



Erasmus+ programme project: Mobile laboratories for
improvement of STEM knowledge (Lab4STEM), No. 2020-1-
LV01-KA201-077502

GUIDELINES FOR SECTOR REPRESENTATIVES FOR IMPROVEMENT OF STEM KNOWLEDGE

Intellectual Output 3

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Project partners: LINPRA, MASOC, Merkuur OÜ, Tehnobuss Latvia, VJDRMC



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1. About Lab4STEM project

Project name: Mobile laboratories for improvement of STEM knowledge

Project acronym: Lab4Stem

Project No. 2020-1-LV01-KA201-077502

Project duration: from October 1, 2020 till December 31, 2022

The leading partner of the project: Association of Mechanical Engineering and metalworking industries of Latvia (MASOC)

The project partners:

- 1) Federation of Estonian Engineering Industry and Merkuur OÜ from Estonia;
- 2) Engineering and Technology Industries Association of Lithuania (LINPRA) and Viesioji Istaiga Vilniaus Jeruzales Darbo Rinkos Mokymo Centras (VJDRMC) from Lithuania;
- 3) Tehnobuss Latvija from Latvia.

Project financier: Erasmus+ programme Strategic Partnerships for school education

The main objectives of the project are:

- 1) Promotion of 7- 9th grade pupils' achievements in STEM in an attractive way.
- 2) Strengthening support for educators by open source, interactive, digital training materials about STEM.
- 3) Strengthening responsibility and involvement of sector business representatives in the education process.

Target groups of the project:

- 1) General education school pupils, grades 7-9;
- 2) Educational staff of general education schools (teachers of STEM subjects, career counselors and support specialists);
- 3) Representatives of the sector and other stakeholders, who want to be involved in improving STEM knowledge;
- 4) Learners, representatives of other educational levels, parents, and policy makers.



Main activities and expected results of the project:

- 1) Interactive and digital training materials about the STEM field in four languages - in English, Latvian, Lithuanian and Estonian;
- 2) Preparation of handbook for teachers in four languages - English, Latvian, Lithuanian and Estonian;
- 3) Guidelines for sector representatives to popularize the STEM field and support pupils in four languages - English, Latvian, Lithuanian and Estonian;
- 4) Pilot trainings of up to 30 teachers and up to 100 pupils in each partner country;
- 6) National competitions for pupils;
- 7) 3 project final events;
- 8) Articles popularizing STEM fields.

More information about the project is available here: <https://ec.europa.eu/programmes/erasmus-plus/projects/eplu-project-details/#project/2020-1-LV01-KA201-077502>

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2. Challenges

Baltic States are vibrant regions with similar sized populations and historical experience and their adaptation to the new digital era is undermined by lack of professionals. (Jansons, Rivza 2019, 146). Across the EU a major reason for labor shortage in science, technology, engineering and mathematics (STEM) fields professionals lies in the insufficient supply of higher education graduates due to stagnant enrolment rates in STEM fields (*Ibid*).

In primary and secondary schools, the disciplines encompassed in “STEM”—Science, Technology, Engineering and Mathematics—have usually been studied as separate subjects, with little effort directed towards non-anecdotal integration (Ortiz-Revilla *et al* 2020, 857). “Integrated STEM education” is one of the most recent interdisciplinary proposals and, under its umbrella, school disciplines are beginning to be integrated in an educationally fruitful way (*Ibid*).

Without the products of the metal sector, it is impossible to imagine the development of such sectors as construction, automotive industry or the production of household appliances, which is why it is a crucial part of the industry (Daron, Gorska 2019, 1). According to the World Economic Forum's Future of Work report, by 2025, machines will perform more than half of the work tasks in the world (Future ... 2018, 10).

The promotion of a smart society largely depends on the education system, because a smart industry (including new products, production, jobs) needs science, engineering, technology and mathematics (STEM) coherence (Hashmi *et al.* 2021, 18).

In Lithuania, Latvia and Estonia as small countries, the main challenges of the mechanical engineering and metalwork industry are quite similar:

1. How would the mechanical engineering and metalwork industry be an attractive career choice for young people? The pupils lack knowledge about the professions and the world of work, so supporting activities must be continued making professional choices that match their abilities and interests (Serbak 2018, 30).



2. How would primary and secondary school provide the necessary preparation for making career choices in the field of engineering and technology?
3. How to change the education policy so that it better meets the needs of the labor market?
4. How to motivate teachers to engage with STEM learning?
5. How to raise the level of pupils' real sciences and skills?
6. How to coordinate the creation of the necessary study materials?
7. What will the role of entrepreneurs, the general education institution and other actors be in renewing education? The role of labor market participants and the responsibility for skill development is not clear (Santiago et al. 2016, 8)
8. How to invite more girls to study and work in the engineering area?
9. Teacher's aging is a huge problem, how to deal with it?
10. Technology area teachers' salaries are smaller than experts in the private sector.
11. Investments in technology area education are expensive, how to share it?
12. Vocational schools need to be more popular, but pupils do not choose it, because they have fear of technology and manual skills.

Low achievements in science and mathematics leads to situation when general education pupils after graduating do not choose VET or higher education in science, technologies, engineering, mathematics (STEM) or are not able to graduate STEM direction and obtain qualification which results in insufficient supply of qualified workforce in manufacturing, also in metalworking and mechanical engineering. Lack of qualified workforce forces sector associations to be involved in education processes by providing information about career prospects as well by other activities.



3. Good practices for cooperation

Estonia, Latvia and Lithuania's situation are quite the same – the next generation in industrial areas is going to be more and more important. When we talk about global trends such as the green revolution, sustainability, energy efficiency and robotics, we need technology conscious engineers and experts – the next generation to work and solve these challenges. To achieve this, it is necessary to think more precisely about the division of roles through education policy, where all stakeholders must contribute. Otherwise, it is not possible. The role of technology increases over time, which is why it is extremely necessary to do so for the sake of competitiveness.

Sector company survey was made in June and in July 2022. 16 companies from Estonia, 21 companies from Latvia and 26 companies from Lithuania gave us information about main topics and attitudes about cooperation between general education institutions and companies.

It is positive that both - general education institutions and companies understand that cooperation is important for the future, but it is not a systematic practice and needs special attention. Many companies emphasize that mostly they have cooperation with vocational education and training (further - VET) schools, by organizing special excursions for sector VET pupils and providing internships. Certainly, in terms of career education, it is necessary to introduce different professions to young people as early as possible, so cooperation should be promoted already in elementary school.

Some of good practice's examples of cooperation between sector companies and general education institutions:

- Interns in company;
- Participation in events, which is for pupils;
- Guided company tours for pupils;
- Introducing working opportunities to pupils (for example introducing welding, locksmithing) in the shape of lessons;
- "Shadow days" – pupils come to company and follow concrete specialist for one day;
- Presentations at schools about the sector and company;
- Organizing different competitions and participating in them;



But also connected with directly financing

- Giving scholarships;
- Financial support for STEM lessons at school.

THE BEST WAYS TO INTRODUCE THE INDUSTRY TO YOUNG PEOPLE

Answers from questionnaires gave signs and messages about best ways to introduce the industry to young people.

Companies' role:

- Factory tours that introduce pupils to real work;
- Giving lessons to pupils on specific topics, involving pupils in the preparation of presentations;
- Placements in factories;
- Involving pupils in joint projects, introducing them to jobs and career opportunities;
- Open days in companies to showcase their products, their purpose and the value they create;
- "Family days" to inform parents about work; Meet with workers, shadowing;
- Summer apprenticeships.

General education institutions' role:

- Organize robotics, motoring and technical creativity clubs, train and motivate teachers to encourage pupils to participate;
- Visiting factories and science fairs;
- Interesting challenges and competitions in school;
- Using modern technologies to show pupils the possibilities of industry;
- Bringing experts and industry representatives to schools;
- STEM learning through play, exploration, modeling etc;
- Set up special demonstration classrooms for young people to learn and practice;

Media (social media) role:

- Getting pupils interested in industry through social networks, apps, games, etc;
- Show pupils attractive working conditions and the advantages of each job;
- Showing success stories;
- More visibility in social media;



- Creating an engineering industry profile.

Professional associations' role:

- To collect and analyze data about industry needs;
- Communication between mechanical engineering and metalwork sector, public sector and general educational institution;
- To make lobby work;
- To work with sector image via media/PR (Success stories, photos, movies, general messages, recognition of the best etc.);
- Initiate or participating in different projects;
- Create and keep an active network.

The government's role:

- To hold big picture in economy, education economic view;
- To understand metalworking and engineering industry area and their needs for to support export, jobs, investments, tax revenue etc.;
- Education policy creation and innovation with stakeholders;
- Making decisions, which are connected with investments in STEM in general education institutions;
- Directs the economy through education policy, taking responsibility;
- Involves professional associations as sector experts to support decision making.

A clearer division of roles and cooperation in the ecosystem will help to better cope with the common challenges of the sector.

WHAT HELPS MOTIVATE YOUNG PEOPLE TO STUDY STEM?

One solution is STEM pedagogy, which could help matchmaker general education institutions and technology area/industrial needs. How to do it? Here are some examples of participant's answers:

- The most motivating are tech clubs, robotics clubs and good science teachers;
- Teachers themselves should be encouraged and motivated, professional and charismatic;
- Modern laboratories, visits to cutting-edge companies, job presentations, career opportunities;
- Innovation and creative solutions;



- Giving pupils real-life examples of how their future careers can benefit them;
- Opportunities to put their creative ideas into practice;
- A desire to explore the world of technology and manufacturing. Young pupils need to be educated about STEM from the very first day of school. It is also necessary to tell them about the different industries so that everyone can find their own personal direction;
- The ability to put knowledge into practice;
- Informal STEM education at school or kindergarten;
- Scholarships, vision and opportunities for the future, popularity of the profession;
- Curiosity and a strong desire to learn about the world, to understand natural phenomena and how they can be applied to life;
- Creativity, willingness to realize ideas and turn them into products, willingness to contribute to the development of new technologies, research and development;
- Creating and upgrading STEM training centers. Adequate demonstration facilities and STEM education program;
- Youngsters should be shown potential workplaces that employ STEM subjects and how these subjects are used in the industry;
- The potential income from jobs like engineering, welding and so forth;
- The study of these subjects should be made more interesting, with more practical outputs;
- More people should come to classes and talk about their jobs and experience with STEM subjects;
- Using YouTube and other social media to introduce STEM subjects in a more entertaining way;
- Competitions for pupils;
- More classes for pupils.

All the ideas are related to the radical renewal of the general education institution at different school levels, which leads to investments (technology, teaching materials, etc.) and the need for new skills among teachers. Only schools and companies without the direction of educational policy cannot do this.

GREAT EXAMPLES FOR SECTOR COOPERATION WITH GENERAL EDUCATION INSTITUTIONS

All these projects are really important to hold and keep moving.

- 1) Merkuur OÜ, Estonia: They have developed mobile workshops with the purpose of introducing young people to the different professions, work practices, and tools of the technology sector. Mobile workshops drive to every school where each pupil, teacher and parent can test their engineering skills, use different tools and make exciting products. In three years, the Merkuur team has organized more than 1000 science, technology and engineering workshops for about 10,000 young people. More information: <https://www.merkuur.eu/>



- 2) Technobuss, Latvia: The central aim of the platform "TehnoBuss" is to *develop closer cooperation* between educational institutions, employers and young people of all ages. They must help current pupils become prospective professionals with a smart mind and professional skills that are needed in Latvian metalworking and engineering companies. Therefore the platform "TehnoBuss" and mobile laboratory is committed to providing both *young people of all ages* with educational opportunities that they can be involved with now, as well as *youth-friendly companies* that can provide excursions or internships. In this way, we hope that by the time young people are ready to get involved in the job market, they will have practical experience with the skills and competencies required by their employers. More information: <https://www.tehnobuss.lv/>



3) Infomobilis, Lithuania: They are presenting real jobs and different technologies to young people.

Target is to present the industry's needs for skills. It is helping pupils to make career decisions for the future. More information: <https://www.infomobilis.lt/>

The Infomobile is a special bus equipped with technology and engineering training equipment – a mobile steam science laboratory of technical direction, where children and young people are introduced to the professions of the engineering industry, learning, practice and career opportunities. The Infomobile, whose length reaches 17.5 m, has updated and installed modern techniques:

- computer and software;
- 3D printers;
- internet of Things system;
- automated smart production line (robots and conveyor belt);
- laser cutting machine;
- mobile electrical laboratory;
- laser outdoor projector;
- welding simulator;
- virtual reality glasses;
- lathes and milling machines;
- various training stands;
- other educational tools.





4) STEAM Centers, Lithuania: The STEAM Open Access Center is a center of modern technologies, where, in cooperation with scientists, municipalities, entrepreneurs, pupils are provided with the conditions for conducting research, constructing, modeling and getting acquainted with scientific innovations during or after lessons, creatively solving problems that have arisen. More information: <https://lithuaniatribune.com/lithuania-setting-up-10-stem-centres-to-boost-interest-in-science-and-engineering/>

The STEAM open access network consists of: Regional STEAM open access centers – in Alytus, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena.

Methodical STEAM open access centers – in Kaunas, Klaipėda and Vilnius.

Each regional STEAM open access center is equipped with standardized biology-chemistry, physics-engineering, robotics - IT laboratories, as well as a specialized laboratory, taking into account the needs of the region. In laboratories, pupils can perform a wide range of research work, both provided for in the general curriculum and related to the specifics and priorities of the region.



4. Common recommendations

- 1) From the results of the teachers' surveys conducted within the framework of this study, it was concluded that in-depth and expanded STEM learning opportunities are also hindered by insufficient and inadequate availability of teaching resources. To a lesser extent, advanced STEM learning is hampered by technical resources lack, insufficient preparation of learners, insufficient involvement of parents and support for motivation of learners, teacher workload and insufficient public interest in STEM.
- 2) Representatives of local governments and general educational institutions leaders are more likely to believe that in-depth STEM education is hindered by insufficient infrastructure and material-technical base and the lack of STEM educators, but this can be explained by different understandings of the technology-enriched learning process provision. Some see it as computer classroom equipment and Internet access, while others see it as educational technology application during the learning process.
- 3) Informal STEM education is available, however, it was concluded that municipalities do not offer modern education of STEM interests (they do not exist at all or the offer consists only of traditional environmental education and/or educational programs of woodworking interests). These are small rural or small-town municipalities.
- 4) The cooperation of various interested parties is essential for the development of STEM extended and in-depth education, as well as the mutual cooperation of the general educational institutions themselves, giving the opportunity to transfer various educational resources to places where they are in demand. It is necessary to improve cooperation between general educational institutions and other organizations, because a third of the pedagogues interviewed in the study are not aware of such opportunities or do not cooperate with other organizations. Cooperation of educational institutions with other entrepreneurs, other general educational institutions or other collaborations for partners in providing, supporting or popularizing STEM learning takes place in the form of campaigns or projects within. Often cooperation is organized thanks to personal contacts and recommendations of colleagues. Respondents' educators are more likely to choose initiatives offered by other organizations **than to propose their own.**



There is potential for companies to build their proposals and strengthen cooperation with general education institutions and with associations can play a crucial role by invitation and giving best practice examples.

- 5) There is also positive cooperation with science centers and museums. There is a lack of unity platforms that would contain information about collaboration opportunities and networking
- 6) Relatively widely offered creativity, robotics and programming classes are the main focus for both private and public service providers. Much less common are provided about foundational STEM subjects or comprehensives STEM programs. This type of offer is mostly typical only for big cities, not countryside.
- 7) The surveyed experts indicate that the content of interest education should not be exactly related to formal education programs, on the other hand, it should show both basic things through a different prism and offer an in-depth and opportunities for learning extended content in an interesting and exciting way. At the same time, those surveyed in informal STEM representatives of the initiatives indicated that there is a lack of emphasis on the importance of science in non-formal education, as most activities center around the practical application of STEM knowledge and skills such as robotics and programming. Experts pointed out that the offer of non-formal education lacks fundamental STEM subjects (mathematics, but especially chemistry, physics, biology and geography) representation.
- 8) The development of non-formal education is promoted by higher and professional general educational institutions, science centers and private interest education centers. Their associations are often involved in various informal promotions in events such as holding competitions or promoting STEM education. Higher general education institutions offer in-depth courses or interactive learning opportunities, thereby both selling educational content and trying to attract potential pupils.
- 9) In children and youth education centers, STEM education remains approximately unchanged at 14-16% of the entire offer, as well as the involvement of girls - 28-29% in the amount of STEM interest education programs total number of pupils. Gender perspective should be emphasized to attract sufficient workforce in the future for metalworking companies.
- 10) Dissemination of best practices of involvement of sector companies in general education institutions have to be made.



- 11) Career days in metalworking have to be organized in all regions of the country by involvement of different sector companies and associations.
- 12) Improvement of knowledge of STEM and the sector is the basis for attracting pupils in vocational education and training.



5. Country-specific recommendations

Good aspect is that between three countries associations (EML, MASOC and LINPRA) there is regular communication within common Baltic seminars in TechIndustry exhibition and via EU projects (4Change, Lab4Stem and others) which help to understand similarities and differences between countries.

Clear is that, Covid19 time disrupted cooperation and developments between stakeholders, also business representatives involvement in general education.

Figure 1. Country-specific conclusions and recommendations

Estonia	<ol style="list-style-type: none"> 1. Education policy needs to take into account industry's needs and policy. Responsible: All stakeholders, EML 2. Lobbywork need to be stronger and based real economy and industry area needs. Responsible: Ministries, associations 3. More technology area experts are needed to schools, vocational schools, but also specific jobs as career counselors etc. Responsible: Education politics 4. Companies need to be more active and open for cooperation with the general education institutions. Responsible: Private sector, general education institution 5. Teachers need to open the real job world to pupils (Different projects, speakers in lessons, factory visits etc). Responsible: General education institutions 6. Education system needs to be more flexible and make much more cooperation than now. Responsible: General education institutions 7. More real science and technology teachers are needed in schools. Responsible: General education institution, Ministries 8. Technology studies need to be more practical and need investments. Responsible: Politics, Ministries 9. Ecosystems need to describe special stakeholders' roles and how to create the
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	<p>future.</p> <p>Responsible: Sector view from stakeholders</p> <p>10. More cooperation, initiatives, finances – everything is needed for industrial area developments.</p> <p>Responsible: All stakeholders</p> <p>11. Media could be more interested in industrial developments, education and the real job world.</p> <p>Responsible: Media, society.</p> <p>12. More girls are needed in metalworking and engineering.</p> <p>Responsible: all stakeholders</p>
Latvia	<p>1. Education policy needs to take into account industry's needs and policy.</p> <p>Responsible: All stakeholders, MASOC</p> <p>2. Metalworking and engineering industry's vocational education institutions need to be promoted more in general education institutions.</p> <p>Responsible: All stakeholders</p> <p>3. More young STEM teachers are needed in the general education institutions.</p> <p>Responsible: Ministry of Education and Science</p> <p>4. Industrial areas need special promotion as a good career choice.</p> <p>Responsible: All stakeholders</p> <p>5. Teachers in general education need special training about STEM and modern technical bases for organizing practical lessons in STEM.</p> <p>Responsible: Ministry of Education and Science, general education institutions</p> <p>6. Pupils in general education need systemically real world examples for career choices.</p> <p>Responsible: General education institutions and sector representatives</p> <p>7. Tehnobuss Latvija is a good example, but they need more capacity - people, resources.</p> <p>Responsible: Association, sector representatives, government.</p> <p>8. Companies need to be more active and open for cooperation with the general education institutions.</p> <p>Responsible: Association, sector representatives</p> <p>9. More girls are needed in metalworking and engineering.</p>



	<p>Responsible: Association, sector representatives, general education institutions</p> <p>10. Local municipalities can be those who improve cooperation between local companies and general education institutions.</p> <p>Responsible: Local municipalities, general education institutions, companies</p> <p>11. Dissemination of good practices of involvement of sector companies in general education.</p> <p>Responsible: Association, sector representatives, general education institutions.</p> <p>12. Companies who are involved in the educational process need recognition.</p> <p>Responsible: Association, General education institutions</p>
Lithuania	<p>1. Lobby-work is better than in Estonia and Latvia, but needs continuing and daily updates.</p> <p>Responsible: Association, government</p> <p>2. STEAM centers are really positive, but need more attention to content and how it is going to work with target groups.</p> <p>Responsible: General education institutions</p> <p>3. Pupils need to understand real job world opportunities for career choice.</p> <p>Responsible: General education institutions</p> <p>4. Companies need to be more open for cooperation with the general education institutions.</p> <p>Responsible: General education institutions and sector representatives</p> <p>5. More girls are needed in metalworking and engineering.</p> <p>Responsible: Private sector, PR</p> <p>6. Media could be more interested in industrial developments, education and the real job world.</p> <p>Responsible: Media, society.</p> <p>7. Technology studies need to be more practical and need investments.</p> <p>Responsible: Politics, Ministries</p> <p>8. Technology area needs more promotion events, where to get better contact with companies.</p> <p>Responsible: Association, companies</p> <p>9. Local municipalities need to do more cooperation to help industrial companies to communicate with schools.</p>



	<p>Responsible: Municipalities, schools, companies</p> <p>10. Companies who are involved in the educational process need recognition.</p> <p>Responsible: Association, General education institutions</p>
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6. Conclusions

Education policy makers and implementers in Estonia, Latvia and Lithuania need to understand that the development of the economy and the speed of the economy depend on technology area developments, investments and availability of skilled labor. Without sector involvement in the education process, skills gained in education can mismatch with labor market needs.

These challenges are emphasized on the EU level. Ursula von der Leyen, president of the European Commission, said in her annual speech on 14.09.22: “The lack of workers is also a problem for European companies. Never before have there been so few unemployed people. This is good! At the same time, the number of vacancies is at a record level. There is a shortage of truck drivers, waiters and airport workers. But also nurses, engineers and IT technicians. We need to invest more in education than before. For this purpose, we want to work closely with entrepreneurs. They know best what kind of workers they need today and tomorrow.” (Von der Leyen, 14.09.22)

It means for national policy level – there is a need for an adequate and connected economic and educational policy to maintain and increase our countries competitiveness. There is a rising need for knowledge about technologies and engineering, starting from early school age, even in general education. It means interdisciplinary cooperation between associations, companies and educational institutions and other stakeholders.

Regional and local level is getting more important in attraction of future specialists to the industry. Local companies and their branches have to be involved more in general education to raise the interest of pupils about metalworking and engineering, STEM field to support growth of the industry. Industry is considered the backbone of the economy. Industrial areas are very close to the government ecosystem, that is why industry companies’ future is really important for all society.

Industry in Estonia, Latvia and Lithuania need much stronger support from the government than before. There is good cooperation between three countries' associations (EML, MASOC and LINPRA), who are proactive and know the metalwork and engineering sector, they must be key-partners to governments supporting building policy which involves the sector companies in educational processes, including in general education.



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Appendix 1. Questionnaire

Author: Federation of Estonian Engineering Industry

Questionnaire:

Question 1. In the last two years, have you worked with schools to introduce your company to pupils?

Question 2. How can you work together between your company and your pupils?

Question 3. What has hindered cooperation at the basic school level?

Question 4. Who in your company would be the contact person to coordinate communication with nearby schools?

Question 5. Could your company have a program for young people to introduce them to industry-related jobs and possible careers?

Question 6. What do you think helps motivate young people to study STEM?

Question 7. What do you think are the best ways to introduce industry to young people?



Appendix 2. Lithuanian best practices

Engineering and industrial technologies are introduced by Infomobilis – mobile STEM laboratory

In order to popularize engineering study fields, specialties and professions the Lithuanian Engineering and Technology Industry Association LINPRA, together with partners, general education institution, vocational schools and other educational institutions in various Lithuanian cities, organizes vocational guidance events for young people using a vocational guidance tool, a mobile STEM laboratory – Infomobilis.

This spring season 2022, Infomobilis has already visited the schools and gymnasiums of Kretinga, Klaipėda, Telšiai, Plungė, Mažeikiai, Kaunas. In May the Infomobile spent in Šiauliai and in five days in a row visited Šiauliai educational institutions: pro – gymnasiums Ragainė, Medelynas, Gegužiai, Juventa and school Dermė.

Throughout the school week, Infomobilis events promoting engineering and technology professions in Šiauliai were initiated by the Šiauliai business community – LINPRA members: UAB Artlux, UAB Metal Production and UAB Baltik Vairas. According to Darius Sakalauskas, the head of UAB Artlux, in order to popularize the professions of the engineering sector, the business sector itself, which seeks to make today's schoolchildren later employees of companies, must also contribute to various initiatives.

The Infomobilis is a special bus equipped with technology and engineering training equipment – a mobile steam science laboratory of technical direction, where children and young people are introduced to the professions of the engineering industry, learning, practice and career opportunities.

The Infomobilis, the length of which reaches 17,5 m, is equipped with the techniques used in modern industrial enterprises, prototypes of various production equipment: an automated smart production line, milling and turning and laser cutting machines, a welding simulator, a 3D printer, computer and software, an IoT system, a robotic arm, a mobile electrical laboratory, virtual reality glasses, other educational tools, various educational stands that provide an opportunity to get to know each other professions and "try on" them. In the laboratory, visitors have the opportunity to observe the mechanized process of assembling parts controlled by programming, the production of a souvenir cube,



to get to know natural science subjects and the worlds of mathematics and technology art (design) up close.

The goal of the mobile STEM laboratory is to present engineering as a modern profession combining electronics, mechanics, computer science, mathematics and other sciences in an attractive way. In the engineering industry, young, inquisitive and receptive specialists in this field are very welcome. Interactive Infomobilis is a great opportunity not only to see and test the latest technologies and devices, but also to learn about the study of the fields of engineering industry, work processes and prospects of engineering industry specialists.

The Infomobilis project was initiated and implemented together with partners by the Lithuanian Engineering and Technology Industry Association LINPRA. LINPRA, encouraging young people to choose engineering professions, is implementing the project of a modern STEM laboratory – Infomobilis together with the Vilnius Jerusalem Labour Market Training Center and the Academy of Practical Training.

The objectives of the mobile STEM laboratory are:

- To introduce young people to the engineering industry;
- To promote the specialties and professions of the engineering industry;
- To engage young people in commercial-technical studies in the metal and electronics industries;
- To engage technology teachers in the laboratory;
- To inform youth them about training places;
- To inform youth about their studies;
- To inform about jobs;
- To provide information and counseling services on career planning;
- To shape a positive attitude of parents and teachers towards career planning;
- To shape a positive attitude of parents and teachers towards the engineering industry;
- To provide them with the information they need and lack.



About STEM Centers

The STEM Open Access Center is a center of modern technologies, where, in cooperation with scientists, municipalities, entrepreneurs, pupils are provided with the conditions for conducting research, constructing, modeling and getting acquainted with scientific innovations during or after lessons, creatively solving problems that have arisen.

The STEM open access network consists of: Regional STEM open access centers – in Alytus, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena.

Methodical STEM open access centers – in Kaunas, Klaipėda and Vilnius.

Each regional STEM open access center is equipped with standardized biology-chemistry, physics-engineering, robotics - IT laboratories, as well as a specialized laboratory, taking into account the needs of the region. In laboratories, pupils can perform a wide range of research work, both provided for in the general curriculum and related to the specifics and priorities of the region.



Appendix 3. Latvian best practices

According research made by order of the Ministry of Education and Science (2021), the most active non-formal STEM education promotion activities:

- 1) **Science centers, museums and practical workshops (experiments, lectures and lessons, interactive exhibits, careers education, trips)** : Society "Association of Latvian Science Centers" and SIA "Zinoo" in Cēsis and Riga; Kurzeme Democenter in Ventspils high-tech park; Liepāja Science and Education Innovation Center; Daugavpils innovation center; Latvian National Museum of Nature in Riga; Riga National Zoo; Paula Stradiņš National Museum of Medical History in Riga; RSU Anatomy Museum in Riga; Pharmaceutical Museum in Riga; LU Museum in Riga; Latvian Railway History Museum in Riga; Riga Motor Museum; Latgale Zoo in Daugavpils; LU Baldones observatory; Starspace observatory in Suntaži (Ogre district); Lielzeltiņų Observatory (Talsu County); Latvenergo Energy Museum in Ķegums; Environmental education and culture center "Ķēpa" in Neikšani (Dagda region)
- 2) **STEM education promotion initiatives**: IT education fund Start(IT) (Accenture Latvian branch, RTU, etc.); STEaMUP ("Latvijas Dzelzceļš", "Possible Mission", etc.); Riga TechGirls (Accenture Latvian branch, LMT, etc.)
- 3) **Companies and others private initiatives (courses, science shows, experiments, trips)**: Science school "Laboratorium" in Riga; HelloIT programming school in Riga, etc.; Learn IT programming school in Riga, etc.; The first programming school in Riga; European programming school Datorium; SIA "AgirVision" (robotics lessons) in Ikšķile, etc.; "Smart Riga" science lessons/shows; SIA "001A" ("Alfa Robot" robotics school); SIA "Bērnu centrs" - center "Like at home" in Sigulda, Cēsis and Valmiera; SIA "Lielvārds" - interest education center in Lielvārde; development of teaching materials; SIA "Robo HUB" (robotics lessons); "Password Techlab" (science and technology classes) in Jelgava; SIA "AMAkids" (mental arithmetic lessons) in Riga; International school of innovation (robotics lessons) – association "Technical; school of education and creativity"; Association "STEM Education Embassy" in Grobina.



Appendix 3. Estonian best practices

4) Science centers, museums and practical workshops (experiments, lectures and lessons, interactive exhibits, careers education, trips):

- AHHA centre, in Tartu (<https://ahhaa.ee/en>)
- Energia Avastuskeskus, in Tallinn (<https://www.energiakeskus.ee/en/>)
- Seaplane Harbour, in Tallinn (<https://meremuuseum.ee/lennusadam/en/>)
- Old Equipment shelter, in Järva-Jaani (<https://varjupaik.jjts.ee/>)
- Estonian Aviation Museum, near in Tartu (<https://www.lennundusmuuseum.ee/en/>)
- Old Technic Museum, in Tallinn (<https://tehnikamuuseum.com/en/>)
- MoMu Motorsport Museum, in Ellamaa (<https://momu.ee/en/>)
- Road Museum, in Varbuse (<https://www.maanteemuuseum.ee/en/>)
- Estonia Firefighting Museum, in Tallinn (<http://www.tuletorjemuuseum.ee/en/>)
- Railway and communication museum, in Haapsalu (<https://salm.ee/en/railway-and-communications-museum/>)
- Estonian Agricultural Museum, in Tartu (<https://maaelumuuseumid.ee/en/estonian-agricultural-museum/>)
- Kohtla-Järve museum of oil shale, in Kohtla-Järve (<https://pkm.ee/en/>)
- Proto Invention Factory, in Tallinn (<https://prototehas.ee/en/home/>)

5) STEM education promotion initiatives:

- Robotex International: <https://robotex.international/>
- Robots battle: <https://robolahing.ee/en>
- Only girls in Tech: <https://unicornsquad.ee/?lang=en>
- Formula Student Team, in Tallinn: <https://www.formulastudent.ee/en/>
- Pneumobil, in Tartu: <https://te.emu.ee/et/struktuur/biomajandustehnoloogiate-oppetool-bt/sundmused/pneumobiil-2018/>
- American Beauty Car Show: <https://americanbeauty.ee/>



- NGO Robotics: <https://www.robootika.ee/en/>
- Metal Week in Tartu (Metal work presented in 5 schools – workshops, lessons, factory tours etc)

6) **Companies and others private initiatives (courses, science shows, experiments, trips):**

- Merkuur OÜ: <https://www.mobileworkshops.eu/>
- Science Theatre: <http://teadusteater.ee/science-theater/>
- Cleveron's Academy, practised based school for pupils: <https://cleveron.com/akadeemia>

7) **TV – shows/ Media**

- Rakett69 - <https://rakett69.ee/>
- Goldberg's machine race (Estonian Public Broadcasting competition)
<https://novaator.err.ee/k/goldbergimasin>
- Donald Dorch alias Donn DIY, the most popular technology area youtuber, building and repairing machinery, <https://services.err.ee/media/embed/1036226>

Companies' role is cooperation with schools: Lectures in lessons, factory tours, projects, sponsoring events, internships etc.