



Results of the survey of the project partners

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Introduction of the “STEM-sport clubs” theme

STEM education represent all Science, Technology, Engineering and Mathematics subjects.

Most European regions face a lack of skilled workers for the local economy. STEM education is a necessity for most skilled occupation. For that reason, enthusiasm for sciences and STEM should developed for young people starting as early as possible in childhood. Growing children should participate in continuous processes in STEM education activities to enrich STEM knowledge and competences, always appropriate to the age and the reached education level of the participants.

STEM education allow many fascinating themes, technologies and research options. The fascination for STEM themes stimulate young people to collaborate with other like-minded people in workshops and to participate in STEM competitions for young researchers, scientists, technologists or entrepreneurs.

The European project “**Clean green future through STEM-sport clubs**” co-founded by the ERASMUS+ programme of the European Union, develop such methods to develop special interests in STEM education. The project targeting in additional activities to the regular curriculum of the school systems. It also analyse the structural background and wants to establish STEM training analogous to sports training. Some partners are experienced in new educational approaches; other partners search for new ideas and want to adapt it for own education processes.

A main part of the collaboration is a survey, filled by all partner organizations. It has examines the status of STEM education from the perspective of the organizations, which are operating in a few European countries (Croatia, Czech Republic, Germany, Hungary, Italy and Norway).

This document contain a summary of the findings of the survey. Results are published on a project website and free available for any European organization that may use it to improve local STEM education with new adapted methodology.

Basics of the research

All findings are based on a multipart questionnaire answered by all collaborating European organizations. The questionnaire allow an overview of national STEM education activities of participating countries and is a base for other parts of the project.

In a first part of the survey, the partners introduced themselves and the education system of their countries and described their relationships to STEM education. Questions asked for the role of partners in STEM education and why it is important to them. In addition, the answers give an overview of the respective national school system and the importance of STEM





education. Other questions targeting on the challenges of STEM education that are known or recognizable and which derived approaches for STEM education could be expedient.

Other parts of the survey asking for financing aspects of STEM activities, available resources and the access to STEM education. Who are those who want to impart STEM education and who are their target groups?

The evaluation of all answers shows that the reasons why STEM education should be strengthened differ only slightly. The Economy's need for skilled workers poses major challenges for the education system of all involved regions. Strengthening STEM education is considered appropriate to prepare more young people for training in STEM professions. In order to strengthen STEM education, additional resources are necessary from outside of the easily comparable school systems.

Beyond the curricula, a wide variety of STEM activities is visible: Talent programs, competitions and Olympiads that create and deepen STEM interest in different ages are available. Different interest groups initiating such activities. Most programs take place independently and often compete with each other.

An overarching STEM strategy, a coordination of the different approaches and actors as well as joint measures the survey has only identified for a few countries. The partners therefore see a high potential in strengthening such structures. In addition, the local economy, which requires STEM specialists, is not sufficiently involved in strategic approaches in STEM education.





Results of the survey – Education system and STEM education

Questions of this part asked for details of the participating organizations, their motivation for project collaboration, the national education systems and existing STEM education activities.

Who are the partners and why do they participate in the STEM-sports project?

Overview of the partnership and the motivation for transnational collaboration:

The project is a collaboration of six European countries and represents seven regions that all face a lack of skilled workers especially in STEM fields. Motivation of all partners is to reduce the gap of skilled workers by using new innovative approaches and methods. All participating organizations belonging to education system of their countries. Each organization feel responsible to support the regional development of human resources in STEM fields and want to strengthen STEM education from early childhood to professional level with the methodology of STEM clubs. The partners represent a range of stakeholders in STEM education including schools as well as organizations of non-formal education and of the development of human resources.

Some partners have successfully implemented STEM clubs in the past; other organizations have started or want to start such new STEM education activities. The main goal of each partner is to raise non-formal STEM orientation and education on regional level and above.

Norway / Odda:

- **Odda vidaregåande skule**, established 1916, Hardanger / Western Norway region
- College and vocational school (five branches), 310 students, 45 staff worker (38 teacher)
- Additional adult education, courses for businesses and authorities
- Collaboration with local economy that offer apprenticeship contracts to hire skilled and well educated local staff for the future, experienced in international collaboration,
- Important role of STEM education leads to new ideas as STEMsport clubs to inspire young people in scientific, IT and technical fields

Italy / Veneto region

- **t2i**, agency for innovation belonging to regional Chambers of Commerce
- About 50 workers support companies, innovative services and technology transfer, including collaboration with schools (VET, etc.)
- Local training centres for vocational training courses / internships / study visits
- Support and development of business ideas, digital innovation hub
- Applied research, technology transfer and networking
- Lack of STEM skilled labour resources on regional level as well as digital divide in society, exclusion from digital benefits, necessity of new methodology
- Questionnaire filled by senior project manager with long-term experience in competencies development and in collaboration with the education system.







Germany / Chemnitz:

- **Solaris FZU gGmbH**, Chemnitz, founded 1992, private non-profit, non-government organization, non-formal education, social work
- Staff: about 100 workers, mostly educators and social workers
- Existing non-formal STEM education (STEM workshops), some based on voluntary work, is one of the models for STEM clubs
- STEM education from early childhood to professional training
- Questionnaire was answered by the STEM education team

Czech Republic / South Bohemia:

- **South Bohemia Company for the Development of Human Resources**
- non-profit organisation, focused on human resources development, founded 2005, related to South Bohemian Chamber of Commerce
- responsibility for development based on regional needs, professional platform
- to fulfil regional key priorities, support of early age STEM education
- Questionnaire answered by HR project manager

Czech Republic / Pardubice:

- **Upper secondary school of chemistry Pardubice**, founded 1946
- VET technical state school, about 1.000 students, education for four branches, some new for at least 10 years, experienced in international collaboration, sustainability award
- Large chemical economic sector of Pardubice region
- Focus: keeping interest of students for STEM on high level with long-term activities as known in sport clubs (long time membership / individual enthusiasm), non-traditional technical clubs / fruitful environment to raise attractiveness, prevention of dropouts as well as assistance for chemical sector
- Questionnaire filled by experienced teacher and HR manager

Croatia / Dugo Selo:

- **Dugo Selo high school**, established 2002,
- About 780 students and 79 staff (67 teachers)
- Partially vocational education in mainly technically STEM fields
- Vision of modern regional school with innovative, creative and professional approaches
- Focus on renewable energy / resources as part of STEM education
- Questionnaire filled by school headmaster assisted by STEM teachers

Hungary / Kecskemét:

- **Kecskemét Piarist School**, Founded 1714, education from age of 3 to 18 years, about 1.000 children and students; Staff: 160 including 100 teachers
- Relevant Student laboratory: <http://ovegeslabor.piarista.hu> (founded 2015), laboratory programmes for students of 11 partner schools, mostly aged 10-14
- Questionnaire answered by school headmaster who has the relevant information of all school segments / activities





Main facts of national school systems

Partners collected information about the main parts of the national school systems.

The education systems of all participating countries have more or less an equal structure. Only a few differences are visible in the details of the charts of these systems.

Education starts in early childhood with Pre-school programmes, followed by primary and secondary school. STEM education always part of the curricula. Only a few differences are visible between the countries, mainly regarding details and content of the educational programmes or regarding the structure of higher and VET education (above grade 10).

Some special STEM schools or STEM education programmes for specialised and interested learners are available in all countries.

The classification of the International Standard Classification of Education (ISCED) is standard of the description of the education system in all participating countries. The education systems include

- Pre-school education
- Primary education
- Lower and upper secondary education as well as
- various types of higher education or VET education

STEM education activities

The questions of this section targeted on **STEM activities** that take place (single or regular activities) as well as the themes, the target groups and the relation of such activities to the regular curriculum.

In all participating countries, special STEM activities take place in addition to the regular education programmes.

- Universities organise summer programmes to attract students
- Sciences Olympiads for different subjects are implemented by professional associations on local, regional and national levels
- Science labs, centres and similar places organize such additional STEM activities and professional programmes for pupils
- National talent programmes launch calls for proposals to fund the high potentials
- Some leisure time or holiday STEM programmes are available
- STEM competitions for special themes are also regularly used





A few different organizations are involved in the activities. Companies searching for workers, universities and VET schools for students. Foundations and umbrella organizations want to attract young people for themes as robotics, renewable energies or environment protection or found creative heads and high potentials of their countries. All activities mostly advertised in schools or education environment.

As a result, the answers of the questionnaire show differences in the intensity and methodology of such STEM programmes or activities and in the availability of those additional STEM activities between the participating countries. The availability depends on responsible organizations for such events as well as on a national or local funding of such approaches.

A few countries – especially Germany and Hungary – answered that specialized student labs and umbrella organizations of such labs promote special extracurricular STEM activities. For Germany, an all-day-school-program also offers new chances for additional STEM education.

Most countries described a wide range of existing extracurricular STEM activities on local, regional and national level mostly addressing competences and education of new technologies but also of other math and natural sciences. Such implemented activities belong mostly somehow to the regular curriculum of the STEM subjects. Beside this, a few activities also targeting subject-linking or regional important themes.

Target groups of the additional STEM programmes are often students in the period of professional orientation. Beside this, a few programmes also address the natural curiosity of growing younger children.

Visible weaknesses and possible adds for STEM education

Questions in this section discussed weaknesses of the STEM education and new ideas regarding content, activities, motivation, enthusiasm, target groups and education process.

Experts have identified a few weaknesses on national levels:

1. The **rapid development of new technologies** is the biggest challenge for all education systems. Most of such new technologies need special STEM competences and knowledge. At the same time, **learners** are often **not interested** in or **not motivated** for such **STEM** themes and turn to other subjects to develop special competences in extracurricular activities.
2. Beside this, experts feel a **lack of strategy** and coordination for STEM based extracurricular education on national level. Many private and governmental institutions independently try to implement project-based extracurricular STEM education. All of them send too much offers and information to schools. School management and teachers are often not able to handle information or content in proper ways and cannot offer it for the addressed target group.



For extracurricular STEM education, most promoters operate independent. In a few cases, they are competitors, trying to attract same pupils for different STEM activities. A managed process of extracurricular STEM activities and stakeholders may help to find better ways of collaboration.

3. **Distribution of extracurricular STEM education** seems not equal for all ages of learners. Activities often address primary school learners while STEM curriculum mostly starts in secondary school. For older ages, extracurricular STEM activities are on an insufficient level.

4. Experts also said that they miss a definition of the **role of local economy** and that the involvement of economy and government is on a low level. The economy invest many resources in application processes to attract and identify the needed professionals but the investment in a special necessary STEM education processes is low. Local economy may able to give additional support, raise the attractiveness of STEM education and show good examples for STEM careers.

5. Students identify STEM subjects as important disciplines. On the other hand, students find it too difficult to study STEM and feel a high level of **complexity of STEM education** as well as a low level of attractiveness. For such reasons students do not want to invest additional time for STEM themes. New developed curricula may probably more interesting for students and raise even the motivation of teachers.

6. Special **enthusiasm** for (extracurricular) STEM education and a good motivation only a few educators and teachers show. The output of the education system for STEM teachers is insufficient. New incentive approaches and motivation is necessary for STEM educators. Project partners have also identified a lack of teachers for STEM education. The salary of teachers is less attractive than in other parts of the economy. Only a few students are attracted for STEM pedagogic, young people often have the feeling that STEM education is harder than other studies. Only very few teachers trained for higher STEM education and the average age of existing teachers is high, many of them will retire soon. An increasing number of working hours for science teachers also challenging them. New investments in the education and training of STEM teachers are needed in many countries. The attractiveness of the teaching profession in the STEM area must be strengthened in most European regions.

7. Extracurricular STEM activities often only **funded by grants**. It is a challenge for schools and promoters to establish sustainable structures and results in short periods in projects and to find new funding options for long-term activities. Funding programmes may cover longer periods in future and should build one on another to cover longer periods of education.

8. It is difficult for partner organizations to provide **outward services** and to attract interested young learners from different parts of the education system.

9. Extracurricular activities for STEM education often take place as STEM project days or competitions in different STEM fields. They are mostly **single activities** taking place once a year and do not establish sustainable interests. Such STEM activities fascinate young people but they forget the experiences mostly soon. An ongoing regularly process for a longer period would create more sustainable interests. That is one of the main ideas of the STEM club methodology.





Results of the survey - Organizational issues and financial resources

Financial issues and available resources

Answers give an overview of responsible organizations for extracurricular STEM education and the available resources for STEM activities.

STEM education in the participating countries is mainly part of the regular education system and the curriculum. Subjects with different STEM content are available for all different ages of the pupils. Basic STEM education is obligatory for learners and special content is voluntary in a few cases.

Beside the regular education, a wide range of promoters and funding organizations organize extracurricular STEM education events and activities. The intensity is different in different countries/regions. The providers belonging to the public, the economy or the non-profit sector. The schools – mainly state schools – do not have extra resources for extracurricular STEM education.

Public funding programmes often targeting only on special target groups as woman, migrants or children with fewer opportunities. They are only available for a very limited period (project based). Some national talent programmes are also public financed programmes. In other countries (i.e. Germany or Hungary), municipalities also funding some STEM activities. In such cases, the funding is more part of social responsibility than of any labour market strategy.

Private funding often has an economy profit background and allow activities only for high potentials or special fields of STEM as robotics or IT. Some funds want to promote special professions as researchers or inventors and funds are often difficult to reach for any local STEM actors. Promoters would offer more regular extracurricular STEM activities as STEMsport clubs are, if necessary financial resources would be available and easier reachable.

In a few cases, parents pay an extra fee for the attendance of their children in extracurricular STEM activities. The local economy mainly do not take part in any STEM education activities (but search for skilled workers in STEM sectors).

The availability, the amount and the quality of the education of providers and of their extracurricular activities, the funding resources and the methodology of such STEM activities differ in a wide range between the participating European countries. STEM education providers mostly follow special interests. Only in a few cases, a regional or national superordinate coordination or strategy is visible.





The access to STEM education

The discussion focusses on the access of the learners to information and STEM activities, on the role of available platforms as well as on the role of the relatives and other persons.

The access of interested young people to information and STEM activities is not really structured. A general registration system or any special platform that includes local activities is available only in a few simple cases. Only a web research on specific webpages may make STEM offers visible for somebody. The provider often independently widespread information by schools, webpages, social media, friends, educators and other contacts. It sometimes ends up with a huge amount of information. Especially schools often do not have the time and the target of a detailed approach and leave information more than use or transmit it to learners in a sustainable way.

The project partners pointed out an important role of parents, relatives and educators since children tend to keep interests mostly on TV, internet and social media. Continuous cooperation and motivation for special extracurricular STEM interests and regular insights into exiting STEM aspects are necessary. The missing structure and the often non-systematic approach may end in a worse promotional impact for some activities. For all the partnership, the school system plays an important role to transmit information and generate interest of learners and to stimulate them even if activities do not take part at the school.

Most schools regularly use a few annual STEM activities as nationwide competitions for learners or science festivals. Such structures are long-term increased and individual developed. On the other hand, new ideas, activities and approaches are often left or used only slightly.

Educators of STEM education

The questions targeting on the people who work as STEM educators, their motivation, their education background and experience and on significant local STEM fields and support.

STEM educators in extracurricular STEM education are mostly not part of the regular school system and they are often NOT educated teachers. Such people are experienced in special STEM fields with a lot of practical knowledge and want to transmit their own enthusiasm and knowledge to younger people. They are able to spend only a few hours a week on education, sometimes based on voluntary work. Private interests as education of younger relatives sometimes also play a role. Such STEM educators are for example experienced engineers or scientists, some of them still retired. Traditional STEM teachers sometimes also do such extracurricular education, delighted by a group of well-motivated and interested young learners.

Such educators are proactive people, loving their job and want to share experience and knowledge with the younger generation. They share not only theoretically knowledge and work more detailed in practically environment. In general, it is hard to find, to activate and to motivate such people and to organise a good learning environment and the resources they may need for sustainable regularly STEM workshops.





Learners of STEM education

The questions targeted on the people who learn and benefit from extracurricular STEM education activities.

Learners of extracurricular STEM education, STEM clubs and STEM activities are growing children with upcoming special interests (as in sports clubs or in music school). If they once find such interest and enthusiasm, they regularly keep on such STEM theme, subject or project for a longer period of the childhood. They train their hobby as other people do and gain new theoretical, practical and social competences that they may need for future professional education. Participation in STEM activities can be also part of the individual orientation process of the participants for their professional education in future.

In the survey, partners said that it is hard to speak about country situation in general for this special question. In such cases, they discussed only the situation of their own school or school environment. In these professional schools, students take part in all regular STEM education and some of them enrol in extracurricular STEM activities as STEM clubs.

Most partners see a lack of interested students for the fields they promote and want to attract more learners for special STEM fields by offering activities as well as by establishing special STEM clubs. Another interest definitely is to prevent dropouts of STEM education by early motivation and orientation.

The learners take part in extracurricular activities mostly for their pleasure. They can test their abilities in such way and have the chance to work alone or to collaborate in teams.

Activities often do not address special target groups but male learners often form the majority. For that reason, some special programs address special target groups as female learners. Some activities also deal with learners with fewer abilities.

