

Activity Deliverable

Interactive Manufacturing @ Schools I

Best practice document for
engaging pupils



Reporting Year:	2020
Activity Code:	20147
Deliverable ID:	DEL04
Area Name:	6. EIT RIS
Segment Name:	RIS Action Line 1
EIT-level KPIs:	EIT.N08.2 # External participants in EIT RIS programmes
Contributing Partners:	036 Slovak University of Technology in Bratislava 001 Laboratory for Manufacturing Systems and Automation, University of Patras 038 Spinea 046 University of Tartu

Version History:

Version	Date	Owner	Author(s)	Changes to previous version
1.0	2020-12-21	Stefan Hicak Activity Leader Slovak University of Technology in Bratislava	Stefan Hicak Heilo Altin Peter Martinak Lydia Athanasopoulou	Initial submitted version
1.1	2021-03-03	Stefan Hicak Activity Leader Slovak University of Technology in Bratislava	Stefan Hicak Heilo Altin Peter Martinak Lydia Athanasopoulou	Submitted version

Content

1. Introduction	4
2. Outline of Best practice document	4
2.1 Slovak University of Technology in Bratislava (STUBA)	5
2.1.1 Short description on realized activities and events	5
2.1.2 Experience and practice gained during implementation	5
2.1.3 Best practices and lessons learned during implementation	6
2.2 SPINEA, s.r.o.	7
2.2.1 Short description on realized activities and events	7
2.2.2 Experience and practice gained during implementation	7
2.2.3 Best practices and lessons learned during implementation	7
2.3 University of Patras – LMS	8
2.3.1 Short description on realized activities and events	8
2.3.2 Experience and practice gained during implementation	8
2.3.3 Best practices and lessons learned during implementation	9
2.4 University of Tartu	10
2.4.1 Short description on realized activities and events	10
2.4.2 Experience and practice gained during implementation	10
2.4.3 Best practices and lessons learned during implementation	11
3. Executive summary	11
4. Resources	12

Main keypoints/highlights for this document

1. Definition of the content of the best practice document for engaging pupils
2. Defining a goal for the best practice document? What do we want to achieve with it?
3. Defining value for participants. What value can we bring to them?
4. Identification of key aspects for engaging pupils into STEM education
5. Defining organizational requirements for realization of engaging activities
6. Defining personnel capacities for engaging activities
7. Defining timeline for engaging activities
8. Promotion and communication before and after the realized activities
9. Call to action approach must be taken into account

1. Introduction

Purpose of the report

Purpose of this report is to summarize best practices and lesson learnt during the activity implementation. By implementation of our activity we wanted to engage more high schools pupils into manufacturing and STEM (science, technology, engineering and mathematics) field and support them in decision to study such disciplines. Nowadays we are facing to big challenges in manufacturing, for example Digital transformation, Industry 4.0 and other new emerging technologies. So this report delivers our best practice gained during implementation, summarize lessons learnt and brings also some recommendations for preparation and organization of such activities.

2. Outline of Best practice document

Typically, this kind of document summarize the best practices and lessons learn during the implementation of activities. In the following chapters you can find short descriptions of executed activities, experience and practice gained during implementation of activities and recommendations we proposed to follow. Walk through the topics you'll be covering in the activities, once by one, and what the key talking points and takeaways will be.

From the view of leaders/stakeholders of these activities it should work hand in hand to:

- Determine webinar/workshops/activity goals
- Identify topics and create interactive and engaging content
- Plan pre and post-activity communication

Successful activity should accomplish three main things:

- Generate measurable results: Before you can think about topics, you need to understand your goals and KPIs. The most effective activity have specific and measurable goals.
- Deliver value to your attendees: The best activity aim to provide real value to their audience first and foremost. Cover topics your audience should cares about and

deliver it in a compelling and effective format with visual and interactive elements.

- Drive action: Too often activities are a dead end, with an obligatory CTA on the final slide. After you've established a clear goal and know how your activities fits into the "audience journey", you can drive attendees/pupils to the next important action.

To produce these kinds of high-impact activities it is highly recommended and needed to work closely with your collaborators at the high schools – high school teachers – to have contact with your audience. They are an absolute goldmine of insight that too often goes untapped and is crucial for success of activity.

2.1 Slovak University of Technology in Bratislava (STUBA)

2.1.1 Short description on realized activities and events

Slovak University of Technology in Bratislava (STUBA) has implemented Interactive Manufacturing @ Schools activity regarding the high schools students (A2002 and 2003) in following structure: 9 webinars, 6 workshops and one virtual open day. There were different topics related to Manufacturing and STEM education, ranging from Circular economy, through building information modelling and virtual reality to Industrial robotics and Industry 4.0 concept. The creation and preparation of activities was accompanied by many changes throughout the year, which were affected by the ongoing pandemic of the Covid virus - 19. Majority of activities has to be transformed into virtual space. STUBA used their webinars recordings as the teasers for their workshops and further activities. In total STUBA reached more than 400 high schools students in activities.

2.1.2 Experience and practice gained during implementation of activities

Changes related to pandemic situation affected the teaching and communication with secondary schools, resulting in the transformation almost all of the events to the online space and difficult preparation of webinars, lectures and workshops.

- **Key Takeaway 1:** *The primary finding was the low interest in communication of secondary schools during pandemic and in the future low cooperation with the*

ending fourth years, here we assume a rapid change in the situation based on a pandemic, which exhausted teachers and leaders in secondary schools.

- **Key Takeaway 2:** An important finding is the need for comprehensive communication with high school students from the first year of their entry into high school. For most people, the last year is a late decision on the possibilities within the preparation. For example in the case of talent exams, which they have to prepare for more than a few months
- **Key Takeaway 3:** Realize a webinar and workshop not only in real time, but give high schools enough time to include these activities in their program - upload video from the webinar to the subscription channel / workshop realize, for example through the web or applications, so that pupils have access to these activities at any time
- **Key Takeaway 4:** Representatives of secondary schools appreciated the time flexibility of both activities, given the current pandemic situation.

2.1.3 Best practices and lessons learned during implementation

From the perspective of STUBA we can say that we have learnt a lot during this challenging year. We had to solve lot of operational problems and issues, we often had to go out of our comfort zone, but it did not stop us in spreading out our and EIT Manufacturing activities. Below we are summarising key recommendation we collected during implementation and realization of InMaS activities.

- **Key recommendation 1:** Necessary personal communication with teachers and students, creation of meetings and personal dialogues, reach as many secondary schools as possible
- **Key recommendation 2:** Indication of interest in the student and giving him a helping hand and consultations, choose clear communication (language) towards pupils in the webinar and workshop
- **Key recommendation 3:** Linking study with practice to gain confidence in the application in the eyes of students
- **Key recommendation 4:** Higher connection with secondary schools (possible summer schools, workshop, external lectures), choose topics for the webinar and workshop, which will appeal to as many listeners and participants as possible
- **Key recommendation 5:** Give the possibility of feedback (not only high school teachers but also pupils)

2.2 SPINEA, s.r.o.

2.2.1 Short description on realized activities and events

SPINEA has implemented Interactive Manufacturing @ Schools activity regarding the high schools students (A2002 and 2003) in following structure: 1 webinar and 1 workshop. Team SPINEA decided to engage secondary schools with which it has already cooperated, but also secondary schools with which it has not yet cooperated. At the end 4 local high schools has cooperated with SPINEA. Both activities had similar the similar topic, but workshop offered more detailed information and deeper insight into selected topic. Overall topic was focused on manufacturing, as SPINEA is industrial partner in project, precisely High precision TwinSpin bearing reducers and Drivespin actuators and their use in robotics and automation. In total more than 140 students joined activities.

2.2.2 Experience and practice gained during implementation of activities

SPINEA team found out the implementation of presence activities is highly affected by pandemic situation. This also affected cooperation with high schools as they had to solve their operational problems. I also affected/decreased interested of pupils as they were “thinking” that they have holidays.

- **Key Takeaway 1:** *There is need for comprehensive communication with high school students from the first year of their entry into high school. For some people, the last year can be late decision on the possibilities within the preparation and sometimes it does not indicate real interest in the eyes of pupils*

2.2.3 Best practices and lessons learned during implementation

We summarized some key recommendations below:

- **Key recommendation 1:** *Indication of interest in the student and giving him a helping hand and consultations, choose clear communication (language) towards pupils in the webinar and workshop*
- **Key recommendation 2:** *Important to show links between study and practice to gain confidence in the application in the eyes of students*

2.3 University of Patras – LMS

2.3.1 Short description on realized activities and events

LMS delivered 2 webinars (A2002), 2 workshops for pupils and 2 Open Days (A2003) for high school students at the age between 15 and 18 years old. Within InMaS, LMS supported the development of the teaching methodology and educational material related to manufacturing process. Throughout all planned activities, LMS focused on increasing the awareness of pupils in Greece with respect to industry and manufacturing. LMS activities were majorly impacted due to COVID-19 pandemic situation, requiring the delivery of all activities online in real-time with the utilization of web tools. It is considered that the performance of the activities remotely instead of the scheduled visits to the laboratory facilities has impacted the number of participants, however all activities were performed without hindering quality and the added value to pupils.

Regarding the delivered activities for pupils, the webinars held by LMS had 30min. long duration each and were focusing on introducing the participants to manufacturing and Industry 4.0 concepts, while presenting the technological progress towards the digital technologies and manufacturing processes utilized in the factories of the future. The workshops for pupils held by LMS had 20min. long duration each and targeted at the real-time presentation and demonstration of Industry 4.0 key enabling technologies, in particular Augmented Reality, Virtual Reality and Additive Manufacturing. Finally, the Open Days performed focused on raising the awareness of students' regarding the opportunities and technological possibilities of Universities in Greece and to gain their attention on the technological infrastructure provided in the Greek laboratories and universities.

2.3.2 Experience and practice gained during implementation of activities

During the implementation of activities for pupils, the following key takeaways were obtained:

***Key takeaway 1:** There are important gaps and lack of information with respect to the educational system in Greece and the initiatives targeting at familiarizing pupils with manufacturing technologies and STEM. Most of the pupils participated to the activities were familiar with the basic principles of the presented technologies, however there is extremely limited educational content and capabilities provided by high schools for emerging pupils with such concepts.*

Key takeaway 2: *Hesitation has been noticed by a notable percent of the teachers in terms of participating to the activities online instead of organizing a physical visit to the university. Most of the teachers, however, supported this initiative.*

Key takeaway 3: *Pupils are interested in being involved in future activities, having the potential of physically visiting the university facilities.*

Key takeaway 4: *No significant issues were faced during the implementation of activities through web tools.*

Key takeaway 5: *Direct communication with the teachers was required to reach pupils.*

2.3.3 Best practices and lessons learned during implementation

The following key takeaways have been gathered as valuable outcomes from the delivery of LMS activities:

Key takeaway 1: *By performing the activities remotely through web tools, it is possible to reach participants without being limited to regional high schools.*

Key takeaway 2: *The participation to the online surveys was significantly less than expected, highlighting the need of making the filling procedure more appealing and the additional benefits that the participants' feedback could have in future activities.*

Key takeaway 3: *Activities focusing on new technologies (3D printing, Augmented & Virtual Reality, Robotics) and their applications in industry and manufacturing were particularly attractive to pupils, with a high request to include additional live demonstrations.*

Key takeaway 4: *The increase of interactive activities would lead to the increased enrolment of pupils' and their familiarity with the presented technology.*

Key takeaway 5: *A notable number of pupils mentioned that after participating to InMaS activities, their opinion about manufacturing has changed and are interested in learning more about the topic.*

2.4 University of Tartu

2.4.1 Short description on realized activities and events

University of Tartu, Institute of Technology held 3 webinars 4 workshops for high-school students. Workshops were called “Manufacturing possibilities in University of Tartu Delta Centre”.

Each workshop for maximum of 20 students, aged 16 – 19 had 4 different parts:

- I. Theoretical part of the project “Interactive Manufacturing @ Schools”, where the project goals and outcomes were introduced. During this part also the importance of field of manufacturing was explained.
- II. First hands-on part of the workshop was the “Python programming for LEGO Mindstorms EV3” where the students had a chance to program a robot to drive autonomously in a model city. Programming a robot is a real good way for the students to explain autonomous vehicles and first things to counter when driving pilotless in a city traffic.
- III. Second hands-on part of the workshop was the “Soldering a LED torch” activity, where students had a chance to solder a circuit including LED, power supply, resistor, button and wires. In that part, also the manufacturing labs and its equipment were introduced. Also the 3D printing technology and equipment were explained. The base frame for the LED torch was 3D printed in the same lab.
- IV. Last part of the workshops was the building tour, where other labs and possibilities of University of Tartu Delta Centre were introduced.

The workshop lasted approx. 2 and half hours for one group. Altogether four groups with 75 students were attending.

2.4.2 Experience and practice gained during implementation of activities

- **Key takeaway 1:** *People liked that there were different workshops and the hands-on part was longer than the theoretical part. Hands-on activities are always good.*
- **Key takeaway 2:** *Some students said that robotics activity should have lasted a bit longer than 45 minutes. We saw it too, as just before the end of the workshop they got really excited and motivated.*
- **Key takeaway 3:** *Making the workshops/open days in University or company facilities gives the students so called “real” feeling of the university/company. They can see and ask right questions on site.*

- **Key takeaway 4:** *If making a practical workshop, one need to be sure to test it multiple times to minimize any failures. One has to keep in mind, that there are always some unexpected errors, so if possible, have to have a spare hardware nearby.*
- **Key takeaway 5:** *It is recommended to make the practical work in pairs. This makes the students feel more comfortable. There might be a few students who like to work alone, so if possible spare workshop equipment in case of that might become handy.*

2.4.3 Best practices and lessons learned during implementation

- **Key recommendation 1:** *Theoretical part and practical part together is the best combination; thus practical part should be at least 75%.*
- **Key recommendation 2:** *To give the students a better overview of manufacturing the workshop/open day should last minimum of 3 hours; If the workshop is round 3 hours, students need to have a slight snack pause.*
- **Key recommendation 3:** *It is highly recommended to bring out parallels between the workshop activity and real life for the students to better understand the concept and importance of the activity and manufacturing overall.*
- **Key recommendation 4:** *Bringing examples of successful companies Worldwide that have been growing out from your country makes the students more aware of Manufacturing and about the opportunities in that area.*

3. Executive summary

As you already have seen in sections above this deliverable summarize key takeaways and also bring some key recommendations suggested by activity partners. From our perspective the implementation of activities in times of the pandemic is very challenging. We were facing lot of problems and issues in implementation of activities. We have to say that it was very hard to get in touch with pupils from high schools, we see this as crucial element and condition for successful implementation of activities. It is important to consider and understand that as the university or industrial partner you are trying to reach third party “customers”. This must be taken into account in preparation of your

activities and events and also it is important to include this in your dissemination and communication strategy.

We summarized lessons learned in several recommendations from each activity partner. The need for strong cooperation with high schools key factor for successful implementation of activities like InMaS. We found out the talking about technologies is nice, but worth little. Hands on experience is very important.

4. Resources

Link to Project webpage and social media channels

www.manufacturing4schools.eu

<https://www.facebook.com/manufacturing4schools>

<https://www.youtube.com/channel/UCakCORCE-4qLwfPAxO4LJpg>

Links to Partner's Website

www.stuba.sk – Activity leader of project (SVK)

www.spinea.com – Activity partner (SVK)

<http://lms.mech.upatras.gr> – Activity partner (GRE)

<https://www.ut.ee/en> - Activity partner (EST)