical and non-academic: instead of long lectures or extensive manuals, participants receive short inputs, live demonstrations, structured exercises, and opportunities for immediate feedback and peer exchange. The materials are designed to be lean and functional, supporting curiosity, autonomy, and collaborative learning in a workshop-like setting.

Practical Considerations (Data Protection & Consent)

To comply with GDPR and youth protection regulations, explicit consent must be obtained before taking photos or videos during the workshop. Since some participants are minors, parental consent is required. A standardized consent form will be distributed and collected prior to the workshop.

Assessment Tools

Assessment is structured around pre- and post-surveys, continuous feedback, and final presentations.

Application and selection: Companies (our stakeholder partners) nominate apprentices to participate. This ensures alignment with training needs and guarantees that the workshop fits into vocational training schedules.

Pre-survey: The pre-survey at the beginning acts as a diagnostic entry point, capturing baseline knowledge and expectations. Learners self-assess their competences in CAD, 3D printing, laser cutting, programming, safety, teamwork, and digital confidence. They also state their expectations for the workshop.

Formative assessment: Trainers provide feedback during each activity, encouraging reflection and iterative improvement.

Post-survey: Participants reassess their competences and provide feedback on the workshop experience. Results are compared with pre-survey responses to measure progress.

Final presentation: Teams present their robotic prototypes, demonstrating technical and collaborative achievements.

The pre- and post-survey items are directly linked to the core learning objectives of the workshop: developing confidence with CAD, 3D printing, laser cutting, and programming. However, the broader objective goes beyond technical skills: the program aims to help apprentices **overcome fear of digitalisation** and to **strengthen their sense of self-empowerment** when facing new technologies.

Assessment is therefore not a grading exercise but a reflective tool. Questionnaires foster learner awareness, highlight progress, and encourage motivation. Trainers also gain actionable feedback to continuously improve the course. Results across pilots will be documented to support comparability and adaptation in other vocational contexts.



Stakeholders

The program is embedded in real vocational training through collaboration with key stakeholders:

- **Jugend am Werk:** Coordinates apprentices and ensures integration into existing training structures.
- **Wiener Linien:** Provides apprentices from mechatronics and validates industry relevance.
- **A1:** Contributes apprentices from technical and business related fields and ensures alignment with ICT-related digital skills needs.

In discussions with these stakeholders, it became clear that the compact three-day format is highly valued. Companies emphasized that such an intensive workshop can be integrated into everyday work schedules without causing major disruptions. This feedback directly informed the program design and confirms its practical relevance for employers and training providers.

These partnerships guarantee that the workshop remains practice-oriented, aligned with company requirements, and sustainable.

Expected Learning Outcomes and Competencies

The workshop provides an introduction to digital fabrication and strengthens both technical and transversal skills.

Technical Competencies:

- CAD design and preparation of files for digital fabrication.
- Independent operation of 3D printers and laser cutters.
- Basic programming with Calliope mini.
- Prototyping and assembly of functional robotic systems.

Transversal Competencies:

- Creative problem-solving and iterative design.
- Teamwork and collaborative innovation.
- Digital literacy and confidence in applying new tools.
- Communication and presentation skills.

Course Objectives:

- Encourage creative and technical problem-solving.
- Enable transformation of ideas into tangible prototypes.
- Build confidence in coding and electronics.
- Foster motivation through collaborative challenges.