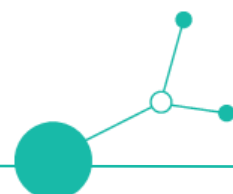


Pilot Run Reports

D 2.2.1

Project Partner: PP7 JINTEK (PP2 FabLab Brno), Czech Republic





PILOT RUN REPORTS - PP7

DiSTT addresses digital skills gaps and supports the development of transferable reskilling and upskilling programmes connected to FabLabs, makerspaces, education providers and employers. PP7 JINTEK (PP2 FabLab Brno) contributes a practice-oriented learning environment where young people can explore digital technologies through direct use, experimentation and the creation of tangible results.

The PP2 pilot activities focused primarily on **high school students aged approximately 15-19**. The programmes responded to the identified need to provide young people with earlier exposure to digital fabrication technologies and to help them develop both technical and transversal competences relevant to future studies and employment.

The activities were designed around **learning-by-doing**. Rather than focusing only on theoretical knowledge, participants worked with real digital fabrication equipment and applied their skills to practical projects and prototypes.

1. Overview of the Pilot Runs

PP2 - FabLab Brno (PP7 JINTEK) implemented two pilot activities within the DiSTT project, focusing on developing practical digital fabrication skills and supporting young people in gaining competencies relevant to further studies and future employment. The activities were designed around hands-on, project-based learning and combined technical skills with soft skills such as teamwork, communication, problem-solving, creativity, and presentation skills.

The pilot activities targeted primarily **high school students and young people interested in technology, engineering, design, and digital fabrication**. Participants had the opportunity to work with professional digital fabrication technologies and develop practical skills through real-world projects.

1.1 Activity 1 - Competition with FabLab for High School Students

1.1.1 Program Description

High School Competition was a practical, project-based competition aimed at high school students, focusing on the development of technical and soft skills through hands-on work in digital fabrication. Over the course of the programme, participants designed and built functional prototypes using professional tools and technologies available at FabLab Brno.

Participants learned to:

- Model and prepare designs for 3D printing using software such as **Tinkercad** and **Fusion 360**.
- Prepare and slice 3D models using **PrusaSlicer** and operate a **Prusa i3 MK3S 3D printer**.
- Create vector files using **Inkscape** and operate a **Trotec Speedy laser cutter** using JobControl software.
- Work with basic electronics, including prototyping with **Arduino microcontrollers**.
- Apply technical knowledge to the development of a functional prototype.



In addition to technical skills, participants developed **presentation and communication skills** through a workshop with a professional lecturer, as well as **teamwork, time management, project planning, and problem-solving skills** while working on their prototypes.

The programme concluded with final presentations, where teams presented their projects to an expert committee. The committee included representatives of FabLab Brno, BUT Brno, VIDA! Science Centre, and Honeywell, providing participants with feedback from both educational and industry perspectives.

1.1.2 Learning Outcomes

The pilot activities aimed to enable participants to:

- Create and prepare simple digital models for fabrication.
- Understand the basic workflow from digital design to physical prototype.
- Prepare and operate a 3D printer.
- Create files and safely operate a laser cutter.
- Understand basic principles of electronics and prototyping.
- Use Arduino and other digital tools for simple projects.
- Apply creative problem-solving and iterative design.
- Work collaboratively and distribute tasks within a team.
- Develop project planning and time-management skills.
- Communicate technical ideas and present project results.
- Build confidence in approaching unfamiliar digital technologies.

1.2 Overview of Activity 2 - Techsprint

TechSprint was a program aimed at high school students, focusing on developing technical and soft skills through hands-on work in digital fabrication. A class of high school students was tasked with a problem they had to solve in teams, and over the course of the program, participants designed and built functional prototypes using real-world tools and technologies. With similar goals and setup, in its essence, TechSprint became a shorter alternative programme for schools in exchange or on top of *High School Competition* (Activity 1).

In relation to the goal of trying to improve students' skill sets based on the demands of the current job market, we tried to team up with different companies to come up with tasks for students that would be simulating real work challenges. The topic of the challenge changed for each run, depending on the type of school participating, whether a company was available or capable of providing a real-life task suitable for given school, etc. The topics ranged from an easier challenge of building an electronic "smart" flowerpot using an Arduino, to a tough challenge using an E-ink display and building a reservation system for meeting rooms.

Regardless of the topic, the main goals for what students should learn during the program remained the same for each run. Students mostly learned to:

- Model and prepare designs for 3D printing using software like Tinkercad and Fusion 360, slice models in PrusaSlicer, and operate a Prusa i3 MK3S 3D printer.
- Use a laser cutter (Trotec Speedy) by creating vector files in Inkscape and controlling the machine through JobControl software.
- Work with basic electronics, including prototyping with Arduino microcontrollers.



In addition to technical skills, participants developed:

- Presentation and communication skills as well as teamwork, time management, and project planning while collaborating on their prototypes.

The program concluded with final presentations, where teams showcased their projects.

2. Methodology

The evaluation of both PP7 (PP2 - FabLab Brno) pilot activities followed a shared, **practice-oriented, mixed-method approach**, combining quantitative pre- and post-programme self-assessment with qualitative observation and stakeholder feedback. While the overall evaluation framework was consistent across both activities, the specific instruments and implementation timeframe were adapted to each activity's format: **Activity 1 (High School Student Competition)** ran as a single multi-month competition format, while **Activity 2 (TechSprint)** was delivered as a shorter, repeated 3-5 day sprint across several school groups.

2.1 Data collection instruments

Data for both activities were collected through structured pre- and post-programme self-assessment questionnaires, complemented by direct observation during practical work and feedback from participants, teachers and external stakeholders.

Activity 1 - High School Student Competition

Participants completed a **Mentimeter-based Likert-scale** self-assessment before and after the programme, rating their competence in 3D modeling, 3D printing, laser cutting, electronics (Arduino), teamwork, communication and leadership. This was complemented by instructor observation during practical work and by feedback from an expert evaluation committee (representatives of FabLab Brno, BUT Brno, VIDA! Science Centre and Honeywell) at the final presentations.

Activity 2 - TechSprint

Participants rated their skills on a **1-5 self-assessment scale** at the start and end of each pilot run, covering 3D modeling and slicer use, 3D printing, laser cutting and vector-graphics preparation, microcontroller programming, basic electronics, teamwork, time management, presentation and communication skills. The same instrument was applied consistently across all pilot runs and was complemented by facilitator observation of team-based challenge work and by input from the partner companies that co-designed the challenge tasks.

2.2 Analytical approach and quality considerations

For both activities, results were analysed by comparing pre- and post-programme mean scores for each competence area, at the level of the individual pilot run and, where relevant, aggregated across runs of the same activity. This approach highlights overall learning trends while allowing differences between runs and target groups to be identified.

The self-reported nature of the data has some limitations: not all participants who completed the pre-assessment were present for the post-assessment, which can affect the precision of the reported gains, and the hard-skill and soft-skill sections of the questionnaires were structured somewhat differently, an



inconsistency that will be corrected in future editions. To address these limitations, the quantitative results are triangulated with qualitative evidence, including instructor and teacher observations, final project presentations, and feedback gathered during partner residency visits – for example, David Škaroupka's feedback on the use of Likert-scale self-assessment as a reflective learning tool.

2.3 Data protection considerations

As participants in both activities are high school students, attendance records and any individually identifiable assessment results are retained internally by FabLab Brno / JINTEK and are not included in this report. Only aggregated and anonymised results are presented in Section 4, in line with data protection requirements for minors.

3. Pilot Implementation

3.1 Partner Residency Visits

As part of the transnational cooperation and experience-sharing effort, representatives from partner organizations participated in the pilot run through residency visits. **David Skaroupka**, representing the DiSTT lead partner, was one of the four members of the final evaluation committee. He provided valuable feedback on the overall structure and delivery of the competition. In particular, he appreciated the use of **self-assessment through Likert scales** as a reflective learning tool, as well as the **well-prepared final presentations**, which effectively demonstrated both technical outcomes and soft skill development among participants. We also had a person from PP3 - Happylab who was observing our finals.

4. Program Evaluation

4.1 Methodology and Evaluation

4.1.1 Activity 1

The pilot activities followed a **practice-oriented, project-based learning approach**. Technical demonstrations and short theoretical inputs were immediately followed by practical work, allowing participants to apply newly acquired knowledge.

The evaluation combined participant self-assessment, observations during practical activities and feedback from participants, teachers and project stakeholders.

4.1.2 Activity 2

The core of Activity 2 was truly **challenge-based learning**. Participants were given a task deliberately calibrated above their existing skill level. Students were introduced to a task that clearly required skills they didn't have yet, and with basic training and their own efforts they learned a lot of things very quickly in the span of a couple days. Necessity and time pressure accelerated skill acquisition more effectively than sequential instruction, despite some students complaining that this learning approach was uncomfortable and not what they were used to from school.



The evaluation combined participant self-assessment, observations during practical activities and feedback from participants, teachers and project stakeholders.

4.2 Self-Assessments and feedback tools

4.2.1 Activity 1

We developed a structured assessment approach based on **pre- and post-program self-evaluation**, designed to track the development of both technical and soft skills. The primary tool used was a **Mentimeter-based Likert scale**, which allowed participants to rate their own competence levels in key areas such as 3D modeling, 3D printing, laser cutting, electronics (Arduino), teamwork, communication, and leadership.

This assessment format was chosen for its accessibility, ease of use, and ability to **generate comparative visual data**. Participants completed the same set of questions before and after the program, enabling individual reflection and program-level impact analysis. The modular structure of the program allowed instructors to observe and adapt support based on skill levels revealed in the pre-assessment.

The results provided valuable insights not only into the effectiveness of the learning process, but also into areas where **additional support or structure** may be needed—especially in soft skill development like collaboration and role distribution.

Visual summaries and data charts from the assessments will be included in the final documentation to illustrate learning outcomes and program effectiveness.

Hard Skills - Clear Improvement

Participants showed significant progress in technical competencies:

- **3D modeling and design preparation** - a strong increase from 2.8 to 4.8
- **Operating a 3D printer** – greater confidence in setup and usage (2.6 → 4.7)
- **Laser cutter operation** – the largest leap, indicating it was a new skill for many (1.3 → 3.8)
- **Basic electronics (e.g., circuit assembly, soldering)** - improved from 3.7 to 5.1
- **Arduino programming** – notable progress in a more advanced area (2.6 → 3.3)

These results confirm that the program **effectively built practical technical skills**, even for participants with limited prior experience.

Soft Skills - Mixed Outcomes

- **Team collaboration** remained nearly unchanged (5.1 → 5.0), possibly due to initially overestimated self-ratings.
- **Project leadership or co-leadership** improved slightly (4.2 → 4.6), but not significantly.
- **Role distribution in a team** slightly decreased (4.2 → 4.0), suggesting discomfort or unfamiliarity with defining team structure.
- **Communication during problem-solving** showed a modest increase (4.3 → 4.6).

These results indicate that **soft skill development did occur**, but to a lesser extent. For many students, working in teams was a new experience, highlighting the value of such programs in preparing them for **real-world, collaborative work environments**. More structured group work and targeted facilitation could support deeper growth in future editions.



Mentimeter

Hard skills - před vs. po

Jak dobře ovládáš vytvoření modelu a zpracování pro 3D tisk?

Před soutěží bych si dal/a..

2.8

Po soutěží bych si dal/a..

4.8

Vůbec neovládám

Ovládám velmi dobře

37

Mentimeter

Hard skills - před vs. po

Jak jistě se cítíš při spuštění a nastavení 3D tisku?

Před soutěží bych si dal/a..

2.6

Po soutěží bych si dal/a..

4.7

Vůbec neovládám

Ovládám velmi dobře

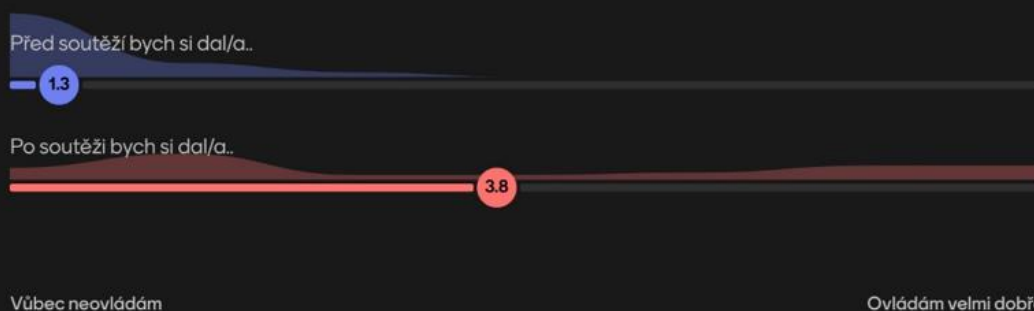
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Mentimeter

Hard skills - před vs. po

Jak ovládáš přípravu souboru a práci s laserovou řezačkou?

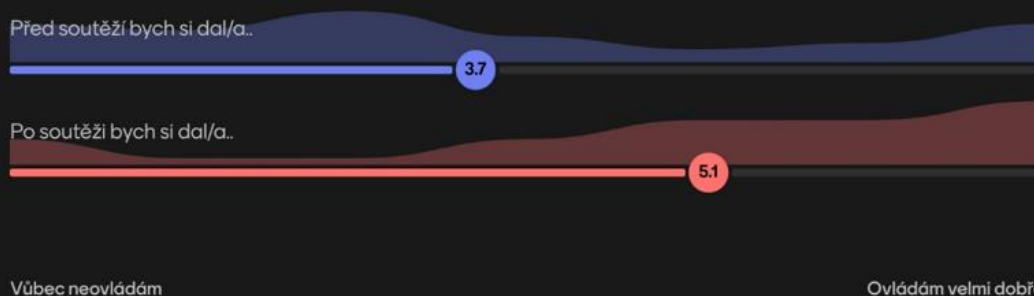


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Mentimeter

Hard skills - před vs. po

Jak si poradíš se základní elektronikou (např. zapojení obvodu, pájení)?



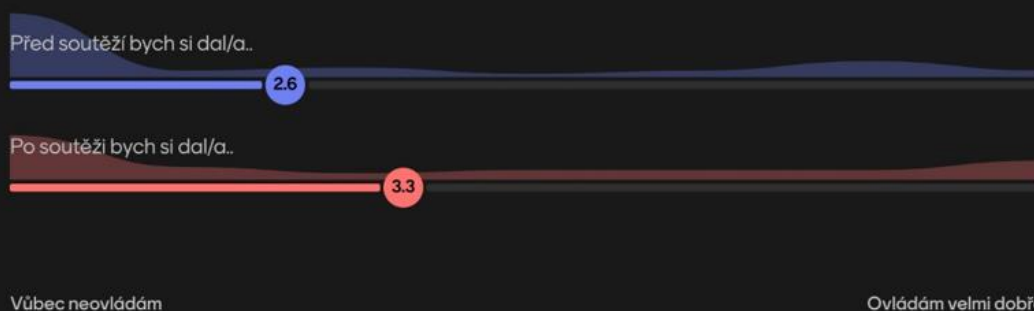
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Mentimeter

Hard skills - před vs. po

Jak se orientuješ v přípravě jednoduchého programu pro mikrokontrolér?

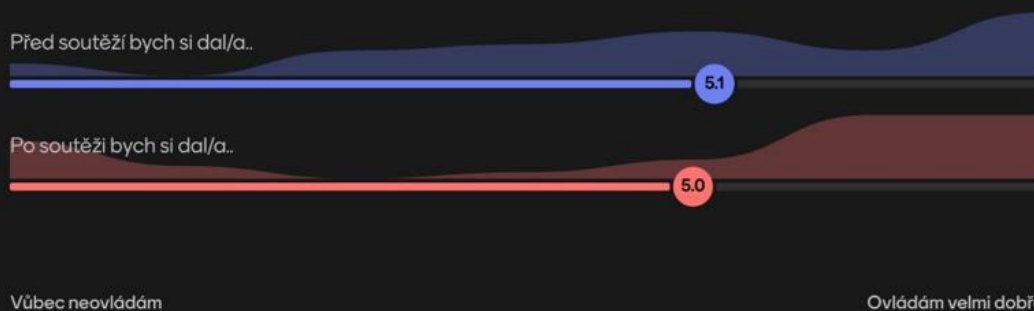


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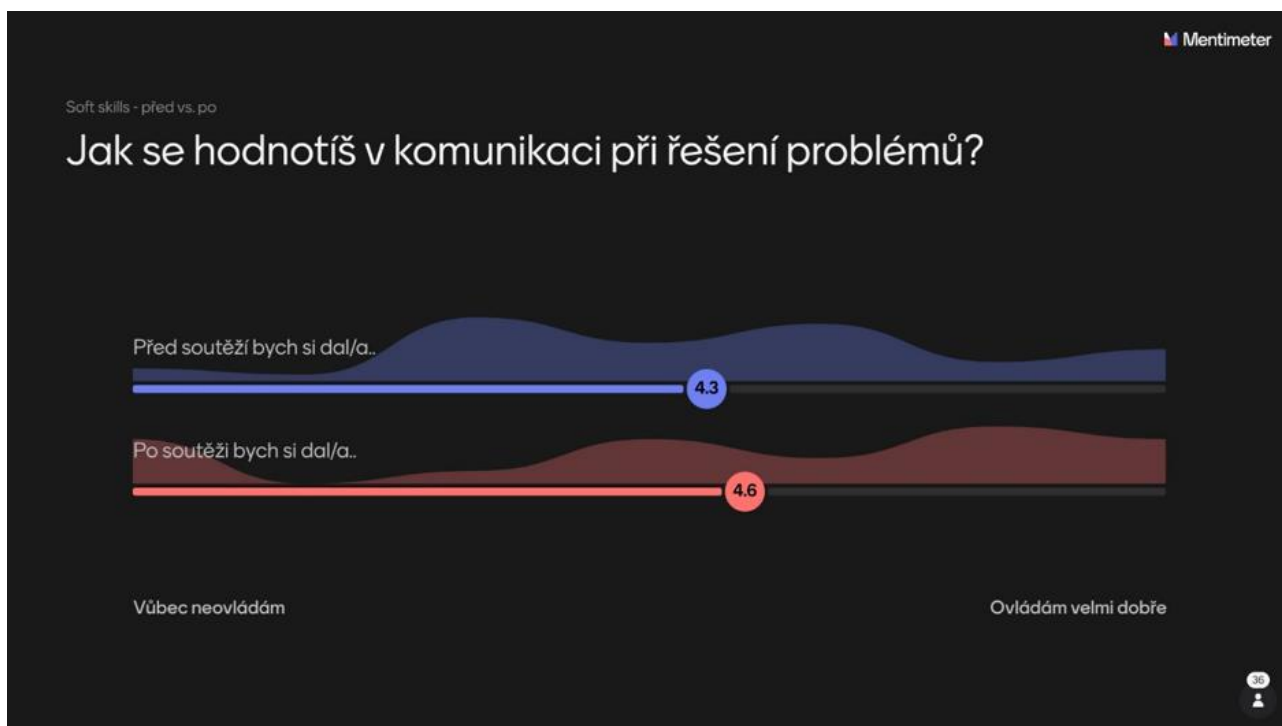
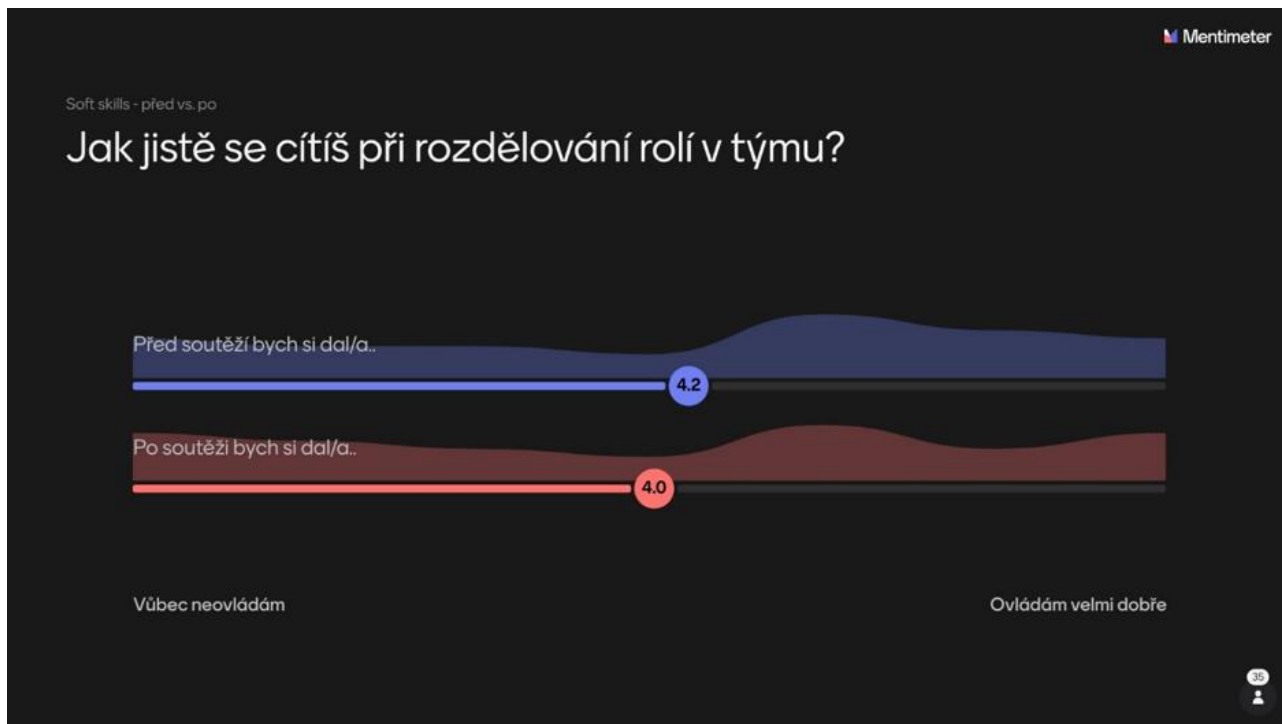
Mentimeter

Soft skills - před vs. po

Jak se hodnotíš ve schopnosti spolupracovat v týmu?



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4.2.2 Activity 2

Hard Skills - Clear Improvement

For such a short program, participants across all pilot runs showed considerable improvement:

- **Operating a 3D printer** - The mean increase in self-assessed skill points was 1.4, with 2 runs reaching a mean increase over 2 points.



- **3D modelling and usage of slicer software** - Mean increase was a little over 1 point across all runs, with the highest for one run being 1.35. Some schools use some basic form of 3D modelling as part of curriculum already without necessarily using it for 3D printing, so the increase in skill points doesn't correlate with "Operating a 3D printer" as much.
- **Laser cutter operation** - The mean increase was by 0.7 points. This was a new skill for many, but students could choose whether to complete their challenge using a 3D printer or laser cutter so not all of them ended up practicing the skill in the end.
- **Creating vector graphics for laser cutter and parameter settings** - On average, students showed considerable increase in the ability to create suitable vector graphics for laser (0.8) and setting the right parameters based on the material they chose to work with (0.6).
- **Microcontroller programming** - The mean improvement in microcontroller programming was 0.6, slightly lower than for previous skills. A lot of the students' code was aided by online resources, especially for classes that didn't have any technical background.
- **Basic electronics (e.g., circuit assembly, soldering)** - Unlike programming, assembling sensors and soldering saw a bigger increase, by 0.6 on average.

These results confirm that the program **effectively built practical technical skills**, even for participants with limited prior experience and given the programme's length. However, not all participants who completed the first questionnaire were present for the final self-evaluation, which, if accounted for, would skew the result a bit.

Soft Skills - Mixed Outcomes

- **Team collaboration** saw a mean increase of 0.4
- **Time management** increased by 0.2 on average
- **Presentation skills** improved on average by 0.2
- **Communication during problem-solving** increased in mean by 0.05

These results suggest that improvement on soft skills occurred to a lesser degree. Soft skills are harder to measure, and significant improvement is challenging to achieve in such a short timeframe as 3-5 days. It's possible that students overestimated their skills in the beginning based on typical schoolwork and found their skills come short in this new environment, working on a project different from what they are used to. Overall, these are good results considering the nature of the programme, but more direct focus on soft skills through workshops in the program would be recommended.

5. Challenges, Lessons Learned, and Next Steps

5.1 Activity 1

During the pilot run of the *High School Student Competition* program, several challenges and valuable lessons emerged. One of the main challenges was the wide range of initial skill levels among participants, which made it difficult to maintain a consistent pace, particularly when introducing more complex tools such as laser cutters and Arduino programming. Additionally, while hard skills showed clear improvement, soft skills such as teamwork, leadership, and role distribution proved harder to develop. This may reflect participants' limited prior experience with collaborative, project-based work. On the positive side, hands-on learning proved highly effective—participants made noticeable progress in digital fabrication and electronics even with minimal prior knowledge. The use of Likert scale self-assessments through Mentimeter offered insightful data on individual and group progress, while final presentations helped boost communication skills and confidence. For future iterations, we recommend adding an initial onboarding or "crash course" phase to align participants' technical readiness, providing more structured support for



teamwork and role definition, and extending the timeline to allow for deeper project development and iteration. Continued use of pre- and post-program self-assessments, possibly combined with peer or mentor evaluations, will help further refine the program and strengthen its impact.

5.2 Activity 2

From the beginning, we knew the difference in individuals' experience with the technologies would pose a challenge. The task they were supposed to solve required working (or learning to work with, on the spot) with technologies they're not all familiar with from school. The result was that those who had experience with these technologies from their own hobbies and interests were more keen to solve the problem than others. We tried to minimize the impact of this skill gap by separating participants into teams so that every team has someone with a skill needed to complete the challenge, based on their initial self-evaluation questionnaire. This way, each team had someone with some experience in electronics, 3D printing, 3D modelling etc.

On the other hand, as opposed to Activity 1, this activity was more suitable for a whole class of students, because sending them away from school for one whole week is easiest logistically for a whole class. This meant that some students of each class were quite uninterested in the challenge and in some cases, the hard workers of each team ended up doing most of the work while the uninterested ones didn't contribute as much. In classes where the skill differences among individual students weren't so big, we allowed the students to make their own teams and the result was quite good both in the quality of students' work as well as their own satisfaction.

Besides those, the biggest hurdle was communication with local companies, trying to get them involved in the project and collaborate on the challenge tasks. They didn't see the programme as something worth investing time into, even though those students are potentially their future workers. It's up for future iterations of the programme to optimize for the company participation to be more alluring.

6. Participants overview

The following table provides an overview of the implementation of both pilot activities. The final dates and participant numbers.

Activity	Number of Participants	Number of hours	Date
High School Student Competition	40	31	5.2.2025 - 30.4.2025
High School Student Competition	32	40	02/26 - 04/26
TechSprint	28	22,5	24.-26.9.2025
TechSprint	25	21	5.-7.11.2025
TechSprint	20	21	5.-7.11.2025
TechSprint	14	30	18.-21.11.2025



TechSprint	28	37,5	1.-5.12.2025
TechSprint	25	37,5	19.-23.1.2026
TechSprint	29	37,5	9.-13.2.2026
TechSprint	15	37,5	13.-17.4.2026
TechSprint	26	37,5	11.-15.5.2026
TechSprint	27	37,5	8.-12.6.2026