

Erasmus+ Programme of the European Union Key Action 2 (KA2) – Cooperation Partnerships project in the field of school education “Diversifying STEM Ecosystem”. Project No. 2024-1-LV01-KA220-SCH-000250755

PANEVĖŽYS REGIONAL STEAM OPEN ACCESS CENTRE STEM ECOSYSTEM DEVELOPMENT STRATEGY 2025–2030



Funded by the European Union. Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Abbreviations	3
Introduction	5
1. General Information	9
1.1. Summary of the Institution	9
1.2. EU-Level, National and Local Planning Documents	14
2. Analysis of the Current Situation	19
2.1. Learning Process, its Results in the Field of STEM	22
2.1.1. Overview of Student Survey Results	22
2.1.2. Overview of Parent Survey Results	27
2.2. Competencies for STEM Teachers	31
2.3. Career Education in STEM	36
2.4. Cooperation Partners in the STEM/ STEAM Ecosystem	39
2.5. Interdisciplinarity in STEAM	41
2.6. Digital Transformation	42
2.7. Internationalization	43
3. Collection of Ideas, Innovative Practices, Solutions	46
4. Analysis of Needs to Improve the STEM Ecosystem	49
5. Program for the 2025/26 Academic Year With Innovative Solutions	53
6. Action Plan	57
7. A Roadmap for Building a STEM Ecosystem	62

Abbreviations

PŠC – Panevėžys Education Centre

LBTU – Latvia University of Life Sciences and Technologies

STEM (Science, Technology, Engineering, and Mathematics) – an acronym used in education policy to refer to the academic field of education, research, and technological development grounded in natural sciences, technology, engineering, and mathematics.

STEAM (Science, Technology, Engineering, Art, and Applied Mathematics) – natural sciences, technology, engineering, creativity, and applied mathematics. A program developed at a university in Virginia (USA) with an emphasis on applied mathematics.

GEMS (Girls in Engineering, Math, and Science) – girls in engineering, mathematics, and science. A week-long summer school targeting the primary education level, aimed at providing girls with applied knowledge in science, technology, and engineering.

STEMM (Science, Technology, Engineering, Mathematics, and Medicine) – STEM plus medical sciences. A program implemented at universities in Australia and the USA, extending the STEM model to include health sciences. In some contexts also referred to as STE-M (Science, Technology, Engineering, Medical).

S&E (Science and Engineering) – natural sciences and engineering. An acronym used in the United States to track developments in higher education and workforce trends in the science and engineering sectors.

STM (Science, Technology, Mathematics) – natural sciences, technology, and mathematics. The concept is similar or even identical to STEM but does not emphasize engineering. Used in the educational policy discourse in Sub-Saharan Africa.

eSTEM (environmental STEM) – an approach within conventional STEM subjects that emphasizes environmental issues and social challenges.

STEMIE (STEM + Invention + Entrepreneurship) – a coalition of over 600 general education programs in the United States promoting creativity and entrepreneurship alongside STEM learning.

STES / STS[E] (Science, Technology, Environment, Society) – a movement associated with environmental education (EE) in science teaching. It aims to develop students' scientific and conceptual understanding, critical thinking, and problem-solving skills when addressing real-world challenges.

STESEP (Science, Technology, Environment, Society, Economy, and Policy) – a sustainability-focused STEM model that combines STES and STEM. It promotes higher-order cognitive skill development through questioning, enhancing systems thinking, critical reasoning, problem-solving, decision-making, moral reasoning, and creative thinking, all integrated into education for sustainable development.

STREM (Science, Technology, Robotics, Engineering, and Mathematics) – a STEM extension that includes robotics as an additional scientific discipline.

STREAM (Science, Technology, Religion, Arts, Mathematics) – STEAM plus religion. A program developed by the National Catholic Educational Association in the United States, aimed at enriching the STEAM framework with “eternal truths of faith.”

J. Vaitiekaitis. *STEM ugdymas: nuo Sputniko iki mergaičių skaučių. Acta Paedagogica Vilnensia*, 2019, 43, 100–118

Introduction

The main activity of the Panevėžys Education Centre is non-formal adult education focused on the development and enhancement of competencies. The Centre has been operating successfully since 1997. From 1997 to 2002, it functioned as a part of the Panevėžys City Municipality's Education Department, and since 2002, it has been an independent institution. The Centre is accredited by the Ministry of Education, Science and Sport of the Republic of Lithuania and develops as well as accredits adult education programmes.

Panevėžys Education Centre has two units: the Panevėžys Robotics Centre RoboLabas, established in 2019, and the Panevėžys Regional Open Access STEAM Centre, established in 2021.

The activities of both units include non-formal education for children in the fields of robotics, engineering, and technology, as well as educational events, competitions, and camps. Non-formal education is provided to children from the age of 5, to youth aged 12–18, and to adults.

The Panevėžys Regional Open Access STEAM Centre has four laboratories: the Biology and Chemistry Laboratory, the Physics and Engineering Laboratory, the Artificial Intelligence Laboratory, and the Robotics and IT Laboratory. Around 500 learners aged 5 to 18 and older are currently engaged in educational activities across both units.

The Centre employs 45 highly qualified staff members with long-term experience in educational service provision. They are committed to enriching the learning experience by organizing various activities and field trips, and teaching subjects aligned with the Ministry of Education's curriculum, including biology, physics, robotics, mathematics, natural sciences, artificial intelligence, IT, and others.

The primary objectives of the STEAM Centre Division are to broaden students' perspectives, promote respect for others, and create opportunities to pursue individual goals. To achieve this, students are engaged in various activities, including robotics festivals, educational projects, thematic learning sessions, competitions, voluntary initiatives, and academic contests.

The Centre has more than 20 years of experience in designing and implementing projects across areas such as economics, social integration, technology, and sustainable environmental development. Following the onset of war in Ukraine and the arrival of refugees in Lithuania, the Centre redirected its human and material resources to ensure safe learning environments for adults, children, and youth. Initial support included language services for adults and robotics classes for their children.

Panevėžys Education Centre carries out projects in cooperation with other non-formal education providers at the municipal level. Notable initiatives have been funded under Priority 8 of the European Union Structural Funds Investment Operational Programme 2014–2020. These include “For Oneself and the Community” and the community support initiative of the same name. Another project, “Best Practices – A Path to Growth and

Development”, was implemented under the measure “Enhancing Social Inclusion and Combating Poverty”.

These projects have fostered strong community engagement. Adults involved in the initiatives developed digital literacy, learned principles of healthy living, explored Lithuanian history and culture, and studied multiple languages, including English, German, Polish, French, and Lithuanian. Participants also took part in a range of additional structured learning activities.

The STEAM Centre actively cultivates partnerships with national and local institutions, including museums, libraries, universities, and schools. In collaboration with these partners, the Centre has initiated and successfully implemented projects such as “Family Health Laboratories”, “Clean Environment and Well-being”, and “Stronger Together”, among others.

Through the Erasmus+ Key Action 2 (KA2) Strategic Partnership project “Supporting Teachers’ Problem-Solving Mindset for Lifelong Learning”, the Centre aims to enhance educators’ competencies that are essential for fostering future-ready learners.

The Centre’s team is committed to innovation and regularly integrates new methods and technologies into its practice. Particular emphasis is placed on initiatives that encourage collaboration between students and institutions, as well as those that harness the potential of emerging technologies.

The project’s designated contact person has over a decade of experience in project management, implementation, and coordination, and has served as an Erasmus+ project coordinator since 2014. Participating educators possess advanced qualifications in fields such as information technology, biology, chemistry, artificial intelligence, robotics, mathematics, physics, and engineering. Their involvement in previous projects, as well as in professional development activities focused on integrating late-stage information technologies into education, ensures their expertise and dedication to this initiative.

All members of the team have contributed to the development and implementation of STEAM, robotics, and IT programs. These programs are designed to support innovative, sustainable, and creative engagement for socially vulnerable children and adults. The aim is to strengthen participants’ capacity to adapt their existing skills to emerging engineering technologies and evolving processes.

The team includes a science educator, six ICT and robotics teachers, and subject specialists in mathematics, chemistry, and physics.

Project objectives

1. To improve teachers’ skills by expanding the availability and quality of STEM education.
2. To create and apply effective and creative methods, tools, and activities that help increase teenagers’ interest in STEM subjects – especially among girls.
3. To build a network of partners across the EU and work together with institutions from different areas of education, using good examples from existing STEM ecosystems.

4. To develop and carry out a strategy for growing the STEM ecosystem.

The project involves five partner institutions from Finland, Lithuania, Poland, Greece, and Latvia.

Main project activities

1. Creating and implementing a strategy for developing the STEM ecosystem;
2. Providing training and professional development for teachers;
3. Designing and testing STEM activities for teenagers.

In many projects, the focus often remains on delivering direct services or completing specific activities within a set timeframe. This project, however, aims to go further — by combining service delivery with the development of skills and the long-term application of new competencies.

The STEM methodology developed within the project will focus on actively involving girls in STEM-related activities and strengthening their technological skills. The approach will help students apply existing abilities to new technologies and processes, encouraging innovation and creative problem-solving.

A key aim of the project is to engage students from grades 6 to 9 in community life, while developing their ability to address real-life challenges in creative ways. By strengthening their STEM-related skills, students are expected to gain a deeper understanding of how engineering works, why it matters, and how it can be used in everyday situations.

During the project, a series of modules and programmes will be developed, including Creativity and Innovation, Product Design, Electronics and Robotics, Green Energy, Materials Technology, Smart Technologies, Future City, and others.

These programmes are planned to be implemented in all participating countries following the project's completion.

The STEM ecosystem development strategy is divided into two main parts:

Part I: Assessment of the current situation

Part II: Strategic and Operational part

The strategy is being developed by a working group established under Order No. V-74 of Panevėžys Education Centre, dated 14 October 2024, concerning Project No. 2024-1-LV01-KA220-SCH-000250755 Diversifying the STEM Ecosystem.

Vaida Repovienė, Deputy Director for Education, is the project manager. She is responsible for overall project management and administration, including financial oversight, cooperation with host organisations, coordination of mobility visits, reporting, strategy development, and activity supervision. Gintarė Eimontaitė Veversė, Programme Coordinator, is responsible for activity monitoring, dissemination, mobility visit coordination, strategy development, and the preparation and implementation of methodologies. Simona Masilionytė, Non-Formal

Education Teacher, serves as Project Coordinator, with responsibilities in activity monitoring, dissemination, strategy development, and the preparation and implementation of methodologies. Edita Strolienė, Career Specialist, is also a Project Coordinator, responsible for activity monitoring and dissemination. Simona Stasiūnienė, Laboratory Head, is a Project Coordinator responsible for methodology development, activity supervision, and contribution to the strategy. Algirdas Veveris, Laboratory Head, serves as Project Specialist and is responsible for methodology development, testing, and activity supervision. Dalia Vizbarienė, Methodologist, is responsible for strategy development, methodology preparation, and implementation. Additional educators are invited to contribute to the preparation of specific sections of the strategy as needed.

1. General Information

1.1. Summary of the Institution

Vision and Goals of the Panevėžys Education Center Related to STEM Education	Mission To be a modern, community-focused center that innovatively promotes lifelong learning, helping communities to learn, create, and grow, while nurturing a technology-friendly and entrepreneurial society. Vision To be a center of meaning, discovery, and successful learning, uniting experiences, change, and progress. Values ● Openness to diverse perspectives, positive initiatives, dialogue, collaboration, and new ideas. ● Creativity by opening doors to innovation, creating and applying knowledge across all education fields, and seeing challenges as opportunities for growth. ● Responsibility for our actions, actively caring for the environment and our community. Our Aim ● To engage children in attending and participating in STEAM (Science, Technology, Engineering, Arts, Mathematics) activities. ● To encourage parents to actively participate in non-formal education and lifelong learning. ● To support teachers in Panevėžys and the community in continuous learning and collaboration. Goals: ● To promote lifelong learning. ● To develop career education activities. ● To strengthen STEAM education.
Educational Programs	Educational programs at robotics center “Robolabas” The Robotics Center “Robolabas” offers a variety of educational programs for children aged 5–15, attracting participants from Panevėžys and nearby regions. Key programs include:

- **Ages 5–7: “Conquerors of Space”**
Exploring space while building and programming a lunar rover, integrating natural sciences, math, and robotics.
- **Ages 6–7:**
 - “Dancing Birds” – learning bird biology and building robotic bird models.
 - “Earth – Our Planet” – hands-on exploration of Earth's structure, building a volcano prototype, and conducting eruption experiments.
- **Grades 1–4: “Young Inventors”**
Learning block-based programming, building and controlling LEGO robots, and developing problem-solving and design skills.
- **Grades 2–4: “Journey to Mars”**
Exploring the solar system, building and programming a Mars rover while deepening engineering and programming knowledge.
- **Grades 3–5: “The Lost World”**
Building models of historical creatures and exploring their structure and functions.
- **Grades 3–6: “Smart Cycling with Spike Prime”**
Building and programming bicycle models while discussing design principles.
- **Grades 5–8: “Robotics Mechanics”**
Introducing mechanical principles by building cars with gear systems.

Educational Programs at the Panevėžys Regional STEAM Open Access Center

- **Biology and Chemistry Laboratory:**
For grades 6–12, hands-on experiments combining chemistry, physics, engineering, and biology, such as “The pH in My Glass,” “Neutralization in the Bath,” “Artificial Caviar and pH,” “Secrets of Dissolution,” “Secret Paints,” “Aqua Detectives,” “Chemical Mosaic,” “My Dream Soap,” “Vitamin A Extraction,” “Alive or Not,” and “Seeing Bacteria.”
- **Robotics and IT Laboratory:**
For grades 6–9, combining IT, math, robotics, geography, biology, and art with activities like “Scaling Challenge with a Robotic Arm,” “Soil Moisture Sensor Workshop,” and “Sorting Robot.”
- **Artificial Intelligence Laboratory:**
The only lab of its kind in Lithuania, offering activities for grades 5–9 using advanced technologies with programs like “Hello, How Can I Help? – Your Chatbot,” “Detectives and AI,” and “Discover the Power of Variables!”

	● Physics and Engineering Laboratory: For grades 6–9 and adults, exploring questions like “Why Doesn’t Water Freeze at Zero?” and “STEAMBER – From Ocean Depths to Outer Space,” integrating physics, engineering, biology, and geography.																
Branch Data	<table><tr><th>School Year</th><th>Total Students</th><th>Grades 1-5</th><th>Grades 6-10</th></tr><tr><td>2022/2023</td><td>468</td><td>370</td><td>98</td></tr><tr><td>2023/2024</td><td>493</td><td>330</td><td>163</td></tr><tr><td>2024/2025</td><td>523</td><td>376</td><td>147</td></tr></table>	School Year	Total Students	Grades 1-5	Grades 6-10	2022/2023	468	370	98	2023/2024	493	330	163	2024/2025	523	376	147
School Year	Total Students	Grades 1-5	Grades 6-10														
2022/2023	468	370	98														
2023/2024	493	330	163														
2024/2025	523	376	147														
Staff Information	Staffing (2024/2025): ● 30 teachers ● 15 technical staff ● 28 specialists ● 5 experts ● 12 administrative staff																
STEM Collaboration Partners and Service Providers (Partnership Agreements)	We actively collaborate with universities and national institutions to implement large-scale projects, including: ● “STEAM Center Development” with LINEŠA, Vilnius University (VU), and Klaipėda University (KU). ● “School of Opportunities” with NŠA, VU, and KU. ● “Enhancing Teacher Competencies” with Vytautas Magnus University (VMU) and other partners. We also work closely with universities on targeted initiatives, such as: ● VMU’s “Life Skills Program” ● VU’s “STEAM Activity Development” ● VGTU’s “Engineering Education” Local partnerships include: ● Schools and the municipality for teacher training and project implementation. ● Industry partners, including Panevėžys Art Gallery, Panevėžys Development Agency “Panevėžys NOW,” Harju Elekter, Roquette Amilina, and others, for projects and sponsorships.																

	The center actively participates in Erasmus+ projects and other national and international initiatives, supporting staff training, project development, and community learning. In 2023, a weekend school for Ukrainian children, “Надія,” was established. The center also ensures inclusive opportunities for children with hearing impairments, autism, behavioral challenges, and those experiencing social exclusion.
Achievements in the STEAM Field	In 2023, the Panevėžys Education Center’s initiative “Lessons Measuring Panevėžys” was nominated for the Emerging Europe Awards. This initiative was implemented in collaboration with the Panevėžys Development Agency “Panevėžys NOW.” In the same year, the Center received the “Collaboration Ambassador of the Year” award for actively promoting engineering pathways and strengthening career-related competencies in this field. At the Innovative Teacher Awards 2023, the Center was recognized as the “Non-Formal STEAM Education Provider of the Year.” In 2023, students from the Robotics Center “RoboLabas” participated in six international student robotics competitions in Lithuania and Latvia, earning eight prize-winning places (including 2 first places, 4 second places, and 2 third places). They took part in ten different competitions, receiving six special nominations. Additionally, “RoboLabas” hosted six thematic and genre-diverse exhibitions within its premises. During the National Lithuanian Young Engineers Championship “STEAM Team” organized by the LINPRA association, the “RoboLabas” students’ Goldberg machine project, “Zitrone,” won first place in the Grades 5–8 category, securing a spot in the national finals. Another Goldberg machine project, “Pykšt Pokšt,” built by the “RoboLabas” team in the Grades 9–12 category, won third place. In the final event held in May, the “RoboLabas” team secured first place in the Grades 5–8 category, winning a €1000 monetary prize. At the final event of the “Future Engineering” program, three “RoboLabas” teams presented year-long projects, including “Decorative Vase,” “Three-Axis Milling Machine EDCR 1.2,” and “Automated Time Tracking System.” The “Decorative

	Vase” project won the top prize in the “Product Design” category. The center organized international competitions, including “Automaton 2023” and “Robot Fiesta.” In 2023, Laura Kuchalskienė, a non-formal education teacher at the Robotics Center “RoboLabas,” was named “Educator of the Year.” She was recognized for her organization of international robotics competitions in Panevėžys, her students’ achievements in engineering and innovation, the development and piloting of new engineering-related teaching materials, her active participation in the “Lessons Measuring Panevėžys” initiative, and her dedication to sharing professional expertise. In 2024, the Panevėžys Education Center and its branches received the “Collaboration Ambassador of the Year” title for actively promoting engineering pathways and strengthening career competencies in this field. In 2024, marking 20 years of Lithuania’s membership in the European Union, the CPVA (Central Project Management Agency) launched a series of open-door events titled “Take a Peek” (UžmESk akį). The Panevėžys Regional STEAM Open Access Center was included in the list of the 20 best EU-funded projects representing successful investments and benefits to society. Students from “RoboLabas” participated in six international robotics competitions in Lithuania and Latvia, including “Robot Fiesta 2023,” “Robotics Olympiad 2024,” and the World Robot Olympiad (WRO), winning five prize placements (2 first places and 3 second places). They participated in ten different competitions, receiving six special nominations, and organized six exhibitions on various topics and genres. Under the “EIT Manufacturing” project titled “Creating a Healthy Future: 3D Printing for Primary School Teachers and Their Students,” the “RoboLabas” team submitted a 3D project titled “Decorative Vase Component.” The “Young STEAMers” club team became the winners in one of the four competition categories. The Panevėžys Industrialists’ Association has recognized and acknowledged the achievements of the Panevėžys Education Center’s “RoboLabas” Robotics Center and the STEAM Center for the second consecutive year. The “Public Servant of the Year” award was presented to Vaida Repovienė, Deputy Director for Education at the Panevėžys Education Center, who
--	---

	is responsible for overseeing the operations of the Robotics Center “RoboLabas” and the STEAM Center.
Collaboration Among STEAM Centers	Joint projects, such as “School of Opportunities,” are implemented to enhance teacher competencies, with participation from teachers in Anykščiai, Rokiškis, Kėdainiai, and other cities. The STEAM Center Network organizes teacher camps and develops joint 40-hour or longer teacher training programs and internships.

Table 1. General Information About the Institution.

1.2. EU-Level, National and Local Planning Documents

This section provides a concise overview of European Union, national, and local-level documents, programs, and strategies related to the development of the STEAM field. It also outlines the role of educational institutions in implementing these planning documents.

Planning Documents	Basis
EU-Level Educational Documents	At the EU level, education policies aim to develop digital, foundational, and transversal skills, such as critical thinking, entrepreneurship, creativity, and civic participation. They also encourage interdisciplinary approaches, mobility for learners and teachers, and cross-border cooperation. Educational institutions are expected to act as catalysts, supporting the transition towards sustainability by integrating environmental perspectives into science and humanities education.
Ministry of Education, Science and Sport Strategies	The strategic documents of the Ministry emphasize the importance of education in equipping students with the competencies needed for the future labor market and innovation development.
2021–2030 Education Development Program	This program aims to enhance digital competence development across all levels of education. It emphasizes integrating digital technologies into the learning process while fostering students’ critical evaluation skills and promoting safe and responsible internet use.
Digital Education Strategy	This strategy outlines actions to improve digital infrastructure in schools, prepare teachers to work with digital technologies, develop digital learning content, and foster students' digital competencies across Lithuania.
2023–2030 STEAM Education Strengthening Plan	This plan defines key priorities and directions for improving the quality, accessibility, and attractiveness of STEAM education in Lithuania. It

	aligns with EU-level goals to foster digital skills and strengthen STEAM education (Science, Technology, Engineering, Arts, Mathematics). Digital Skills Development: The EU aims for all citizens to acquire essential digital skills necessary for daily life, employment, and continuous learning. Transversal Digital Skills: The EU emphasizes the need to develop not only technical skills but also transversal digital skills such as critical thinking, creativity, entrepreneurship, and collaboration, which are crucial for living and working in the digital age.
National Progress Program	This program includes elements supporting the development of STEAM education, recognizing its importance in driving economic growth and competitiveness in Lithuania.
Digital Agenda Implementation Strategy in Lithuania	This strategy focuses on implementing digital transformation across sectors, including public administration, education, healthcare, and the economy. It outlines specific actions to improve digital infrastructure, foster digital skills, encourage innovation, and ensure cybersecurity.
STEAM Development Strategy/Action Plan (2014)	<i>Goal 1: Improve Student Achievement in STEAM Fields</i> • Update curricula and integrate natural sciences courses. • Implement IT education at the primary level and STEAM education in preschool and pre-primary settings. • Improve infrastructure by equipping schools with natural sciences laboratories and ensuring fast internet and digital tools for all schools. • Support gifted and talented students through targeted programs. <i>Goal 2: Prepare 21st-Century Teachers and Develop STEAM-Relevant Competencies</i> • Enhance teacher qualifications through targeted internships and STEAM module studies. • Provide targeted scholarships for graduates in physical, biomedical, and technological sciences who choose teaching careers. <i>Goal 3: Promote Public Education and Interest in STEAM Topics</i> • Establish science museums, STEAM centers, science valleys, and promote science popularization initiatives.

Table 2. EU-Level and National Documents, Programs, and Strategies.

Planning Documents	Basis
--------------------	-------

Panevėžys City Municipality Strategic Plan	This plan may outline directions and measures for developing STEAM education in the city, improving student achievement in STEAM fields, and fostering student interest in science, technology, engineering, arts, and mathematics.
Panevėžys City Municipality Education Development Program	This program covers STEAM development aspects, including teacher professional development, updating educational resources, and fostering cooperation with businesses and academic institutions.
Decisions of the Panevėžys City Council	The City Council may adopt decisions related to STEAM development, such as providing funding for establishing STEAM centers or equipping schools with necessary resources.

Table 3. Local Planning Documents Related to STEAM.

The Role of Educational Institutions in Advancing STEAM Strategies and Programs

- **Catalysts:**
The EU views educational institutions as key catalysts for promoting sustainability and digital skills development. Schools should ensure that students acquire the competencies needed to live and work successfully in the future.
- At the EU level, various programs and initiatives support the development of digital skills and STEAM education. For example, the Erasmus+ program offers opportunities for students and teachers to participate in international projects and exchanges. Various platforms and resources are also being developed for educators and learners.
- Digital skills development and STEAM education are considered priority areas across the EU, aiming to equip all citizens with the competencies necessary for the digital era while contributing to building a sustainable future. Educational institutions play a critical role in this process by fostering interdisciplinarity, sustainability, and international cooperation.

Key Digital Transformation Goals in Lithuania:

- **Modernize Public Sector Services:**
Digital technologies should be widely implemented to improve the quality and accessibility of public services.
- **Promote Digital Economy and Innovation:**
Lithuania aims to become an attractive destination for digital technology investment, encouraging local businesses to adopt innovative solutions.
- **Develop Digital Skills Among Citizens:**
All residents should have opportunities to acquire the digital skills necessary for successful participation in the digital economy.

- **Ensure Cybersecurity:**

Lithuania should be prepared to counter cyber threats and ensure the safe use of digital technologies.

On October 27, 2021, STEAM Open Access Centers were launched in Alytus, Marijampolė, Panevėžys, Šiauliai, Tauragė, and Telšiai, with a seventh center soon opened in Utena.

The organizational work for establishing these centers began in 2015. In 2019, the National Education Agency initiated the project “Provision of Schools with Natural and Technological Science Tools” under which the creation of STEAM Open Access Centers was supported. Project funds were used for purchasing laboratory equipment, furniture, and renovating center premises. Additionally, research activity descriptions were developed, and training for center staff was conducted.

The project is funded by the European Regional Development Fund and the state budget, with municipalities, partners, and academic institutions contributing additional support.

The regional centers operate modern laboratories, including:

- Standard laboratories: Biology-Chemistry, Physics-Engineering, Robotics-IT, and Natural Sciences-Mechatronics-IT.
- Specialized laboratories that reflect the priorities and needs of each region.

The STEAM centers offer formal and non-formal educational activities, various children’s educational projects, teacher professional development seminars, and other initiatives.

Laboratory Specializations in STEAM Regional Centers:

- Alytus – Food Technologies
- Kaunas – Smart City
- Klaipėda – Marine Research
- Marijampolė – Creativity and Media
- Panevėžys – Artificial Intelligence
- Šiauliai – Health Technologies and Quality of Life
- Tauragė – Sustainable Development and Green Alternative Energy
- Utena – Astrophysics and Aeronautics
- Vilnius – Life Sciences

STEAM LT network:
7 regional & 3 methodical
centres:

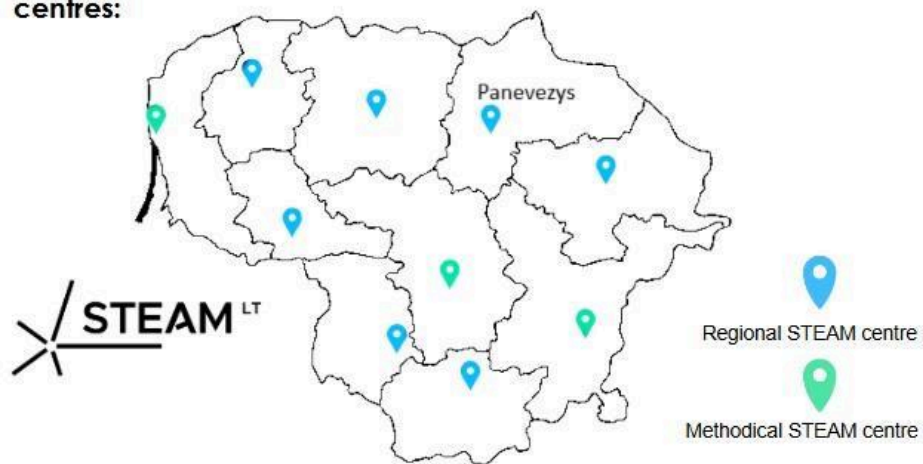


Figure 1. STEAM Centers Network in Lithuania.

2. Analysis of the Current Situation

STEAM fields (Science, Technology, Engineering, Arts, and Mathematics) are experiencing a renaissance both in Lithuania and globally. Today, STEAM education is not only an essential part of education but also a key to a successful future. However, despite national-level initiatives to promote STEAM, there is still a lack of unified understanding of what STEAM truly encompasses among education system professionals at all levels. The broader public often underestimates the importance and necessity of STEAM education. Parents may question its relevance for their children, not understanding why STEAM-based learning is necessary. Even within higher education institutions, including those directly engaged in STEAM education, interpretations of STE(A)M vary among academic community members.

The Importance of STEAM

STEAM education is essential because it fosters critical thinking, problem-solving skills, creativity, and the ability to adapt in a rapidly changing world.

STEAM in Lithuania

In Lithuania, increasing attention is being given to STEAM education. Educational institutions are implementing new programs to encourage students' interest in science, technology, engineering, arts, and mathematics. Numerous STEAM centers across the country provide opportunities for students to develop their skills through hands-on experiences.

STEAM Worldwide

Globally, STEAM education is highly valued, with many countries recognizing its role in ensuring competitiveness in the global market. Significant investments are made in STEAM, leading to the development of new educational programs.

Despite this growing interest, several challenges remain:

- A declining interest in studying and pursuing careers in science, engineering, and technology fields.
- An increasing demand for qualified researchers and STEM specialists.
- A lack of informed career choices, particularly in STEM-related areas.
- Concerns over declining innovation and economic competitiveness.
- Disappointing results in international student assessments (PISA, TIMSS).
- Education experts emphasize that the earlier STEAM education begins, the better the outcomes, highlighting the importance of early childhood education.

STEAM education is an integrated approach that aims to develop students' abilities to understand, apply, and solve real-world problems within the context of science, technology, engineering, arts, and mathematics.

Arts (A) within STEAM refer to an interdisciplinary creative process that combines creativity, technology, and management, delivering content that is innovative, culturally relevant, and reflective of contemporary challenges.

This creative element contributes to the design, functionality, modeling, and planning across all disciplines.

STEAM (Science, Technology, Engineering, Arts, Mathematics) is an educational methodology that integrates these five core disciplines, encouraging interdisciplinary learning. It applies creativity, problem-solving, and innovation skills to help students understand how these areas connect with real-world contexts.

STEAM education helps students develop critical and creative thinking skills while addressing real-life challenges. It encourages collaboration and teamwork, enhances technical skills through practical projects and experiments, and integrates artistic and engineering solutions to connect diverse disciplines. This approach not only prepares students for future job markets but also equips them to navigate a world where technology, science, and the arts are constantly evolving and interconnected.

STEAM didactics refers to the set of teaching and learning strategies aimed at integrating science, technology, engineering, arts, and mathematics into a cohesive, interdisciplinary learning process. This approach is based on active, experiential learning, project-based activities, problem-solving, and collaboration, with the goal of fostering students' creativity, critical thinking, and innovation.

The general goals of STEAM education are illustrated in Figure 2.



Figure 2. General Goals of STEAM Education.

Objectives of STEAM Education

- To provide students with a strong foundation in STEAM knowledge, fostering their interest in science, encouraging them to pursue STEAM studies, choose careers related to STEM knowledge, and apply STEAM skills to solve contemporary challenges.
- To enhance learners' abilities to integrate and apply knowledge and skills, foster creativity, collaboration, and problem-solving, and promote a spirit of innovation and entrepreneurship.
- To identify and nurture talents, preparing the experts necessary for national progress.

Core Principles of STEAM Didactics

Integration: STEAM education combines separate disciplines into a unified whole, helping students understand the connections between them and apply knowledge in a complex manner.

Interdisciplinarity: It encourages students to solve problems using knowledge and methods from various disciplines.

Practical Application: STEAM emphasizes the practical use of knowledge, encouraging students to conduct experiments, create projects, and solve real-life problems.

Creativity: It promotes students' creativity, innovation, and the ability to think outside the box.

Collaboration: STEAM education encourages teamwork, knowledge sharing, and joint problem-solving.

Experiential Learning: It is grounded in learning through experience, motivating students to actively participate in the learning process and discover knowledge independently.

The main strategies of STEAM didactics are illustrated in Figure 3.

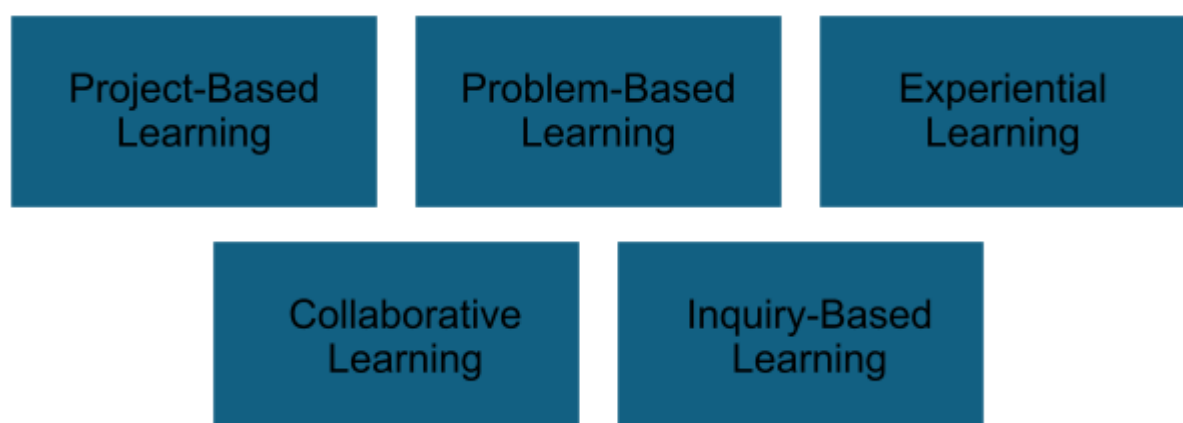


Figure 3. Main Strategies of STEAM Didactics.

Key Strategies in STEAM Didactics

- **Project-Based Learning:** Students engage in long-term projects where they solve real-world problems using their STEAM knowledge and skills.
- **Problem-Based Learning:** Students address complex challenges by analyzing situations, forming hypotheses, conducting research, and experimenting.
- **Experiential Learning:** Students actively participate in experiments, trials, modeling, and other practical activities during the learning process.
- **Collaborative Learning:** Students work in teams, sharing knowledge and skills while solving problems and developing projects.
- **Inquiry-Based Learning:** Students formulate their own questions, conduct research, and seek answers driven by curiosity and motivation.

2.1. Learning Process, its Results in the Field of STEM

2.1.1. Overview of Student Survey Results

One of the primary goals of the STEAM system is not only to provide students with a solid foundation in STEAM disciplines but also to foster their interest in science, motivate them to pursue STEAM studies, and encourage them to consider careers related to these fields. To achieve these goals, it is essential to analyze the current situation, assess students' perspectives, and understand their experiences. With this in mind, a survey was conducted among students in grades 6–9 at Panevėžys educational institutions to represent their interests and needs in the STEAM field.

A total of 209 students from grades 6–9 participated in the survey, including 124 boys (59.3%) and 85 girls (40.7%) (see Figure 4). The survey was conducted during January–February 2025.

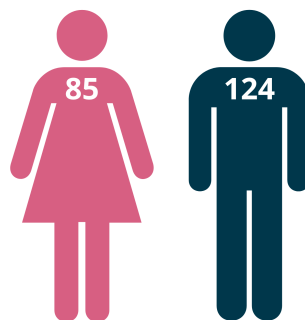


Figure 4. Distribution of survey participants by gender.

Students' Vision for the Future

The survey aimed to determine whether students in grades 6–9 have decided on their future educational and career paths. When asked, “Do you know where you would like to continue your studies after completing primary education?”, 40.7% of respondents indicated they planned to continue in a gymnasium, 40.2% were still undecided, and the remaining students indicated they would continue in a progymnasium (11.5%) or another secondary or vocational school (6.7%).

The data shows that a significant portion of students (58.9%) have already decided on their next educational steps in a gymnasium, progymnasium, or other educational institutions. However, the high percentage of undecided students (40.2%) indicates the need to strengthen career education at earlier stages, highlighting that promoting STEAM from a young age can play an important role in shaping students’ future choices.

When asked, “How do you envision your future profession?”, 19.6% of respondents expressed interest in engineering, programming, and technology, while 10.5% were interested in medicine and natural sciences. This reflects positive trends in the context of STEAM education, as these fields are highly relevant to today’s labor market. Other students indicated interest in fields related to culture, arts, and creativity (9.1%), entrepreneurship (7.7%), teaching or coaching (6.7%), and tourism (1.4%).

It is worth noting that many teenagers today are also interested in professions related to law enforcement, national defense (police, military, criminology), social sciences (journalism, sales, law), and sports (professional athletes, coaches). Of all respondents, 27.8% remain undecided about their future profession.

The survey results reveal that while some students have a clear professional direction, many are still uncertain. This underscores the importance of early career education to help children better understand their career opportunities and personal strengths. The popularity of STEAM fields is encouraging, but to maintain students’ interest, it is crucial to ensure consistent practical learning opportunities.

Opportunities for Career Exploration

The survey also aimed to determine whether students have opportunities to learn about professions of interest to them. 18.7% of respondents stated that they have such opportunities through school-organized excursions, educational trips, and meetings with professionals. 27.3% indicated that they know someone working in their field of interest and can independently deepen their knowledge in that area. However, more than one-third (33.5%) reported having no opportunity to explore careers of interest, and 28.7% are undecided about their career direction and are not actively exploring the topic. This means that more than half (62.2%) of students lack clear opportunities to explore potential career paths.

When asked, “Which activities would best help you explore different professions?”, students could select multiple options. The most frequently chosen were:

- Excursions to companies (99),
- Job shadowing visits (95),
- School-organized meetings with professionals (77),
- Project-based or independent work related to career exploration (63).

Students also noted that family members, friends, and relatives, as well as internships, volunteering in companies, non-formal education activities (e.g., STEAM clubs, robotics), and online information, could support their career exploration.

The results show that students value practical activities that allow them to explore fields of interest up close. This suggests that career orientation should be integrated into real work environments, balancing structured and self-directed learning opportunities.

The Role of Non-Formal Education

Non-formal education plays a significant role in career choices by providing opportunities for students to engage in various activities, develop specific skills, and gain practical insights into professions. Surveyed students in Panevėžys most commonly attend sports (70), arts (26), STEAM-related (26), or other activities (10). However, a large portion of respondents (77) do not attend any extracurricular activities (see Figure 5).

Participation in Non-Formal Education Activities

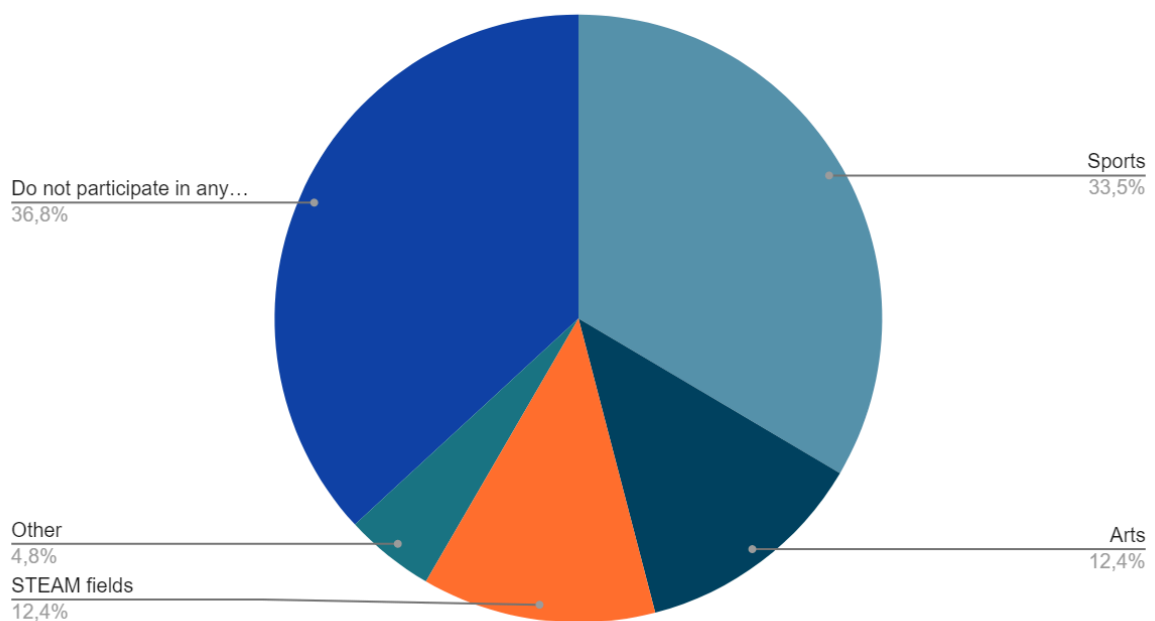


Figure 5. Participation in Non-Formal Education Activities by Field.

This distribution shows that while non-formal education can support career exploration, many students are not utilizing these opportunities.

The results indicate that a considerable number of students (74) would like to attend additional clubs, but there is an insufficient supply, especially in arts, sports, and STEAM fields. Meanwhile, another group of students (38) remains undecided about participating in additional activities, and 68 respondents stated they are satisfied with the current offerings. This reflects diverse student needs—some require a broader range of activities, while others are content with existing opportunities.

Students' Digital Skills

Students were asked to assess their digital skills and abilities, with results presented in Table 4.

No.	Digital Skill	I can do this very well and can help others	I can do this myself	I could do this if shown how	I do not know how to do this
1.	Finding necessary information online	91	109	-	9
2.	Copying and transferring files (e.g., documents, videos)	75	70	51	13
3.	Using advanced video conferencing functions (moderation, recording)	35	63	88	23
4.	Creating and sharing documents with permissions	33	51	91	32
5.	Identifying illegally shared digital content	31	45	79	52
6.	Creating new content and combining media (text, images)	41	68	76	22
7.	Checking if a website is secure before submitting personal data	46	60	71	32
8.	Protecting oneself from unwanted or harmful content (spam, identity theft)	58	82	49	20

Table 4. Students' Digital Skills.

The survey revealed that students are proficient in basic digital skills, such as searching for information online and transferring files. More complex skills, such as creating shared documents, managing video conferencing tools, and recognizing illegal content, are less developed, with many students requiring guidance to learn them. There is a particular lack of skills related to digital safety, with some students unaware of how to identify secure websites or protect themselves from online threats. This indicates a need to strengthen digital literacy education, focusing on safety and critical thinking.

The survey also explored which tools students use for completing homework, with results shown in Table 5.

No.	Tool or Online Environment	Often (daily)	Sometimes (several times a week)	Rarely	Do not use
1.	Artificial intelligence tools	74	80	35	20
2.	Shared documents	20	77	74	38
3.	PowerPoint or other presentation tools	45	76	63	25
4.	Other	59	75	48	27

Table 5. Tools and Online Environments Used by Students for Homework.

The data shows that students actively use AI tools, with more than half using them daily or several times a week. Presentation software (PowerPoint and others) and other digital tools are also frequently used, although less relevant for some students. Shared document usage is less common, with a significant portion not using them at all. This suggests that while some digital tools are integrated into students' daily routines, there is potential to increase the use of collaborative tools within the learning process.

Recommendations

Based on the survey results, the following recommendations are proposed:

- 1. Shaping Future Visions:**

Strengthen career education from an early age, integrate career exploration into lessons, and focus on self-awareness and presenting STEAM fields in real-life contexts.

- 2. Career Exploration Opportunities:**

Expand practical activities (excursions, meetings, job shadowing) and promote collaboration with businesses and academic institutions.

- 3. The Role of Non-Formal Education:**

Ensure a broader variety of clubs, particularly in the STEAM field, reflecting students' actual needs.

4. **Developing Digital Skills:**

Focus on digital skills development, integrate digital competencies into lessons, and ensure teacher readiness.

5. **Use of Digital Tools:**

Encourage the use of collaborative tools, promote responsible AI usage, and position the STEAM center as a methodological and consultative leader in this area.

2.1.2. Overview of Parent Survey Results

The family is a child's first and primary environment, where social skills, values, and norms are learned. Factors such as family relationships, parental behavior, and values shape a child's character, outlook on life, and behavior.

Parents often decide what types of after-school activities their children participate in, and their support or indifference can directly influence a child's engagement in STEAM activities. Surveying parents helps to better understand the factors influencing children's choices and how to effectively develop a STEAM offering that aligns with the expectations of both children and their families. For this reason, as part of developing the Panevėžys Education Center's STEAM Development Strategy, a survey was conducted among parents of children aged 12–15 to represent their perspectives on their children's interests and after-school activities.

A total of 180 parents responded to the questionnaire, of whom 55% are raising girls and 45% boys. The distribution of children's ages is presented in Figure 6.

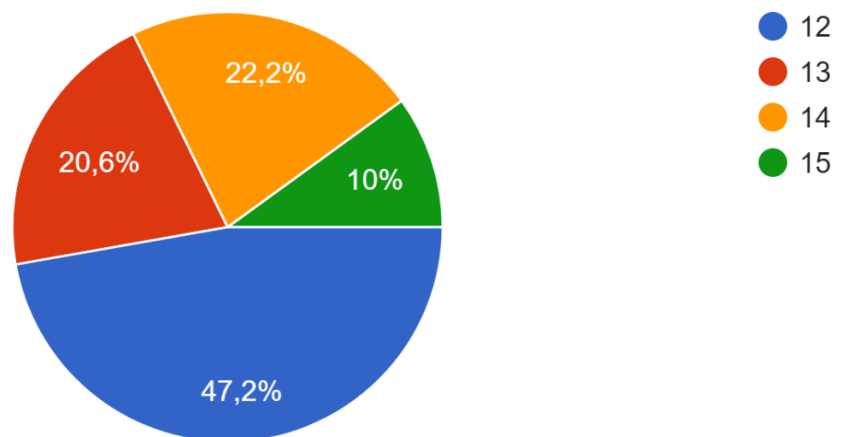


Figure 6. How old is your child?

When parents were asked, “Does your child plan to pursue a future career in the STEAM field (science, technology, engineering, mathematics)?”, the majority of respondents (73%) indicated that they are still undecided about their child's future plans, and 12% believe their children will not choose a STEAM-related career. Only a small proportion of parents (13%) see a clear connection between their child's future profession and STEAM fields. This suggests the need to strengthen family involvement in career guidance processes and clearly communicate the opportunities, benefits, and prospects of STEAM education.

Parents were also asked, “Do you encourage your child to participate in extracurricular activities or clubs?” The responses indicate that the majority of parents (53.9%) motivate their children to join clubs to gain additional skills useful for the future, and 36.7% want their children to participate in regular after-school activities. Only a small portion indicated that their child has hobbies at home (8.3%) or that they do not encourage extracurricular participation at all (1%). This reflects parents’ positive attitudes toward extracurricular activities and their willingness to support non-formal education, which can significantly contribute to the development of STEAM competencies.

Based on parents’ answers to the question, “What activities is your child interested in and currently attending?”, sports activities dominate—with 70 parents (51.1%) indicating that their children participate in basketball, football, swimming, martial arts, horse riding, tennis, and similar activities. This suggests that sports activities in Panevėžys are not only widely accessible but also valued by families. In second place by frequency were arts activities, mentioned 48 times (35%), including music, art, theater, and ceramics, indicating the accessibility of cultural education and parents’ attention to their children’s emotional and aesthetic development. Meanwhile, STEAM activities such as robotics, programming, and nature or geography clubs were mentioned 16 times (11.7%) (see Figure 7). Although this is a smaller portion, the data shows that a certain level of STEAM offerings is present in the city. However, compared to sports and arts, these activities remain less visible, which may be due to limited availability or a lack of information about their content and benefits.

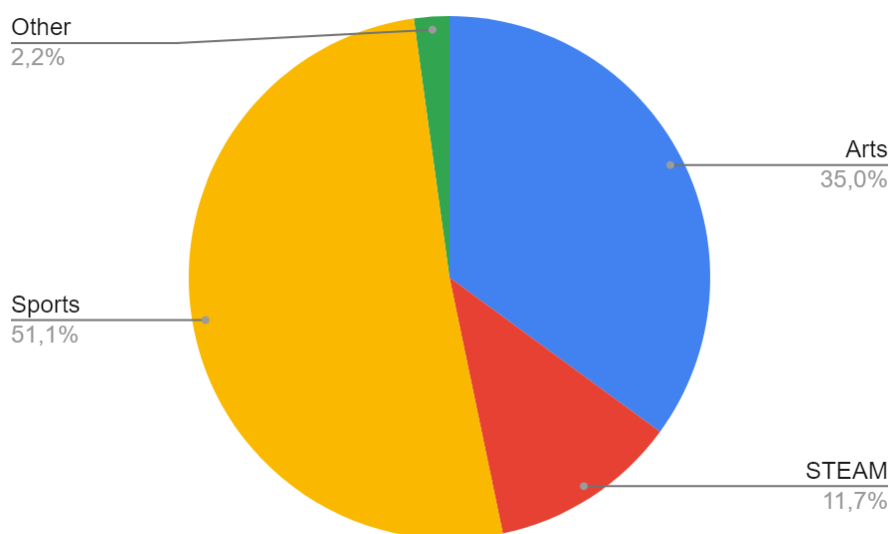


Figure 7. Distribution of Children’s Participation in Extracurricular Clubs by Field.

These results reveal a disproportion in Panevėžys’ non-formal education structure—sports and arts activities dominate, while STEAM, though present, is not yet sufficiently integrated into the overall offering. This indicates untapped potential that could be developed by increasing the visibility of STEAM activities, improving accessibility, highlighting their benefits, and purposefully integrating this direction into the city’s educational strategic priorities for 2025–2030.

Valuable insights into the current situation were provided by parents' responses to the question, "What types of after-school activities are missing in schools that would encourage your child to participate?" Data analysis identified thematic directions reflecting parents' expectations and opinions on the missing non-formal education activities in city schools (see Figure 8).

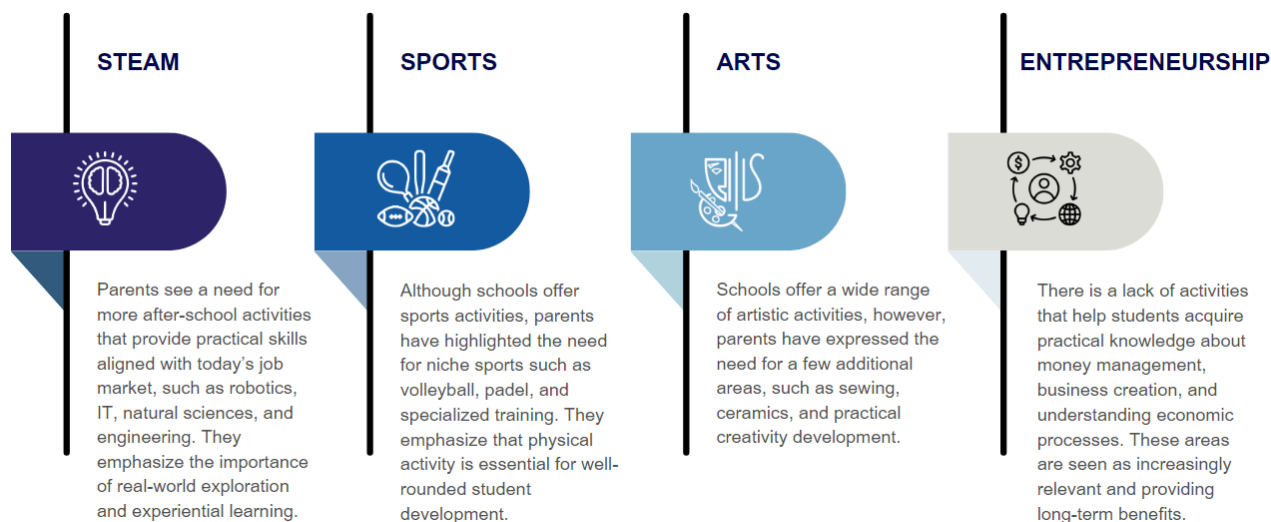


Figure 8. Thematic Areas of Missing After-School Activities.

In the context of STEAM, parents frequently mentioned missing activities such as robotics, information technology, engineering, artificial intelligence, natural sciences, and geography clubs, with programming being the most commonly noted missing activity. The lack of STEAM-related clubs was highlighted by the majority of surveyed parents (24 mentions). Notably, parents emphasized the need not only for content but also for the format of activities-seeking practical, experiential opportunities.

Parents expressed desires for:

- “Practical, real-life learning in actual company environments so that children understand what real work is”.
- “Training opportunities abroad would be very valuable, allowing children to see different environments, work cultures, and specifics”.
- “Learning through collaboration with foreign students”.

These insights show that some parents expect non-formal education to provide engaging, applied activities that complement formal education and allow students to gain real-life experiences. Considering the current limited accessibility of STEAM activities in schools, these responses should be seen as a well-reasoned indication of need.

Although earlier survey data shows that the supply of sports activities in Panevėžys is well-developed, parents noted the lack of a few more specialized sports activities, such as volleyball, tennis, and padel. This suggests that while the basic sports club network (e.g., basketball, football) is functioning, there is demand for alternative or less common sports activities. The same applies to arts activities, which are broadly available in Panevėžys, with parents identifying only a few missing specialized options, such as ceramics and sewing.

Among the missing activities in schools, entrepreneurship and financial literacy activities were also noted (3 mentions). Even this small number indicates that some parents want their children to be prepared for real-life challenges, capable of managing finances, understanding economic processes, and confidently realizing ideas and taking initiative. These activities align closely with the principles reflected in STEAM education—critical thinking, problem-solving, and entrepreneurship.

The open-ended question, “What types of after-school activities are missing in schools that would encourage your child to participate?” also provided valuable parent feedback, revealing structural and organizational challenges in non-formal education, presented in Table 6.

Teacher Competence and Methods	Parents are critical of some teachers’ abilities to organize engaging, relevant clubs, highlighting the need for teacher qualification improvement focused on modern education practices. <i>Parent feedback: “Clubs in schools are outdated, information is presented in an unengaging manner, and led by the same subject teachers.”</i>
Limited Accessibility	Some children cannot participate in after-school activities due to time, scheduling, logistical, or economic reasons. <i>Parent feedback: “Schools have activities, but the timing overlaps with external clubs.”</i>
High Academic Workload	A heavy academic workload is a significant barrier to non-formal education, with fast learning paces and large amounts of homework limiting participation. <i>Parent feedback: “The curriculum is overloaded, and the amount of homework and expectations for home learning are so high that adding another intellectual activity would be too much.”</i>
Lack of Information	Insufficient communication about available activities limits parent and student engagement; activities are inaccessible not due to absence but due to a lack of awareness, emphasizing the need to strengthen school-community communication. <i>Parent feedback: “I don’t know what activities are offered at school.”</i>

Table 6. Challenges to the Accessibility of Non-Formal Education.

Survey results show that in Panevėžys, sports (51.1%) and arts (35.0%) dominate non-formal education participation, while STEAM-related activities are attended by only 11.7% of respondents. However, parents clearly emphasize the lack of STEAM-related activities in schools, particularly natural sciences, technology, engineering, programming, and experiential learning opportunities.

Parents’ insights also reveal significant barriers, including high academic workloads, limited accessibility, lack of information about available opportunities, and insufficient teacher preparation to organize engaging, modern activities.

2.2. Competencies for STEM Teachers

To assess teacher competencies in the STEM field, a survey was conducted with 200 STEAM subject teachers. They were asked to evaluate their digital skills and the tools they use in their activities. The collected data allows conclusions about teachers' strengths and areas requiring further development, supporting the planning of professional development initiatives and resource allocation.

The tools used by STEAM teachers in their activities and the frequency of their use are shown in Table 7.

No.	Tool	Daily	Once a week	Once a month	Once a semester	Once a year	Do not use
1.	Computer	178	22	-	-	-	-
2.	Printer or copier	98	82	3	5	7	5
3.	Mobile classroom	17	15	35	13	17	103
4.	Interactive whiteboard	105	17	13	6	4	55
5.	Computer lab	36	11	44	46	14	49
6.	Document camera	17	16	3	18	23	123
7.	Other tools	92	28	22	28	1	29

Table 7. Frequency of Tools Used by Teachers.

Teachers were also asked to evaluate their IT skills, digital literacy, and their use of non-standard, innovative technologies in their activities and lessons. The data is presented in Table 8.

No.	Skill	Very good	Good	Neutral	Needs improvement
1.	Ability to select and use IT tools and online programs in lessons	89	49	37	25
2.	Ability to plan and manage time	76	114	4	6
3.	Ability to engage students in learning	63	98	28	11

4.	Ability to collaborate with colleagues and parents	45	97	27	31
5	Ability to build relationships with students	41	101	42	16
6	Ability to observe and identify students' needs	39	103	31	27
7.	Ability to maintain discipline	37	115	27	21
8.	Ability to select appropriate teaching methods	39	103	31	27
9.	Digital literacy: finding, evaluating, using information, creating new content	47	121	23	9
10.	Ability to use innovative technologies	36	123	33	8

Table 8. Teacher Competencies.

During the survey, teachers were also asked about the IT equipment needed in schools to ensure a high-quality teaching and learning process.

Equipment and Resource Needs

Teachers indicated that schools lack interactive tools and computer equipment, including interactive whiteboards, smart screens, smart boards, and interactive displays. They expressed the need for more computer labs (especially additional computers), laptops, tablets, document cameras, projectors, 3D printers, programmable machines, VR glasses, and laser pointers. Teachers also highlighted their interest in learning to use AI tools.

Many respondents emphasized that it is important not only to have the equipment but also to regularly update it. Some teachers noted challenges in providing sufficient printed learning materials for students. Others mentioned that sometimes it is not the lack of equipment but the lack of opportunities to use it effectively. Some teachers felt that while schools are generally well-equipped, there is always room for improvement.

Teachers also identified the most frequently used tools in their lessons, illustrated in Figure 9.

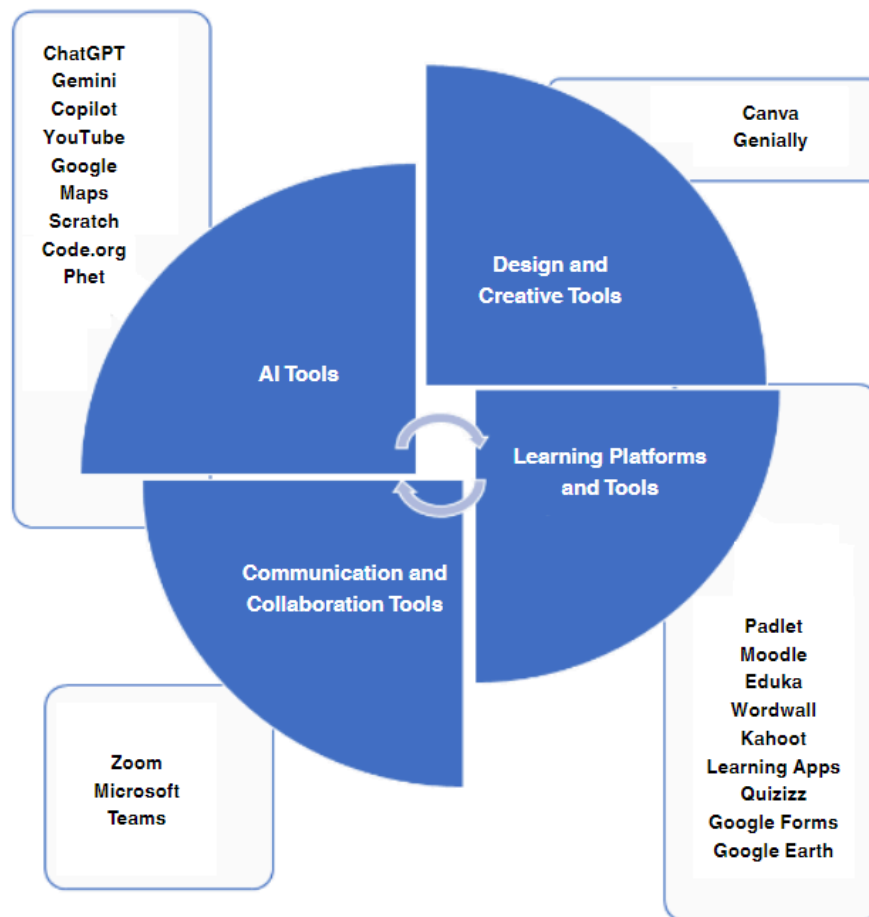


Figure 9. Tools Most Frequently Used by Teachers in Lessons.

It can be concluded that teachers use a wide range of online tools, depending on their subject and needs. Design and learning platforms are particularly popular, and there is a noticeable increase in the use of AI tools. Many teachers use Google products and a variety of specific educational tools that help them create interactive lessons, collaborate with students, and enhance the learning process.

Student Engagement

To improve the quality of learning and increase student engagement, it is important to apply diverse, practical, and creative methods. Teachers use a variety of teaching methods during lessons, after-school activities, and non-formal education, aiming to combine theoretical and practical knowledge with real-world applications.

Commonly used approaches include project-based learning, problem-based learning, and experiential activities. Teachers encourage active learning styles, foster student creativity, and use interactive tools to present theoretical material. Students are offered creative assignments, group collaboration opportunities, games, and simulations. Teachers strive to involve students in educational activities, role-playing, and simulations to help them better understand complex concepts and processes.

Teachers were also asked how they could further motivate and engage students in the learning process and non-formal activities. From the data, four categories emerged:

1. Student Engagement and Motivation:

- *Interesting and creative tasks:*
 - Replace dry theory with practical, real-life tasks.
 - Allow students to choose how to complete tasks (format, method).
- *Gamification:*
 - Use game-based learning and interactive apps.
 - Create a gamified learning environment.
- *Active teaching methods:*
 - Tools: ChatGPT, Gemini (Bard), Copilot, YouTube, Google Maps, Scratch, Code.org, Makecode.microbit.org, Phet.
- *Challenge-based lessons:*
 - Organize unexpected, challenge-oriented lessons instead of routine instruction.
- *Educational trips and meetings:*
 - Organize trips to institutions and meetings with inspiring individuals and guest speakers.
- *Encouragement and praise:*
 - Actively encourage and motivate students.

2. Practical Application of Knowledge:

- *Practical work and experiments:*
 - Organize laboratory work and experiments, especially in science lessons.
- *Project-based and creative work:*
 - Encourage students to create projects, videos, and artistic presentations.
 - Integrate activities across different subjects.
- *Real-life problems:*
 - Solve problems related to real-life situations.
 - Apply theoretical knowledge in practical contexts relevant to everyday life.
- *Digital skills:*
 - Use digital skills in creative, practical tasks.
 - Teach students how to format mathematical texts, formulas, and more.

3. Use of Technology:

- *IT tools and apps:*
 - Use interactive whiteboards, tablets, and computers in lessons.
 - Apply apps that provide instant feedback and assessment.
- *Digital educational content:*
 - Use digital learning materials and websites with interactive tasks.
 - Foster creativity through IT tools.
- *STEAM resources:*
 - Support the acquisition of STEAM tools.

4. Other Ideas:

- *Individualization:*
 - Allow students to choose learning methods that meet their needs.
- *Educational activities:*
 - Organize diverse educational sessions on various topics.
- *Olympiads and competitions:*

- Enable free participation in high-quality competitions and Olympiads.
- Speech therapy materials and engaging educational websites for students.
- *Appropriate learning environment:*
 - Ensure spacious, comfortable classrooms with appropriate temperatures.

In summary, teachers indicated that student motivation can be increased through practical application, an engaging environment, and real-world experiences. The suggestions provided by teachers are presented in Table 9.

No.	Definition	Proposed Activities	Count
1.	Practical Application	Organize lessons in companies, institutions, laboratories, STEAM centers; enable students to perform practical tasks and test their knowledge; provide transportation to remote locations; ensure free access to cultural institutions; organize thematic educational activities; conduct laboratory work and experiments.	144
2.	Meetings with Practitioners	Invite company representatives, specialists, and artists to lessons; organize meetings with well-known individuals and professionals (e.g., military personnel, psychologists).	73
3.	Excursions and Trips	Organize excursions to museums, exhibitions, cinemas, libraries, STEAM centers in other cities; trips abroad (e.g., British Council).	69
4.	Project-Based Work	Organize long-term projects to encourage creativity and independence.	58
5.	Integrated and Thematic Weeks	Organize integrated lessons combining multiple subjects; create thematic weeks focused on specific areas.	33
6.	STEAM Activities	Encourage student participation in STEAM activities at RoboLabas and the STEAM center.	78
7.	Creativity and	Organize events promoting creativity and self-expression; create reading and debate clubs.	36

	Self-Expressi on		
8.	Physical Activity and Recreation	Organize physical activities to encourage student movement.	21
9.	Encouraging Collaboration	Promote student collaboration and community spirit (e.g., eTwinning projects).	14

Table 9. Activities to Increase Student Motivation.

2.3. Career Education in STEM

Career education in the STEM/STEAM field is an integral part of modern education, helping students discover their vocation and prepare for the future labor market. This activity is implemented in various forms, integrating it into the learning process and organizing additional initiatives.

Career education is successfully integrated into the daily learning process, supplemented by educational excursions and guest lectures by professionals at schools. Interdisciplinary lessons are actively used, helping students see the practical application of academic subjects in real life. For students in grades 10–12, visits to higher education institutions are organized together with class tutors to introduce them to study programs and opportunities.

Schools traditionally organize Natural Sciences Days and IT Skills Days, which encourage student interest in these fields. Additionally, Job Shadowing Days are widely utilized, providing students with the opportunity to spend a day with a professional of interest and observe their work firsthand.

Typically, two career education specialists work in schools, closely collaborating with class tutors and subject teachers. This cooperation is crucial and should continue to be developed, particularly by strengthening relationships with local businesses and companies.

Career Education Activities Include:

- **Educational Excursions:**
Visits to higher education institutions, companies, and science centers are organized to provide students with real-world experiences and a broader understanding of various professions and study opportunities.
- **Guest Lectures by Professionals:**
Specialists from various fields are invited to schools to share their experiences, knowledge, and inspire students.

- **Interdisciplinary Lessons:**
Lessons that integrate knowledge and skills from various subjects to demonstrate their practical application in real life and different professions.
- **School Initiatives:**
Traditional Natural Sciences Days and IT Skills Days encourage exploration of STEM/STEAM fields. Job shadowing opportunities are also actively used, allowing students to observe professionals at work.
- **Specialist Support:**
Two career education specialists collaborate with class tutors and teachers, providing individual support to students. Their work is invaluable in establishing connections with nearby businesses and should continue to be expanded.

This activity is particularly important, as school administrations consistently support career education initiatives, and young people are open to new knowledge and experiences related to career opportunities.

Challenges and Possible Solutions

Despite the successful implementation of activities, certain challenges require a structured approach:

- **Limited Space for Events:**
The current school facilities can accommodate a maximum of three classes at a time, limiting the organization of larger, high-quality events. This affects air quality, the quality of technological support and projections, and can make students feel uncomfortable after events.
- **Event Funding:**
Additional funding is needed to attract truly memorable guest speakers and ensure high-quality events.
- **Diverse Student Interests:**
Different student interests require a flexible approach to event organization, adapting them to specific interest groups (e.g., by gender) or fields. For example, visiting a drone manufacturing company may not engage the entire class.
- **Collaboration with Local Companies:**
Due to safety concerns, local companies often do not organize student excursions.

Classification of Career Education Events Over the Past Three Academic Years (Table 10).

Type of Event	Description
---------------	-------------

Visits to Companies and Business Organizations	Regular visits to manufacturing companies, IT firms, engineering offices, and other organizations related to STEM/STEAM fields. These excursions provide students with real-life experiences, exposure to work environments, insights into the latest technologies, and direct interaction with professionals. Over the past three years, visits have included drone manufacturing companies, software development studios, robotics laboratories, and local engineering firms.
Meetings with Professionals and Guest Speakers	Meetings are organized with professionals from various fields, including engineers, scientists, IT specialists, architects, designers, artists, and data analysts. These guest speakers share their career paths, experiences, daily professional challenges, and future perspectives. Often, interactive seminars or discussions are held, allowing students to ask questions and delve deeper into areas of interest.
Science and Technology Days/Workshops	Schools organize themed days focused on natural sciences, information technology, engineering, and art. Activities include hands-on workshops, experiments, project presentations, and creative assignments. For example, Natural Sciences Days may feature chemistry experiments, physics demonstrations, or biology investigations, while IT Skills Days may include programming basics, robotics activities, or virtual reality demonstrations. These initiatives help students gain practical skills and understand the real-world applications of academic subjects.
Visits to Higher Education Institutions and Vocational Training Centers, and Businesses	Particularly for students in grades 10–12, excursions are organized to universities, colleges, and vocational training centers to introduce them to study programs, faculties, laboratories, and dormitories. Students learn about admission requirements, study opportunities, and career prospects related to various study fields, especially those connected to STEM/STEAM.
Job Shadowing and Individual Career Consultations	Job shadowing allows students to spend a day with a professional of interest, observing their daily work and gaining direct insights into the profession. This activity is often complemented by individual career consultations provided by the school's career specialists, during which students' interests, abilities, and strengths are discussed to help them

	develop personalized career plans and identify suitable study or professional development paths.
--	--

Table 10. Classification of Career Education Events Over the Past Three Academic Years.

Future Actions for Effective and Sustainable Career Education in STEM/STEAM

To ensure effective and continuous career education in the STEM/STEAM field, the following actions are recommended:

- **Developing a Comprehensive Database:**
Conduct needs assessments and create a database for class tutors and teachers containing information about local companies, projects, programs, and science centers relevant to STEM/STEAM development. This database will facilitate information access and collaboration.
- **Strengthening Community Engagement:**
Actively engage the community through e-class platforms, social media, and other communication channels. Share best practices from other schools and invite participation in career education initiatives.
- **Enhancing Teacher Collaboration:**
Encourage and strengthen collaboration between teachers and class tutors in organizing educational excursions, setting a goal for each class to participate in at least one STEM/STEAM-focused excursion per academic year. This will ensure systematic and consistent exposure to various career opportunities for students.
- **Implementing Mentorship Programs:**
Establish a mentorship program where STEM/STEAM specialists from local businesses and universities can mentor students, providing valuable insights, practical advice, and exposure to real professional environments.
- **Developing Practical Skills:**
Integrate more practical assignments, projects, and experiments into the curriculum to develop students' problem-solving, critical thinking, and creativity skills essential in the STEM/STEAM fields.
- **Involving Parents:**
Actively engage parents in the career education process by organizing meetings, seminars, and providing information about career opportunities in STEM/STEAM fields.

2.4. Cooperation Partners in the STEM/ STEAM Ecosystem

The Panevėžys Regional STEAM Open Access Center is one of the regional STEAM centers operating in Lithuania, dedicated to strengthening interdisciplinary education, encouraging student interest in STEAM fields, and creating an innovative, inquiry-based learning environment.

The primary objectives of the Panevėžys Regional STEAM Center, along with other regional STEAM centers, are:

- To encourage students to pursue studies in STEAM fields.
- To support schools in implementing general education programs through the Center's activities.
- To create modern and inspiring STEAM learning environments.
- To enhance the competencies and qualifications of science teachers.
- To provide students with career guidance.
- To promote achievements in STEAM fields.

The implementation of these objectives depends on various factors, including EU, national, and local planning documents, human resources, infrastructure, and a partnership network. The partnership network is particularly important for promoting the STEAM field and developing student competencies aligned with the needs of the current and future labor market.

The Panevėžys Regional STEAM Center has successfully developed a sustainable partnership network that includes:

- Business and industry partners, such as UAB "TPA," UAB "Harju Elekter," UAB "Voltai," UAB "Specagra," UAB "Roquette Amilina," UAB "Biznio Mašinų Kompanija," UAB "Auresa," IĮ "Anodas," and UAB "Phoenix Business Services."
- Educational institutions, including Kaunas University of Technology Panevėžys Faculty of Technologies and Business, Panevėžys College, Panevėžys "Minties" Gymnasium, Panevėžys Training Center, and other educational institutions participating in the Center's activities.
- Public sector institutions, such as Panevėžys Art Gallery, Panevėžys Development Agency, Panevėžys City Municipality, Biržai District Municipality, Kupiškis District Municipality, Pasvalys District Municipality, and Panevėžys District Municipality.
- Non-governmental and non-profit organizations, including the Panevėžys Chamber of Commerce, Industry, and Crafts, Panevėžys Rotary Club, and the Lithuanian Engineering and Technology Industry Association LINPRA.

The partners of the Panevėžys Regional STEAM Open Access Center contribute to its activities in various ways, including:

- Promoting and popularizing STEAM education and activities.
- Providing opportunities to integrate STEAM education into practical industrial/manufacturing activities.
- Supporting actions aimed at reducing the STEAM skills gap.
- Supporting the Center's activities by equipping laboratories with necessary tools and equipment.
- Contributing to the Center's operations with human resources and soft resources.

Sustainable and strategic partnerships are a cornerstone of the STEAM ecosystem, enabling the provision of modern, practice-oriented education while creating added value for the region

by developing future specialists capable of creating innovative solutions and contributing to a competitive knowledge society.

2.5. Interdisciplinarity in STEAM

The Panevėžys Regional STEAM Open Access Center and the “RoboLabas” Robotics Center operate under the principle of interdisciplinarity in all their activities.

In the 2023/2024 academic year, the Panevėžys Regional STEAM Center and “RoboLabas” actively implemented a variety of initiatives aimed at promoting interdisciplinary education and developing STEAM competencies across different age groups. The activities of both centers are designed to allow students to practically explore the principles of science, technology, engineering, arts, and mathematics, discover the latest innovations, conduct experiments, and create.

Joint STEAM and Interdisciplinary Activities:

- **Laboratories:**

The Panevėžys STEAM Center operates four laboratories: Robotics and IT, Physics and Engineering, Biology and Chemistry, and Artificial Intelligence. Additionally, the FAB LAB workshops enable the integration of different scientific fields.

- **Integrated Lessons:**

The centers organize STEAM Education Days, such as “GeoNight,” “Climate Fresco Workshops,” and others, during which students from general education schools, accompanied by their teachers, come to the Centers for hands-on activities. Other integrated activities are also organized in collaboration with Panevėžys city educational institutions.

- **Culture Pass Programs:**

Activities have included “STEAMBER – A Connection Between the Ocean Floor, the Human Heart, and Outer Space,” introducing students to the origins and research of amber using modern equipment and creating amulets with laser technology. At “RoboLabas,” the Culture Pass program “Explore Panevėžys with Ozobot” was implemented. These are excellent examples of how art (amber, cultural heritage) and technology (lasers, robotics) are integrated with science.

- **Exhibitions and Events:**

Creative exhibitions such as “A Journey Through Time: Baltic Zodiac Signs and STEAM” and “Ceramics Through the Microscope” were held, integrating art and science. Additionally, the science festival “Spaceship Earth” (2023) and challenges like “Informikas Knowledge Forum 2024,” where “RoboLabas” students presented IT projects related to the Lithuanian language, history, and mythology, as well as the “Traditional Basketball and Robot Basketball Duel,” combining sports and robotics, took place.

- **Robotics Competitions:**

Regular robotics competitions are organized, including “Robot Olympiad,” “Robot Fiesta,” “AUTOMATON,” “Happy Robot,” and others, promoting engineering and programming skills.

Teacher Professional Development Events in 2023/2024:

The Panevėžys STEAM Center and “RoboLabas” actively contributed to teacher professional development, initiating and implementing eight STEAM-focused events for teachers, including artificial intelligence and robotics topics.

Topics included:

- “Generative AI Tools”
- “Working with Microbit”
- “Creating Graphical User Interfaces for Smart Device Control”
- “Data Mining”
- “The Magic of Artificial Intelligence”
- “Design and 3D Modeling”

40-hour training programs for preschool/primary and subject teachers were planned and implemented in the 2023/2024 academic year on the topic of “Using Interactive Tools in Preschool/Primary Education.”

Additionally, eight professional development programs were prepared and implemented, including:

- “Interactive Tools in Primary Education”
- “Designing with Solid Edge Engineering Software”
- “Developing Teachers’ Competencies in Creating Practical STEAM Education Content and Organizing Practical STEAM Activities”

In summary, during the 2023/2024 academic year, the Panevėžys Regional Open Access STEAM Center and Robotics Center “Robolabas” actively contributed to interdisciplinary and STEAM education by offering a wide range of activities for students of various age groups and implementing intensive teacher training programs, including artificial intelligence and robotics topics.

2.6. Digital Transformation

Digital transformation in the institution represents fundamental changes in the organization's operations, processes, culture, and customer experience through the integration of digital technologies. This is not merely the implementation of individual technologies but a strategic approach to leveraging technology to achieve better outcomes, efficiency, and competitiveness.

Digitally managed processes within the institution include:

- **Document Management:**
Digitization of paper documents, electronic document signing, and management.
- **Communication:**
Transitioning internal and external communication to digital platforms (email, chat applications, social networks).

- **Finance and Accounting:**
Electronic invoicing, online payments, cloud-based accounting software.
- **Learning and Education:**
Use of distance learning platforms and virtual training.
- **Data Analysis:**
Big data analysis and business analytics tools.
- **Security:**
Implementation of cybersecurity measures and data protection protocols.

2.7. Internationalization

Panevėžys Education Center has extensive experience in implementing projects in education, social inclusion, environmental protection, and community engagement. This section presents projects implemented by the Panevėžys Education Center in partnership with others during 2023–2024 (Table 11), as well as STEAM projects planned for 2023–2027 (Table 12).

PROJECT IMPLEMENTATION EXPERIENCE	
2023	2024
INTERNATIONAL PROJECTS	INTERNATIONAL PROJECTS
2023 Erasmus Accreditation	Erasmus+ KA1 Mobility Project, 2024-1-LT01-KA121-ADU-00020061
Erasmus+ KA1 Project: “Democracy for All!”	Erasmus+ KA2 Partnerships Project “Diversifying the STEM Ecosystem,” prepared and won together with partners from Latvia, Greece, and Finland
European Solidarity Corps Project “Ready, Set, Act!”	Project “Lithuanian Summer” for Ukrainian children (orphans)
European Solidarity Corps Project “Awaken Your Superpower”	
Project “Towards Professionalism” implemented in 2023	
NATIONAL PROJECTS	NATIONAL PROJECTS
Project “Expansion of Non-Formal Education Services for Children,” funded by the European Union (based on the partnership agreement of August 17, 2021, No. R8-152)	Project “Expansion of STEAM Center Activities”
Initiated and implemented the project “Reception and Early Integration of Refugees from Ukraine.” A weekend school for refugees from Ukraine (children and adults) “Надія” was established and is operating	Project “School of Opportunities”

Implementation of the Education Development Program Progress Measure No. 12-003-03-06-01 “Providing Opportunities for Teachers to Improve Competencies in National Qualification Development Programs and Master’s Studies”	Project “Ceramics Through the Microscope,” won and implemented in cooperation with Panevėžys Art Gallery
Regional student entrepreneurship fair “Junior Achievement”	
REGIONAL PROJECTS	REGIONAL PROJECTS
“Journey Through Time: Baltic Zodiac Signs and STEAM,” a children and youth art project funded by Panevėžys Municipality	“Journey Through Time: Baltic Zodiac Signs and STEAM,” a children and youth art project funded by Panevėžys Municipality
“Eureka!” – a children’s summer activity project funded by Panevėžys Municipality	“Eureka!” – a children’s summer activity project funded by Panevėžys Municipality
	Environmental education project “Clean Environment – Good Well-Being”
	Social inclusion project “I Can!”
	Science project “The Dynamics of Plant Growth in Relation to Mechatronic System Parameters”
	Regional student entrepreneurship fair “Junior Achievement”

Table 11. Panevėžys Education Center Project Implementation Experience 2023–2024.

Project funding is purposefully used for improving learning environments and purchasing necessary equipment (e.g., the establishment of the Panevėžys Regional STEAM Open Access Center, the Ukrainian weekend school), as well as for compensating staff salaries (career specialists, laboratory heads, methodological work coordinators, etc.).

All projects have been successfully implemented, with planned indicators achieved and no ineligible expenses incurred.

STEAM Projects

The Panevėžys Education Center implements two Erasmus+ program projects, along with municipality-level and structural fund-funded projects that enhance STEM and STEAM education processes, improve institutional environments, and enable the acquisition of new tools for implementing new STEAM activities in AI, IT and Robotics, Physics and Engineering, and Chemistry and Biology laboratories.

The list of STEAM projects planned for 2023–2027 is presented in Table 12.

Think inside the Box	2023 m.
----------------------	---------

“The Dynamics of Plant Growth in Relation to Mechatronic System Parameters”	2024 m.
STEAM Center Modernization	2024-2026 m.
Expansion of STEAM Center Activities	2024-2026 m.

Table 12. STEAM Projects Planned for 2023–2027.

Teachers professional development and student mobility in the STEAM field abroad under Erasmus accreditations are presented in Table 13.

	2023/24 m.m.	2024/25 m.m
STEM Teacher Qualification Training	4	5
Teacher Digital Skills Improvement through Shadowing	4	5
Mobilities	2	3

Table 13. Teachers Professional Development and Student Mobility in the STEM Field Abroad Under Erasmus Accreditations.

3. Collection of Ideas, Innovative Practices, Solutions

In a world rapidly advancing in technology and experiencing shifts in the labor market, STEM (Science, Technology, Engineering, and Mathematics) education is becoming increasingly important. Our goal is to create and implement innovative modular programs for targeted groups. These programs will deepen knowledge, enhance practical engineering skills, and open new opportunities for future professionals.

Planned activities and modules for the target group will cover essential and advanced areas, including:

- Creativity and Innovation:
Encouraging non-traditional thinking and generating new ideas.
- Product Modeling:
Learning to create virtual and physical product models using modern design tools.
- Electronics and Robotics:
Exploring electronics principles, robot construction, and programming to develop practical engineering skills.
- Green Energy:
Investigating renewable energy sources and sustainable solutions.
- Materials Technology:
Learning about new materials and their applications.
- Smart Transport:
Analyzing future transport systems and their innovations.
- Future Cities:
Designing sustainable and smart city concepts and models.

These activities will not only provide theoretical knowledge but will also allow learners to test themselves by creating real, innovative products.

The Importance of Collaboration and Innovative Solutions

Collaboration in this project is fundamental. The programs being developed will be implemented in all partner countries in the future, including additional target groups, ensuring broad dissemination and the opportunity to share best practices.

The Panevėžys Education Center branches, “RoboLabas” Robotics Center, and the Regional STEAM Open Access Center are already leaders in this field. Children and adults learning at these centers successfully integrate robotics, technology, and engineering to create innovative products. By combining the experience and skills of partners, it will be possible to find innovative solutions for addressing regional challenges.

While partner activities will share similar goals, each will have its own specifics. The Education Center branches will focus more on product development processes, production, program and module development, and deepening engineering skills, enabling the delivery of comprehensive and practical learning content.

Sustainability and Integration into the Labor Market

During the project, the Panevėžys Education Center will actively collaborate with industry representatives to ensure that training programs align with real labor market needs and that

students gain in-demand skills. After the project, efforts will be made to successfully integrate the trained target group into the labor market, facilitating their professional careers.

Unity and Diversity: A Broader Context

EU member states and their societies form a complex network of social and ecological systems, united by cultural and social dimensions based on principles of unity and diversity. These principles must be implemented through inclusion and engagement; otherwise, they remain only theoretical or abstract concepts rather than a practical set of perspectives, beliefs, values, competencies, and skills capable of transforming society.

Thus, collaboration across cultures, geographies, legal, and social systems will enrich not only the project partners but also the target group. It will enable a broader perspective, deeper understanding of global challenges, and the creation of sustainable, universal solutions that benefit all communities. This intercultural dialogue and exchange of experiences are keys to the future success of engineering and STEM education.

The planned short-term activities for 2024–2025 are presented in Table 14.

Activity	Description	Quantity	Target Group
Practical/Creative Workshops “Girls in Engineering”	Includes robot building and programming workshops, bridge design and construction challenges, electrical circuit building, 3D modeling and printing, and career talks with successful women engineers.	1	Girls (grades 5–9) and their mothers
STEAM Center Visits	Students will visit STEAM centers, explore laboratories, and try various activities.	4	Grades 4-10
Joint Activities with Businesses	“Measuring Panevėžys: Culinary League” (students learn culinary skills with local businesses), “Junior Achievement Youth Entrepreneurship Expo”.	2	Grades 5-12
Conferences	Includes “Science Conference” and “STEAM Challenge” with presentations from business, engineering, STEAM centers, teachers, and students.	2	Grades 5-12
Business Visits	Visits to companies like UAB “Harju Elekter” and UAB “Profibus” for practical learning.	4	Grades 6-9
Participation in Competitions	National Competition “I Can Be an Engineer!”, “Challenge Box: DIY”, “STEAM ABC”.	4	Grades 5-9
Organizing Competitions at the STEAM Center	“STEAM Puzzle”, “STEAM ABC”, “Discover STEAM Connections”, “Code STEAM”.	5	Grade 11
Integrated Lessons	“Biophysics Day,” “Spaceship Earth”, Environmental Day, NASA Globe activities	10	Grades 5-11

Parent Meetings with Practical Activities	Workshops with parents involving practical STEAM activities.	4	Grades 5-11
Experimental Research/Projects	Practical experiments and projects for students.	10	Grades 5-11
Establishment of STEAM Ecosystem Initiative Group	Creating a group of STEAM Center, school, preschool, and business representatives to foster collaboration.	1	STEAM center, schools, preschools, business representatives

Table 14. Planned Collaborative Activities for 2024–2025.

4. Analysis of Needs to Improve the STEM Ecosystem

This section provides a comprehensive SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of the Panevėžys Education Center and its divisions: the “RoboLabas” Robotics Center and the Regional STEAM Open Access Center. The SWOT analysis is a strategic planning tool used to evaluate internal and external factors that influence the organization’s activities and growth. This analysis is conducted to objectively assess the current situation of the Panevėžys Education Center and its divisions. It helps to highlight available resources and successful aspects of operations, identify areas for improvement, and determine external opportunities and potential threats. The analysis results will serve as a foundation for developing a sustainable, data-driven STEM ecosystem development strategy for 2025–2030 (Table 15).

STRENGTHS	WEAKNESSES
• The Panevėžys Education Center and its divisions—the “RoboLabas” Robotics Center and the Regional STEAM Open Access Center—employ highly qualified specialists who consistently enhance their professional competencies by participating in training, job shadowing, and seminars in Lithuania and abroad. Employees actively share their knowledge with the education community by giving presentations at conferences and organizing and leading regional and national STEAM training sessions. • Since its establishment in 2002, the Panevėžys Education Center has developed a strong partnership network. The divisions operating since 2019 and 2021—the “RoboLabas” Robotics Center and the Regional STEAM Open Access Center—are well-known among Panevėžys city and regional educational institutions. The Center collaborates closely with the Panevėžys City Municipality and local businesses, successfully implementing changes, joint initiatives, projects, and events that strengthen STEAM education in the	• Although STEAM education is actively promoted at the national level, there remains an inconsistent understanding of its purpose and practical value within the education community. Not all education institution staff clearly understand the goals and benefits of STEAM education, resulting in insufficient integration of the Center’s services into schools. Experience shows that teachers often avoid organizing visits to the STEAM or “RoboLabas” centers due to concerns about the duration and thematic openness of activities interfering with curriculum implementation, particularly in senior grades where exam preparation is prioritized. Even with free transportation, visits are perceived as an additional challenge for lesson planning, and practical activities lasting longer than one class period can disrupt other classes. • Parents remain a hard-to-reach audience, limiting the impact and accessibility of the STEAM Center’s services. Although the Regional STEAM Open Access Center offers relevant and innovative activities for children, some parents do not sufficiently understand the

city. • The divisions of the Panevėžys Education Center provide opportunities for STEAM competency development for students aged 5–18. The Center actively collaborates with city and regional educational institutions, offering non-formal education activities focused on expanding STEAM competencies. At “RoboLabas,” students can develop STEAM competencies through non-formal education activities and by participating in integrated lessons and educational activities alongside subject teachers. The Regional STEAM Open Access Center offers opportunities for students and teachers to engage in complementary activities, conduct laboratory work, and explore STEAM sciences through educational initiatives and science popularization events. These activities are tailored to the needs of educational institutions and are organized to supplement and enrich the formal education process. • The divisions of the Panevėžys Education Center are recognized and valued not only by the city’s educational community but also by the broader public, including families, seniors, and other social groups. Science popularization events are regularly organized to increase public awareness and understanding of STEAM education. Notable initiatives include family-focused events such as “Puzzle Evenings” (2024, 2025), “Girls in Engineering” creative workshops involving girls, mothers, and grandmothers, and practical training for seniors. Given the influence of families on children’s career choices, there is a clear need	importance of STEAM education. Since parents significantly influence children’s career choices and motivation—as shown in KTU’s (2018) insights—their perceptions directly affect students’ career directions. For this reason, it is essential for the Panevėžys Education Center to strengthen targeted communication with parents using clear information channels and by educating them about the benefits of STEAM. • Some activities at the Center are currently driven by the initiatives and creativity of individual specialists. While this approach allows for innovative solutions, in the long term, it is important to strengthen collaboration-based organizational practices, ensure knowledge sharing among staff, and facilitate experience exchange to guarantee continuity and resilience of activities within the institution.
---	--

to expand the Center’s visibility not only within the education sector but also within the wider city community.	
THREATS	OPPORTUNITIES
- Declining student interest in natural sciences, engineering, and technology poses a future risk for Panevėžys in terms of a shortage of qualified professionals. Although the STEAM Open Access Center and “RoboLabas” Robotics Center offer relevant educational services for children starting from age 5, awareness of these activities remains limited. A targeted communication strategy involving schools, businesses, the city municipality, and media is necessary to increase the visibility of STEAM education and gradually build a pipeline of specialists needed for the city’s development. - Panevėžys City has one of the oldest populations in Lithuania, with approximately 20% of residents being seniors. This demographic trend is reflected within the teaching community: in the 2024–2025 academic year, the average teacher age was 50 years, and 8.7% of teachers were of retirement age, with many being chemistry and physics teachers. According to the Ministry of Education, Science and Sports data (March 17, 2025), the shortage of physics, chemistry, mathematics, and IT teachers is a national issue, and Panevėžys is no exception. Young specialists who pursue STEAM-related studies at universities (often outside Panevėžys) frequently do not plan to return to work in their hometown or choose higher-paying positions in the private sector. These trends suggest that the shortage of STEAM subject	- At the national level, STEAM education is a strategic priority, aligning the Center’s activities with national education directions. This creates opportunities to actively participate in projects and secure funding for infrastructure and program development. - Panevėžys is an industrial city with companies interested in a qualified future workforce. Joint initiatives can be developed with businesses (e.g., mentorships, practical activities, or project-based programs) to align STEAM education with real labor market needs. “RoboLabas” already engages children from the age of 5, providing a strong foundation for continuity. Early involvement in STEAM helps build learning motivation, making it worthwhile to expand targeted programs for kindergartens and preschool groups. - Organizing engaging, non-traditional activities—such as lectures, creative workshops, or meetings with scientists (e.g., the 2023 visit by a NASA scientist)—presents opportunities to systematically popularize STEAM within the community. These initiatives should strategically involve not only students and teachers but also parents, ethnic communities, youth, and seniors, building a broader STEAM-supportive community in Panevėžys.

teachers may further increase in the near future. Teachers' preparedness to apply modern teaching practices is insufficient. Some teachers use methods and tools that are not aligned with the needs of today's learners, resulting in a static curriculum with limited focus on relevance, experiential learning, and STEAM principles. There is a clear need to strengthen teacher competencies in the STEAM field, with particular emphasis on digital literacy, the use of IT and ICT tools, and the integration of these technologies into the learning process.	Expanding communication about the Center's activities can reach a broader audience and increase the attractiveness of STEAM fields. Modern, audience-tailored communication channels—social media, video content, community events, and public partnerships—should be utilized. Clear, consistent, and visually engaging communication can help build a positive image of the Center and strengthen its relationships with schools, families, and the community.
--	--

Table 15. SWOT Analysis of the Panevėžys Education Center and Its Divisions.

Based on the presented SWOT analysis, it can be concluded that the Panevėžys Education Center and its divisions—the “RoboLabas” Robotics Center and the Regional STEAM Open Access Center—have clear potential to effectively contribute to the development of STEAM education in the city. Strengths such as highly qualified staff, close collaboration with educational institutions and the municipality, and a well-developed infrastructure are evident. However, internal challenges and threats, such as inconsistent understanding of STEAM among educators and limited parental engagement, restrict the Center's impact. The analysis identified key development directions: strengthening communication, expanding cross-sectoral collaboration, and continuing to create innovative activities for all community groups.

5. Program for the 2025/26 Academic Year With Innovative Solutions

Technology is evolving rapidly, and innovation has become part of everyday life, making STEM (Science, Technology, Engineering, and Mathematics) education critically important for preparing future generations. In planning activities for the 2025–2026 academic year, significant attention is dedicated to the interdisciplinarity of STEM subjects and the application of innovative solutions.

Program Goal:

To provide students not only with knowledge but also with the skills that will enable them to become active creators of change.

This program will nurture critical thinking, problem-solving abilities, and creativity. Close collaboration with business, academic, and community partners will ensure a unique learning experience enriched by real-world challenges and opportunities.

Program Objectives:

1. Expand the STEM offering and encourage youth interest in STEM fields.
2. Increase teenagers’—especially girls’—interest in STEM and motivate them to choose STEM-related studies.
3. Select and collect effective and innovative tools and activities that help engage teenagers, particularly girls, in STEM education.

The program activities are detailed by month in Table 16.

Month	Activity	Description
September	Introductory Visit to Electrical Equipment Manufacturing Company UAB “Harju Elekter”	The company specializes in electrical engineering, automation, and energy solutions, designing and producing power distribution equipment, control systems, panel boards, and innovative industrial and infrastructure solutions. Students will learn about modern manufacturing technologies and career opportunities in IT, electrical engineering, logistics, and business management.
October	Initiative “Lessons Measuring Panevėžys: Series of Challenges”	To encourage students to consider careers relevant to Panevėžys businesses, this initiative will implement non-traditional, experiential learning in city institutions and companies. Students and teachers will visit these sites and attempt to solve real challenges presented by local companies and institutions. Challenges will be “purchased” using symbolic “Panknotas” currency in auctions, and proposed solutions will be presented at a final event.

November	Educational Visit to Industrial Robotics Integration Company UAB “Profibus”	Students will visit one of the leading companies in industrial automation and robotics, learning about its operations, modern robotics solutions, and practical applications of technologies in manufacturing. They will gain insights into automated systems and the skills required for careers in robotics.
December	Christmas Engineering Workshops	Students will design technological holiday-themed objects using engineering, electronics, and design principles. Projects may include illuminated greeting cards, LED-controlled Christmas trees, moving or mechanical toys, electronic cards, or other interactive objects, integrating physics, engineering, art, and IT knowledge while developing technical, design, and creative skills.
January	Meeting with a STEAM Company Representative and Practical Workshops	Students will meet a representative from a local or national STEAM company, followed by hands-on workshops. The first part will be an introduction and discussion, while the second will involve practical, creative problem-solving activities in engineering, technology, design, or science. Students will learn about STEAM professions, their role in the job market, and develop career education competencies through authentic exposure to professional environments.
February	Experiential Activity “Challenge: LEGO Brick?”	Students in grades 7–9 will explore engineering using LEGO, learning its history and engaging in interdisciplinary practical tasks. Activities will include analyzing the physical properties of LEGO bricks in the physics and engineering lab, creating LEGO constructions with the Dobot robotic arm in the robotics and IT lab, building molecule prototypes from LEGO in the chemistry and biology lab, and programming a color recognition system for LEGO bricks using AI.
March	Competition “Challenge Accepted: Traditional Basketball vs. Robot Basketball”	Students will compete in both traditional basketball and robot basketball using “ULTIMATE 2.0” robots. This experience will require students to understand robot controls and strategize to defeat opponents, providing a new and engaging learning experience.
	Intellectual Challenge “Puzzle Night”	A community-building intellectual challenge where families, friends, and colleagues will compete to complete a randomly selected 300-piece puzzle within one hour. The fastest and most accurate team will win. Although presented as entertainment, this event will develop STEAM-relevant skills, including

		critical and strategic thinking, structured planning, and collaboration.
	“Girls in Engineering”	This event will bring together different generations—mothers, daughters, granddaughters, and grandmothers—to explore, create, and solve engineering challenges together. The interdisciplinary activities will encourage girls to engage in technical fields, discover their potential in engineering, and build positive, science- and technology-related experiences while fostering intergenerational collaboration among women.
April	National Young Engineers Championship “STEAM TEAM”	Students in grades 5–12 from across Lithuania will demonstrate their engineering skills by constructing complex Goldberg machines that perform simple tasks in the most complex way possible. The best teams from the semi-finals will compete for the championship title in the national finals.
May	World Environment Day: STEAM Company Visit and Practical-Creative Workshops	To celebrate World Environment Day, a visit from a STEAM company representative applying sustainability principles will be organized. The event will include a lecture-discussion on environmental challenges and sustainable technologies, followed by practical-creative workshops. Students will learn about sustainable development in STEAM and generate ideas to improve environmental sustainability while developing teamwork skills.
	National Creative Contest “I Can Be an Engineer!”	This contest aims to foster creativity, critical thinking, and video content creation while promoting the engineering profession and the importance of STEM. Participants will create a 3–5-minute video revealing the essence of the engineering profession: its significance, its scope, and the role of STEM in engineering.
June	Summer Camp “Science and Adventure Lab”	This week-long experiential STEAM summer camp for students in grades 1–8 will encourage curiosity, creativity, and interest in STEM fields through experiments, research, and team challenges. The program will combine theoretical and practical activities, including laboratory experiments, technical model construction, robot programming, and applying sustainability principles in engineering solutions while developing problem-solving, critical thinking, communication, and teamwork skills.

Table 16. Program Activities for the 2025–2026 Academic Year.

Evaluation:

Participant Reach and Gender Diversity:

- Total number of students participating in the program.
- Number of girls participating in the program.

Activity Relevance to the Target Group:

- Participant feedback (via surveys and verbal feedback).

Effectiveness of Collaboration:

- Number of partners involved in program implementation.
- Number of program activities led, participated in, or initiated by partners.

Program Sustainability:

- Expression of interest in participating in similar future activities during feedback collection.

6. Action Plan

Panevėžys Education Center (hereinafter – the Center) was established in 2002. It is a municipal, budget-funded non-formal adult education institution, with its primary purpose being the improvement of adult qualifications through non-formal education and providing non-formal education for children. The Center creates opportunities for lifelong learning, meeting the needs of individuals for career-oriented competencies, knowledge, and self-expression.

The Center's main areas of activity are teacher professional development, career education, and non-formal education for children and adults. Since 2019, the Center's activities have expanded:

- In 2019, the “RoboLabas” Robotics Center, a division of the Center, was established.
- In 2022, the Center was assigned to implement career education activities in general education schools.
- In 2022, the Panevėžys Regional STEAM Open Access Center, another division of the Center, was launched.

Since 2016, the Center has consistently implemented and developed STEAM education, establishing the Panevėžys Regional STEAM Open Access Center, enhancing STEM teachers' professional competencies, strengthening cooperation with businesses, and organizing STEAM-focused events for students and adults.

The Center's philosophy is:

“We create the world in which we live”

The **Center's vision** is children actively engaging in STEAM learning and other activities, parents actively participating in non-formal education for children while continuing to learn themselves, teachers consistently improving, and fostering a learning community in the city.

Strategic Goals of the Center:

1. Implement the idea of lifelong learning.
2. Expand career education activities.
3. Strengthen STEAM education.

The STEM ecosystem development strategy presented below aligns the activities of the Panevėžys Education Center and its divisions with regional, national, and international STEM strengthening guidelines while also incorporating insights from parent, student, and teacher surveys and the Center's SWOT analysis.

The strategy's objectives align with the main directions for developing the STEM system: enhancing teacher competencies, increasing student interest, improving the quality of the learning process, expanding internationalization, integrating digital resources, and strengthening infrastructure.

The strategy also emphasizes the project's strategic objectives, such as increasing teenagers' (especially girls') motivation and engagement in STEM subjects and creating a comprehensive, high-quality STEM learning environment through lessons, non-formal education, and career education. The defined objectives form a coherent strategic system aimed not only at sustainable institutional changes but also at creating long-term value by establishing a modern STEM learning environment.

Vision

An innovative and inclusive STEM ecosystem that develops future-ready competencies in the Panevėžys region.

Mission

To create opportunities for students of all ages to explore, create, and learn through STEM.

Slogan

STEM – From Curiosity to Solutions!

Goal No.	Objective No.	Title	Evaluation Criteria for Goal, Objective, and Result				Implementation Period
			Title	Measurement No.	Indicator Value		
					Result for 2027	Result for 2030	
1	Strengthen and Develop STEAM Competencies Among Panevėžys Teachers						
1	1	Develop and implement long-term STEM teacher qualification improvement programs	Number of programs prepared and implemented per year	Units	3	5	2025-2030
1	2	Promote collaboration among STEM teachers for sharing best practices	Number of networking (collaboration) events per year (camps, workshops, etc.)	Units	2	4	2025-2030
1	3	Strengthen the Panevėžys STEAM Center’s role as a regional mentor	Number of training sessions (seminars, lectures, conference presentations) conducted for	Units	5	15	2025-2030

			Panevėžys region teachers				
2	Increase Student Interest in STEAM Subjects, with a Focus on Teenagers and Girls						
2	1	Organize and implement experiential non-formal and supplementary STEM education activities for students	Number of students participating in non-formal STEM education activities at the STEAM Center per academic year (including girls)	Units	100 (30 girls)	150 (60 girls)	2025-2030
			Number of students participating in supplementary STEM education activities at the STEAM Center per academic year (including girls)	Units	400 (140 girls)	450 (200 girls)	2025-2030
2	2	Organize science popularization events and initiatives for teenagers and youth to increase interest in STEM fields	Number of science popularization events organized at the STEAM Center per year (e.g., camps, meetings with scientists, STEM professionals)	Units	4	8	2025-2030
2	3	Encourage girls' interest in STEM through targeted thematic initiatives and science popularization events	Number of events organized specifically for increasing girls' participation in STEM	Units	2	4	2025-2030
3	Create Favorable Conditions for Developing Student Talents and Future-Ready Competencies						
3	1	Promote collaboration	Number of experiential	Units	2	4	2025-2030

6	1	Ensure accessible, fast, reliable, and secure internet connection in all divisions for students and staff	Percentage of divisions with high-speed internet accessible to all	%	80	100	2025-2030
6	2	Expand the quantity of digital and physical tools for STEAM education to meet growing visitor demand	Annual percentage increase in the quantity of digital and physical tools for STEAM education compared to the previous year's baseline	%	10	15	2025-2030

Table 17. STEM Ecosystem Development Strategy.

7. A Roadmap for Building a STEM Ecosystem

To successfully implement the goals set out in the 2025–2030 STEM Ecosystem Strategy, it is essential to prepare a sustainable action plan tailored to different age groups, aligned with the institution’s infrastructure, available resources, and educational priorities. This section of the strategy outlines key areas of activity for children of different ages, specifies educational formats, and identifies external partners who can significantly contribute to achieving the strategic goals (Figure 10).

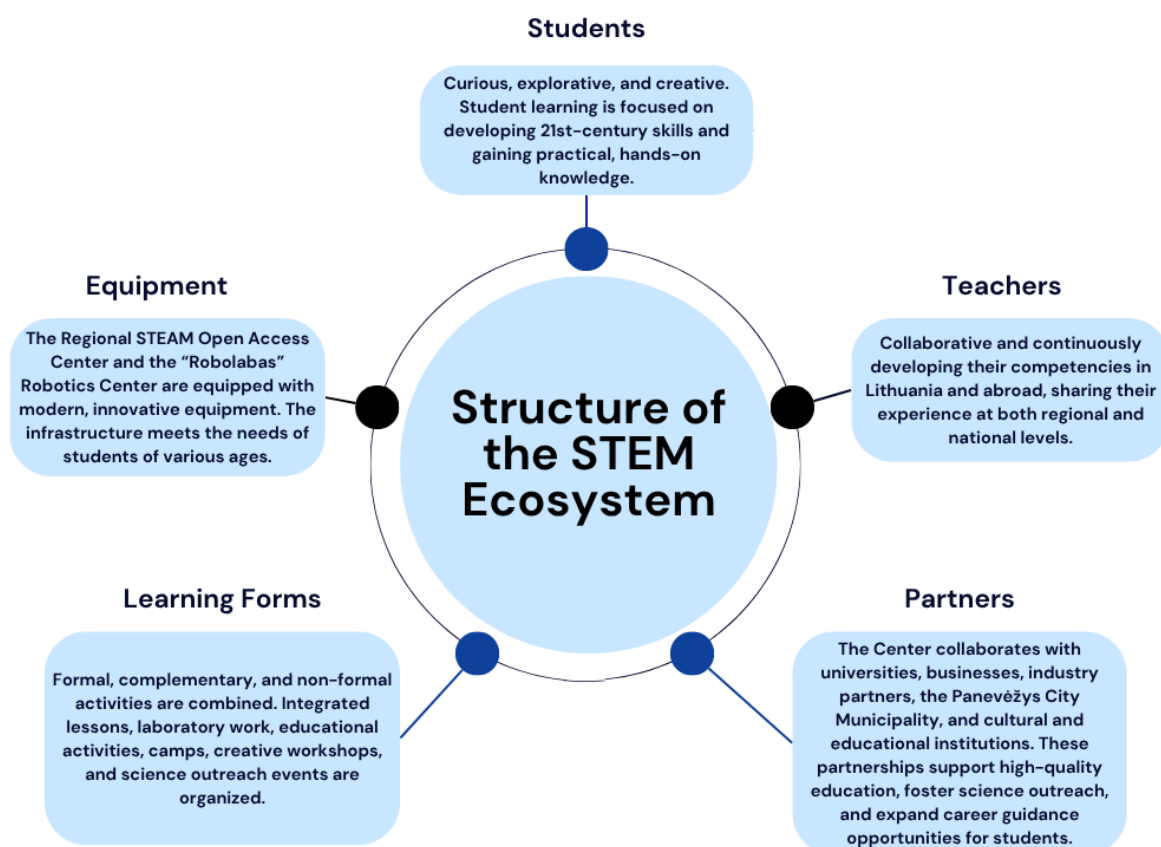


Figure 10. Structure of the STEM Ecosystem.

Age Groups:

- **Ages 5–6 (Pre-primary education):**

STEAM education at this age is based on children’s natural curiosity and exploration of their environment. Sensory tools, engineering kits (LaQ, Plus Plus), and educational construction sets (LEGO Spike Essential, LEGO WeDo 2.0, LEGO Simple Machines) are used, alongside simple scientific experiments such as mixing liquids, dissolving materials, observing natural processes, recording data, and discussing findings. Innovative educational robots (Photon, Mind Designer, mBot) are used to develop STEAM skills, while mathematical and logical games (interactive puzzles, sorting

geometric shapes by type and properties) are integrated into learning. STEAM skills are developed through creative activities and experiential learning.

- **Ages 7–9 (Grades 1–3):**

STEAM education for this age group is based on inquiry-based learning, encouraging students to ask questions and explore the world through experimentation. The learning process is problem-solving oriented, with students seeking solutions using STEAM knowledge, critical and logical thinking. Motivation is enhanced through various learning methods that address individual needs.

Educational tools include engineering kits and construction sets (LEGO Spike Prime, LEGO WeDo 2.0, LEGO Mindstorms), with programming basics taught through gamified activities and innovative robots such as Photon, Ozobot, Mind Designer, and mBot. Students learn block-based programming using Scratch. Motivation is maintained through differentiated learning formats that match students' ages, abilities, and individual needs.

- **Ages 10–12 (Grades 4–6):**

STEAM education is based on project-based learning, where students engage in long-term, interdisciplinary projects addressing real-life problems. Inquiry-based learning is crucial at this stage, involving laboratory work and experiential activities that encourage questioning, recording, analyzing results, and drawing conclusions. Motivation is strengthened through participation in non-formal activities such as camps, science challenges (competitions, hackathons), and meetings with STEM professionals and companies.

Programmable robots (Ozobot, mBot, Photon, Micro:bit microcomputers) are used. Spatial and creative thinking is encouraged with 3D design tools (Tinkercad, 3D printers), and virtual reality tools help sustain motivation. These learning formats and tools develop essential 21st-century skills and prepare students for future STEM career opportunities.

- **Ages 13–16 (Grades 7–10):**

STEAM competency development is based on advanced tools and methods that promote deep subject understanding, creativity, and readiness for future challenges. Project-based learning is applied, where students work on interdisciplinary projects addressing real-life issues over an extended period. This format allows for in-depth exploration, experimentation, and data analysis.

Critical thinking, problem-solving, and research skills are developed through inquiry-based learning. Students work individually or in groups to investigate material properties such as conductivity, density, and strength, make predictions, and analyze collected data.

The Panevėžys Education Center divisions are equipped with innovative tools and well-developed infrastructure, using resources such as Micro:bit, Arduino microcontrollers, Dobot robotic arms, microscopes, modern laboratory equipment, and virtual reality tools. Student motivation and engagement in STEAM activities are fostered through science

popularization events, meetings with professionals and companies, experiential field trips, creative workshops, competitions, and STEM challenges.

Learning Formats:

- **Formal and Complementary Formal Education:**

The Center's divisions offer formal and complementary education, helping students apply theoretical knowledge in practice. The "RoboLabas" Robotics Center provides integrated lessons for pre-primary and grades 1–8 students. The Regional STEAM Open Access Center offers complementary formal learning and laboratory activities in biology and chemistry, robotics and IT, artificial intelligence, and physics and engineering laboratories, tailored for grades 5–12.

- **Non-formal Education:**

The "Robolabas" Robotics Center offers non-formal education programs for students aged 7–19, while the Regional STEAM Open Access Center offers programs for students aged 10–19 and non-formal adult education activities. In the **2024–2025 academic year, 523 students participated in non-formal education activities** at the Center.

- **Informal Education:**

The Center's divisions organize educational field trips, science festivals, competitions, engineering challenges, and meetings with scientists and representatives from companies working in the STEM field.

Partners:

- **Business and Industry Partners:**

UAB "TPA," UAB "Harju Elekter," UAB "Voltai," UAB "Specagra," UAB "Roquette Amilina," UAB "Biznio Mašinų Kompanija," UAB "Auresa," IĮ "Anodas," UAB "Phoenix Business Services".

- **Educational Institutions:**

Kaunas University of Technology Panevėžys Faculty of Technologies and Business, Panevėžys College, Panevėžys "Minties" Gymnasium, Panevėžys Training Center.

- **Public Sector Partners:**

Panevėžys Art Gallery, Panevėžys Development Agency, Panevėžys City Municipality, Biržai District Municipality, Kupiškis District Municipality, Pasvalys District Municipality, Panevėžys District Municipality.

- **Non-governmental and Non-profit Organizations:**

Panevėžys Chamber of Commerce, Industry, and Crafts; Panevėžys Rotary Club; Lithuanian Engineering and Technology Industry Association LINPRA.