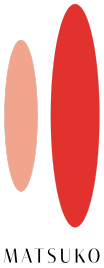
XR Training for Sustainable Electric Manufacturing

Report on the Activity in the Framework of the European Inventor Network



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Name of the person who implemented the activity

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2026

Profile of the Activity Lead

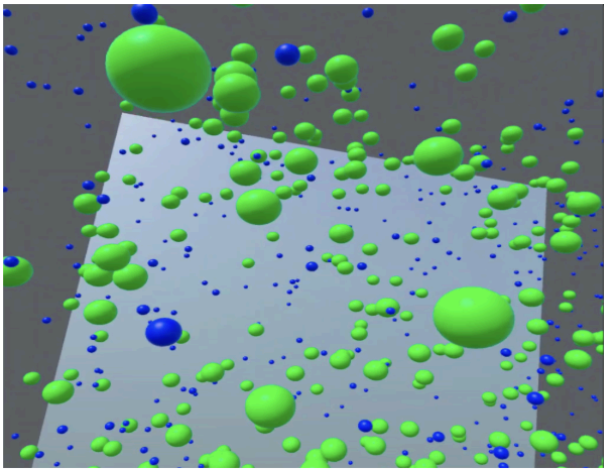
Maria Vircikova *is a co-founder and CEO of* ***MATSUKO s.r.o.****, a Slovak technology company developing advanced extended reality and holographic communication solutions for education, training, and industry. She has a strong background in innovation-driven entrepreneurship and has led multiple European and international projects focused on immersive technologies, digital education, and sustainable industrial transformation. Through her work at MATSUKO, Maria actively promotes the use of emerging technologies to make technical education more accessible, engaging, and aligned with real-world industrial needs. She is particularly committed to inspiring young people, including underrepresented groups, to pursue careers in technical and inventive fields by connecting education with practical applications of innovation.*

Maria Vircikova and the team of MATSUKO implemented the ***XR Training for Sustainable Electric Manufacturing*** *activity to share the experience at the intersection of technology, industry, and education, and to demonstrate how European innovation can support sustainable development and future skills using XR.*

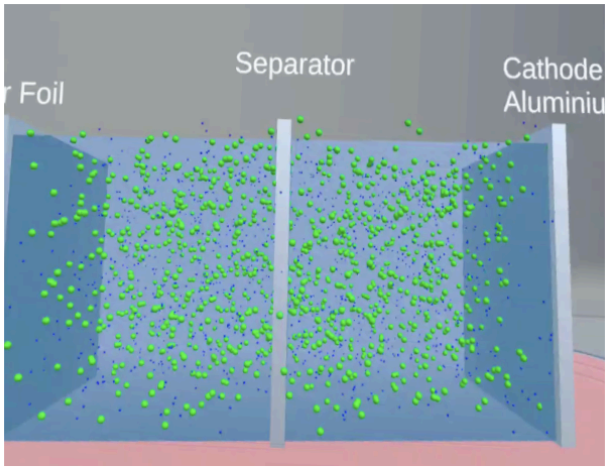
Short Description of the Activity

XR Training for Sustainable Electric Manufacturing consisted of a series of immersive educational workshops introducing secondary school students to extended reality (XR) technologies and their application in technical sciences and sustainable electric vehicle manufacturing. The workshops served both as an introduction to XR technologies and as a practical exploration of real-world automotive and industrial processes. Students were introduced to the basic principles of XR, its current use in industry and education, and its potential role in future technical professions. Using **Meta Quest standalone XR devices**, students experienced **MATSUKO's interactive XR training modules**, which allowed them to explore electric vehicle assembly, battery systems, and sustainability principles in modern manufacturing.

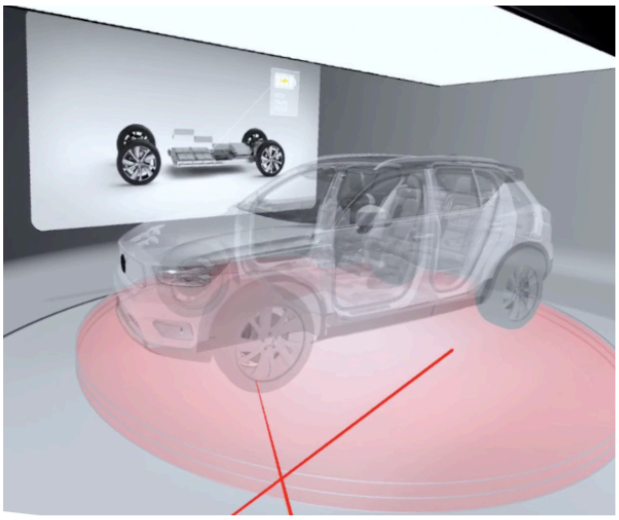
The main objective of the activity was to inspire young people, including both technical and non-technical students, to better understand complex engineering concepts and to perceive technical sciences as accessible, engaging, and relevant to real-life challenges. The workshops demonstrated that advanced technologies such as XR can function as practical and scalable educational tools, even for first-time users, and can effectively motivate students to consider careers in engineering, technology, and innovation-driven fields.



Electrons swirling around as the Battery production module begins



Animated view of lithium ions and electrons during charging and discharging



A 2D video panel demonstrating battery integration in electric vehicles

Fully assembled car completing the assembly process

XR Training - screenshots from the app

Basic Information about the Activity

The XR workshops were organized in **January 2026**, specifically on **22, 23, and 24 January 2026**, in **Košice, Slovakia**, and delivered at the following locations: Secondary Vocational School of Industrial Technologies, Košice–Šaca, Dneperská Secondary School, Košice and MATSUKO premises, Kasárne Kulturpark, Košice.

The workshops were integrated into regular school activities and conducted within standard lesson schedules, ensuring minimal disruption while maintaining high student participation. Participants included both **vocational secondary school students with a technical focus**, particularly in industrial and automotive studies, as well as **general secondary school students without a technical background**. This mixed audience demonstrated that XR-based technical education can be accessible and engaging across different levels of prior knowledge. The **age range of participants was 15 to 19 years**. Most students had little or no prior experience with XR technologies, making the workshops a first hands-on exposure to immersive digital tools used in modern industry and education.

Photos of students during the XR Workshops

Group photos after the XR Workshops

Students at MATSUKO office experiencing the XR training

Description of the Activity and Methodology

The XR workshops were delivered as fully immersive and interactive learning sessions using **Meta Quest standalone XR headsets** with **MATSUKO's XR training modules**. Each session accommodated up to **20 students simultaneously**, with students working individually in shared virtual environments across multiple workshop groups. This setup demonstrated that XR can be used not only for individual experimentation but also as a **scalable classroom learning tool**.

Each workshop followed a clear and repeatable structure:

1. **Introduction and onboarding**
   Explanation of XR technology, basic principles, and safety guidelines, ensuring that even first-time users could participate confidently.
2. **Immersive XR session**
   Interactive exploration of electric vehicle manufacturing processes, including vehicle assembly and component integration.
3. **Short knowledge checks**
   Brief questions and prompts integrated into the session to reinforce key concepts and ensure understanding.
4. **Guided reflection and discussion**
   Facilitated group discussion allowing students to reflect on what they learned and relate it to real-world industrial contexts.

The learning content focused on key topics relevant to sustainable electric manufacturing, including e.g. Electric vehicle safety, Battery structure and production, Vehicle assembly workflows, Sustainable materials and production choices and Environmental impact of manufacturing decisions.

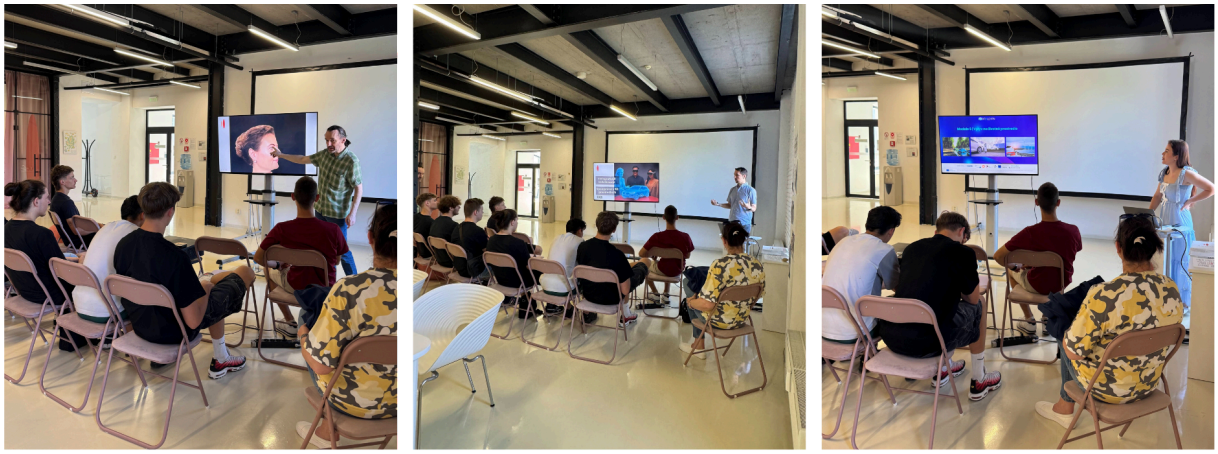
Students actively interacted with and assembled virtual components, gaining spatial and process-based understanding that is difficult to achieve through textbooks or static presentations. Teachers supervised the sessions as part of regular lessons, while technical facilitators ensured smooth operation of the XR equipment. This approach demonstrated that XR workshops can be realistically delivered within standard school environments, not only within research or laboratory settings.

Outcomes and Achievements

The XR workshops delivered strong educational and motivational outcomes across all participating groups.

- **High student engagement and motivation -** Students remained focused throughout the sessions and actively discussed the content during and after the workshops. The immersive format sustained attention and curiosity far beyond typical classroom activities.
- **Improved understanding of complex technical topics -** XR made abstract concepts such as battery structure, assembly sequences, and sustainability trade-offs easier to understand, visualize, and remember.
- **Accessibility for first-time XR users -** Despite having little or no prior experience with XR technologies, students adapted quickly after a short onboarding process and were able to use the equipment confidently.
- **Inclusivity and confidence building -** Female students and students without a technical background demonstrated high levels of curiosity and engagement. The immersive and hands-on format reduced intimidation often associated with automotive and engineering subjects.
- **Scalability in a classroom setting -** Running multiple XR headsets in parallel within standard classrooms proved that XR-based training can support typical class sizes and lesson structures.

Teachers reported that the XR workshops significantly improved students' ability to visualize industrial processes and stimulated interest in innovation, engineering, and sustainable technologies. The activity confirmed XR's potential as an effective educational tool for technical sciences at the secondary school level.



XR Workshops - Theory about XR by MATSUKO

Relevance to Slovakia and European Innovation

Slovakia is one of the world's leading automotive producers per capita and is undergoing a significant transition toward **electric vehicles and sustainable manufacturing**. Preparing the next generation for this transformation is essential for maintaining long-term competitiveness, innovation capacity, and skilled employment within the region.

The XR workshops directly addressed this need by:

- Connecting education with **real industrial and manufacturing contexts**
- Introducing sustainability and responsible production principles at an early stage
- Encouraging interest in **technical, engineering, and inventive careers**
- Demonstrating how **digital and immersive technologies** can modernize technical education

By combining XR technology with concrete industrial use cases, the activity helped bridge the gap between theoretical education and real-world innovation. Students were exposed not only to how products are manufactured, but also to how technological choices influence environmental impact and sustainability outcomes.

We believe that the activity also aligns strongly with the mission of the **European Inventor Network** by inspiring young people, promoting a culture of innovation, and highlighting the societal value of technology and invention. It showcases how advanced European technologies can be used to support education, sustainability, and industrial transformation across member states.

Conclusion

The **XR Training for Sustainable Electric Manufacturing** activity demonstrated how extended reality technologies can be effectively integrated into secondary education to support technical learning, sustainability awareness, and innovation mindset development. By combining an introduction to XR technologies with hands-on exploration of real industrial processes, the workshops made complex technical concepts accessible, engaging, and relevant to young learners.

The activity proved that XR is not only a cutting-edge technology but also a **practical, scalable educational tool** that can be successfully deployed within standard school environments. Students with diverse backgrounds, including first-time XR users and non-technical learners, were able to confidently engage with advanced manufacturing topics and gain a deeper understanding of electric vehicle production and sustainability challenges.

Based on the experience and outcomes of the XR workshops, several recommendations can be made to further strengthen impact and scalability - these steps would enhance the educational value of XR-based training and further support the development of technical skills, creativity, and innovation mindsets among young people:

1. **Introduce creative and design-oriented tasks**
   Allow students to design, modify, or optimize virtual components to deepen understanding and encourage problem-solving and creativity.
2. **Combine XR workshops with innovation challenges**
   Include short ideation or pitching exercises where students propose their own sustainable manufacturing or mobility solutions.
3. **Expand to additional schools and regions**
   Scale the workshops to other regions, particularly those connected to industrial and automotive development, to reach a broader audience.
4. **Strengthen links with industry and inventors**
   Involve engineers, inventors, or industry professionals as guest speakers to provide real-world perspectives and further inspire students.

The XR workshops demonstrated that immersive technologies can make advanced technical and sustainability concepts tangible, inclusive, and inspiring for young people, while realistically fitting into standard school education and preparing students for the future of European industry.