

Research on STEM Education

BULGARIA



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Chapter 1: Desk research in STEM education

Over the past 20 years, there has been growing interest in science education in most European countries, as well as around the world. Such policies usually have a dual purpose: to promote science literacy among all young people (and even adults) and attract young people to science and the disciplines of technology in secondary and higher education, with the aim of encouraging them to move to science and technology professions and/or research-scientific careers. The primary reason for this was the global shortage of science graduates. At the same time, increased attention was paid to science education for girls and young people with vulnerable socio-economic backgrounds. According to the European Schoolnet (EUN), skills in science, technology, engineering and mathematics (STEM) are becoming an increasingly important part for basic literacy in today's knowledge economy. *There is a need for one million additional researchers by 2020 in order to keep the Europe growing.* Science education can no longer be viewed as only elite training for future scientists or engineers. It is clearly visible that only science-aware citizens can make informed decisions and engage in dialogue on science-driven societal issues. As stated in the recent Report of the European Commission (EC) – *Science Education for Responsible Citizenship*, knowledge of and about science are integral to preparing our population to be actively engaged and responsible citizens, creative and innovative, able to work collaboratively and fully aware of and conversant with the complex challenges facing society.

In recent years, Bulgaria has started reform of the education system and the relevant regulatory framework. The reform determines new profile of the teacher as a main participant in the educational process. National educational standards for expected results in natural sciences, technology, engineering and mathematics (STEM) emphasize the need from the development of key professional competencies. The change in knowledge, skills and the attitudes of the teachers, of their professional habits and behaviors, along with the new understanding teachers' responsibilities and encouraging students, is a huge challenge.

Bulgaria has a competitive advantage in the technology sector, combined with fast growing technology industry (especially IT, automotive, electronics and mechatronics), which requires qualified personnel. By targeting students to promising areas will support the industry and help their preservation and growth in the future will improve the professional and life prospects of young people in Bulgaria.

National best practices to encourage STEM:

1. National programme for development of school STEM environment

The National Program "Building a School STEM Environment" aims to increase students' interest and their achievements in the field of science and technology by supporting the establishment of school centers with a focus on STEM. They will provide all the necessary conditions for conducting modern and quality STEM training in school. The program will finance projects for the construction of school STEM centers in two categories: small (up to BGN 50,000) and large (up to BGN 300,000). After the first financing round, 50 schools received funding for the development and implementation of projects under the large category and 100 schools under the small category. The importance of the programme is connected with:

- Young people will acquire the necessary knowledge and skills to succeed in the professions of the future;
- Students will learn in an environment and through methods close to business and real life;
- School education will encourage learning through creativity and the creation of innovative solutions to real-world problems;
- More young people will choose to be trained and realized in professions related to science and technology;
- Young people can have a successful future and a dignified life in Bulgaria.

Each school STEM center contains a change in four elements:



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- Educational environment and technologies;
- Educational content;
- Teaching methods;
- Organisation and management of school processes

2. STEM Journal

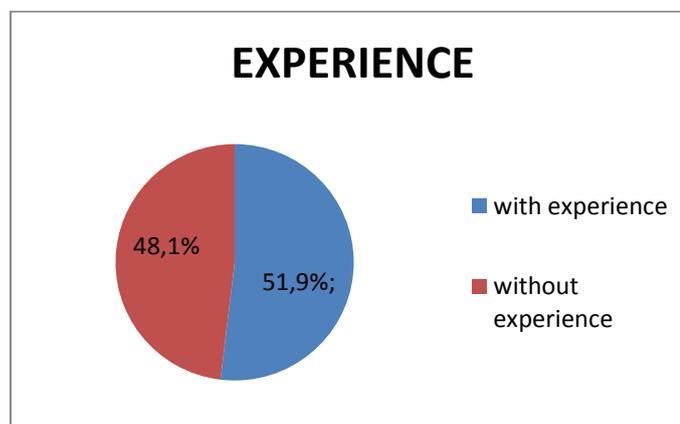
STEM in Bulgaria, Europe and the World is a specialized journal for science and education that aims to develop and support the sharing of best practices, scientific achievements and innovations in the fields of natural and engineering sciences, technology and mathematics. The journal is published by the Foundation European Institute of Technology, Education and Digitization. The journal is the first scientific periodical in the field of STEM in Bulgaria. It publishes original works related to the development of STEM, as well as related STEAM, STEMS and other interdisciplinary fields. The journal publishes results of empirical research, methodological and theoretical developments, practical studies, projects and results of scientific and educational activities carried out. The journal publishes articles in Bulgarian and English.

Chapter 2: National results from the questionnaire

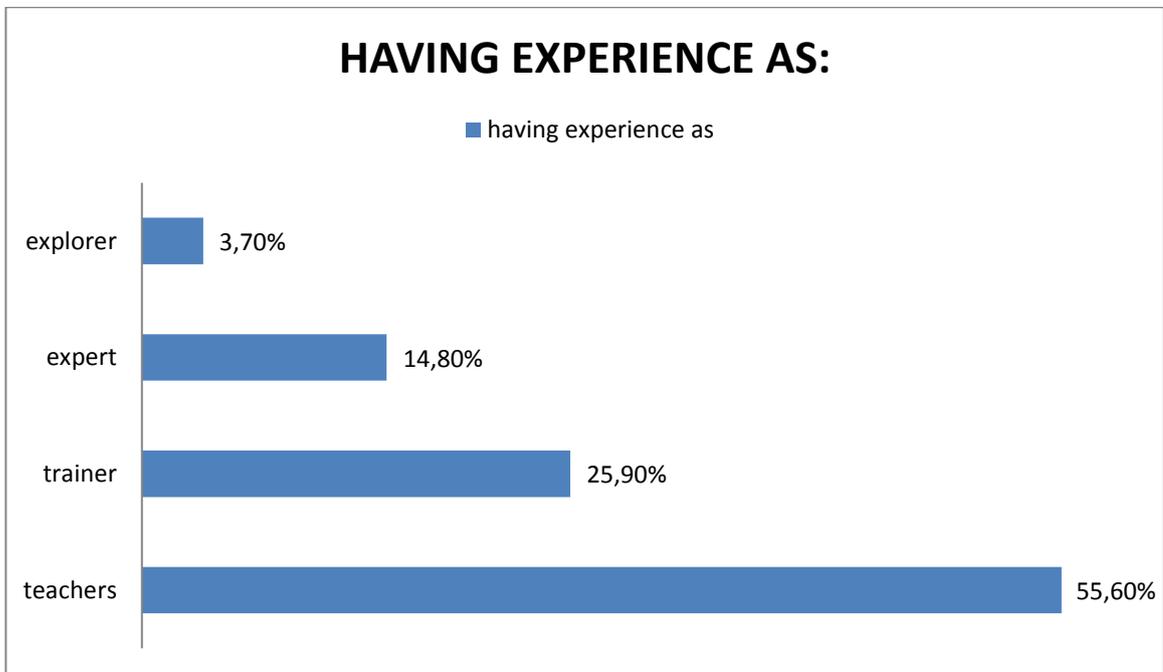
Analysis of a survey conducted on the SAPPHIRE project - Survey in STEM education

52 people took part in the survey. 100% of them give online consent, declaring that they have read all the information, that they accept voluntary participation and that they are more than 18 years old.

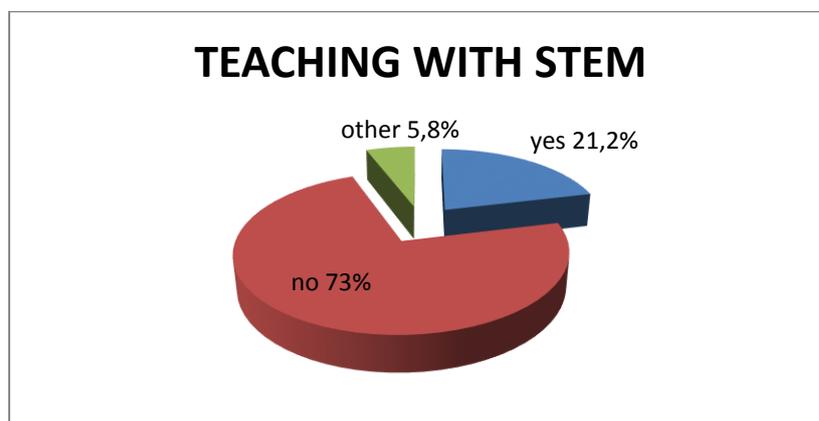
To the question “What is your experience? (STEM teacher, trainer, researcher, expert, etc.)”, the respondents answered as follows:



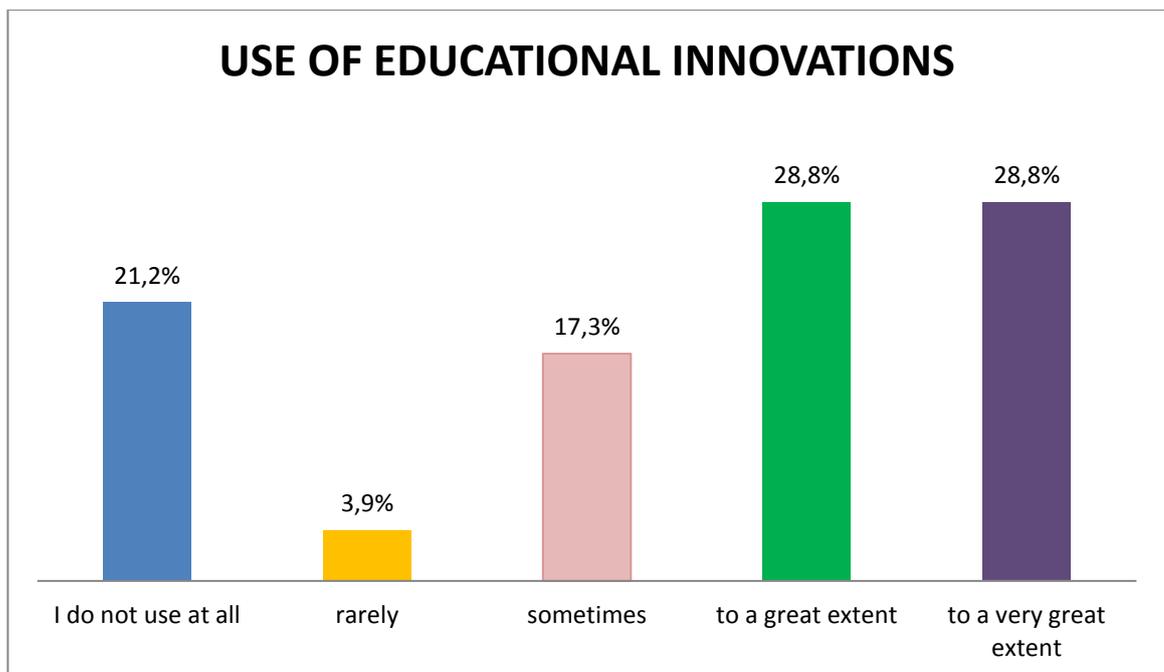
Those with experience self-identify as follows:



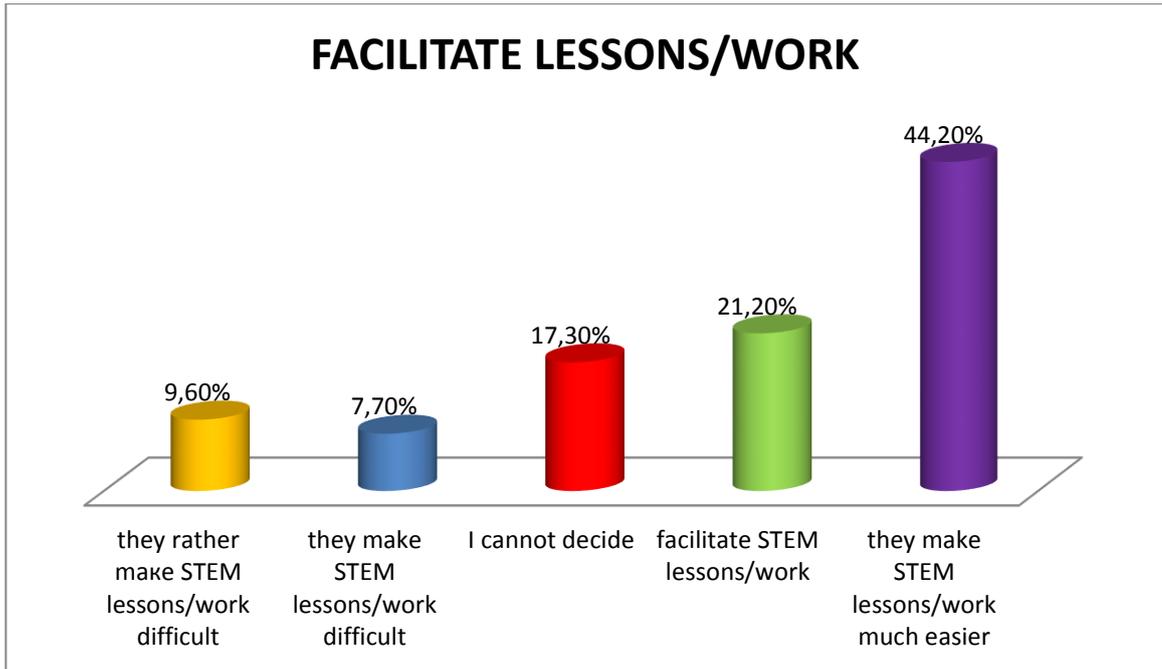
To the question "Do you currently teach in STEM classes?", the respondents indicate:



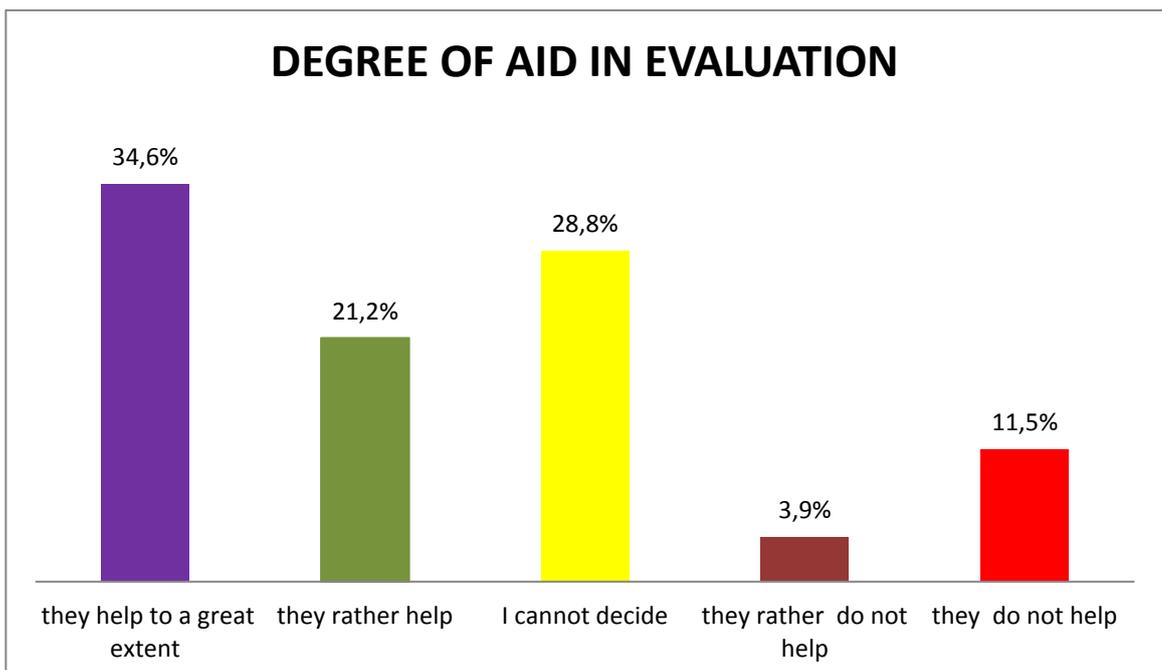
To the question "To what extent do you use educational innovations (e.g. toolkits, applications, electronic platforms, cloud technologies, new methodologies, programs, etc.) in your STEM lessons / work?"



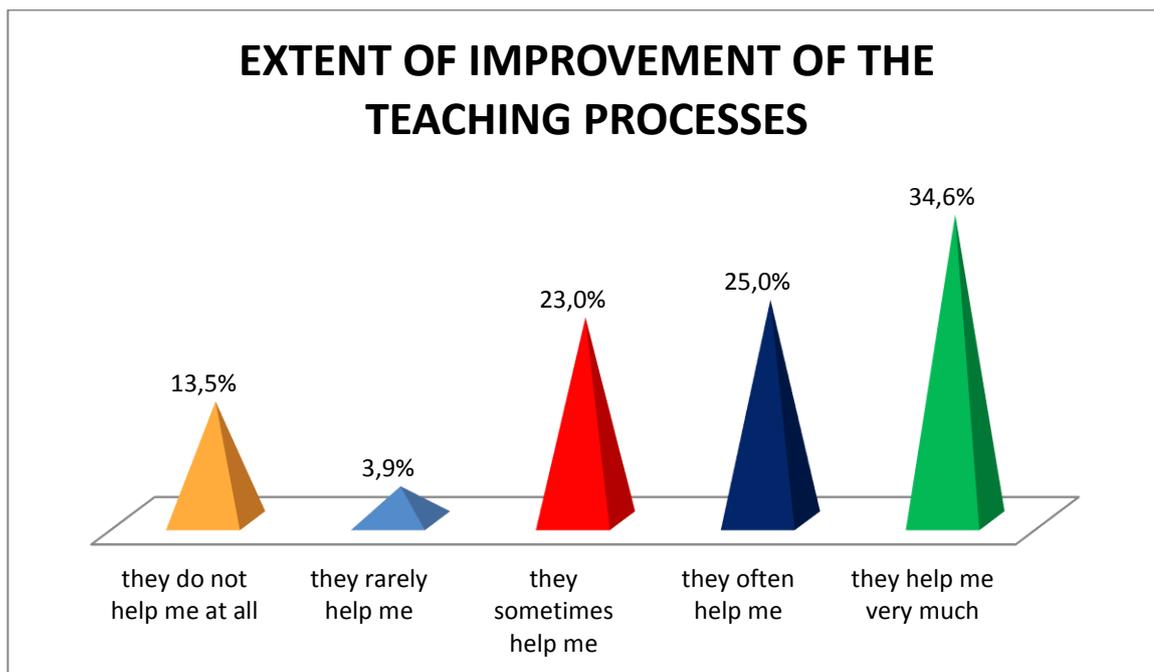
To the question "To what extent do educational innovations (e.g. toolkits, applications, electronic platforms, cloud technologies, new methodologies, programs, etc.) facilitate STEM lessons / work?", respondents indicate the following:



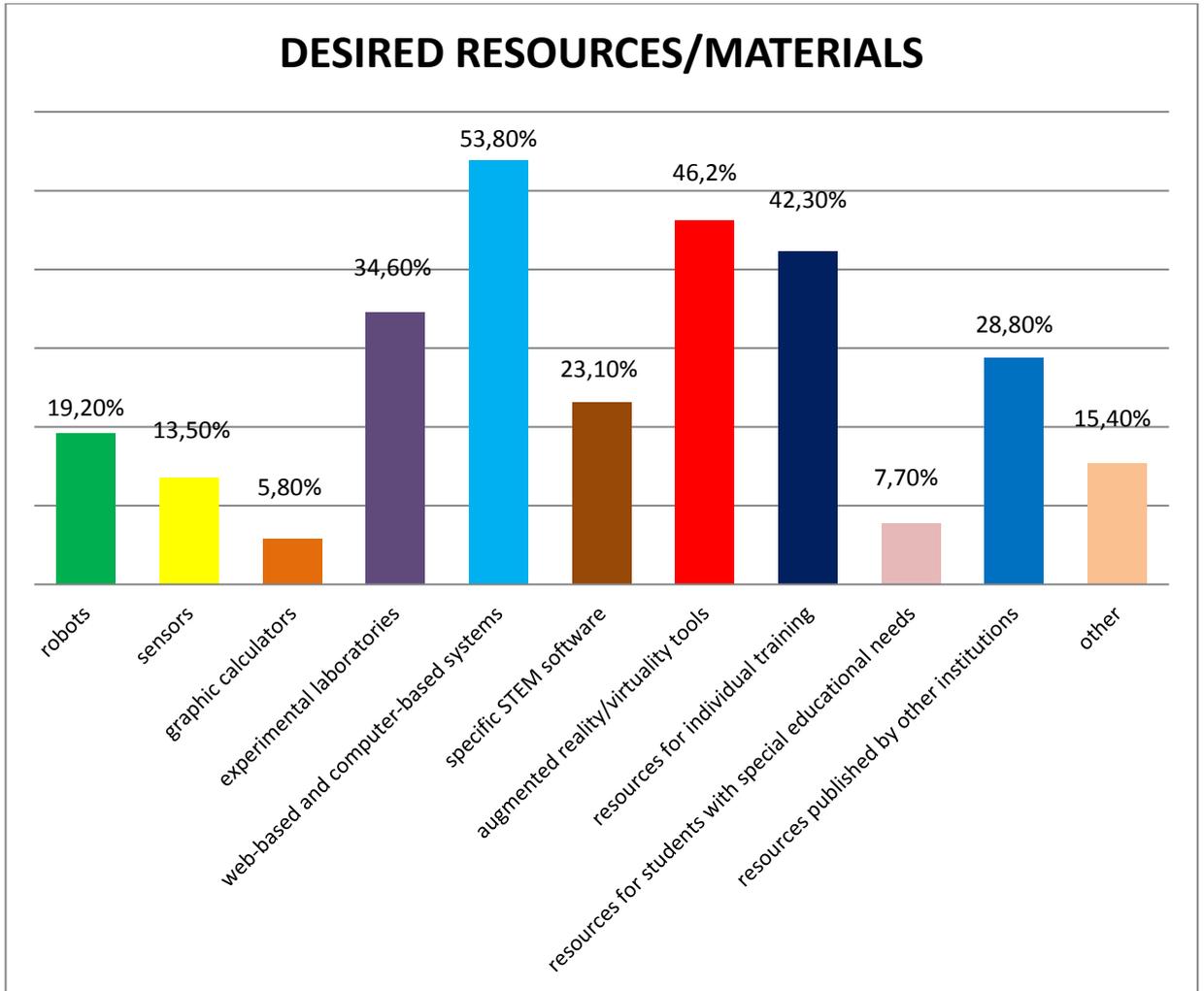
To the question "To what extent do educational innovations (e.g. toolkits, applications, electronic platforms, cloud technologies, new methodologies, programs, etc.) help you to improve testing and assessment in student learning?", the respondents stated the following:



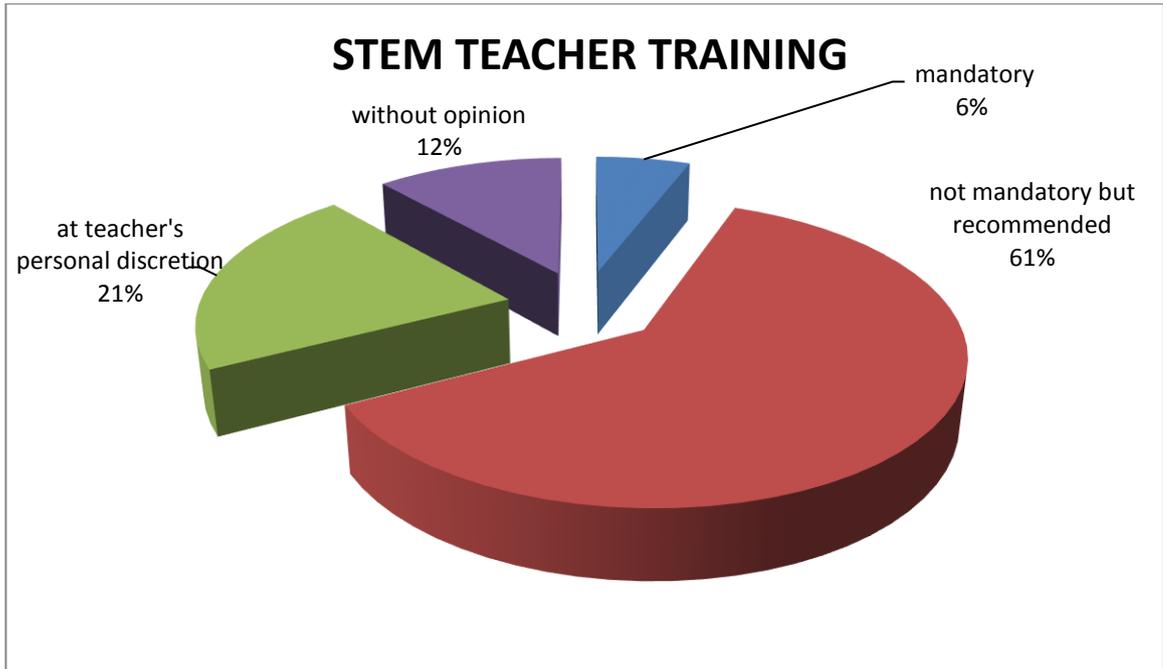
To the question "To what extent do educational innovations (e.g. toolkits, applications, electronic platforms, cloud technologies, new methodologies, programs, etc.) related to STEM help you to improve your teaching and learning processes?", the respondents answered as follows:



To the question "Which learning resources / materials would you like to use but you do not have?", the respondents indicated:



To the question "In your country / region, STEM training for teachers, for the subject you teach is:"



Teachers indicate that they need the following support in STEM lessons:

-  **facilities**
-  **technical resources**
-  **specific software**
-  **work platforms**
-  **training for working with STEM**
-  **sharing good practices and exchanging ideas**
-  **developed lessons and work materials**

Chapter 3: Conclusions

The main conclusions are related to purposeful work to create and implement comprehensive integrated solutions for a new school creative environment with a focus on science, engineering, mathematics and technology (STEM), including different elements according to the specific needs of the school and school community, incl. : reconstruction of existing spaces, technologies, new teaching methods, new or integrated learning content, new organization of the learning process. Technology centers should be established in schools, which are an integrated set of classrooms, and other learning spaces in schools, creating a culture of innovation among school communities. In addition to building a learning environment, technology, management, integrated content, qualifications and teaching methods, it must be worked towards international cooperation and exchange of good practices.

The most important issues are:

- Increasing the motivation of students to study science and mathematics;
- Creating opportunities for project-based training, integrative knowledge, training on scientific topics and changing educational paradigms;
- Increasing the engagement, skills and achievements of students (digital literacy; digital arts and creativity; skills related to the requirements of the industry; skills to solve real problems of life and business; mathematical thinking; skills to create technological solutions; work in team, critical thinking, etc.);
- Increasing the number of students interested in university specialties and jobs in the technology industries;
- Contribute to the growth of technology industries and their share of GDP;
- Promoting a positive image of science education and STEM based on facts;
- Raising the general level of public awareness about the seriousness and significance of science education and STEM;
- Improving science teaching and learning;
- Improving continuous increase in students' interest in the field of science and STEM;
- Seeking for a long-term STEM projects and programs in order to receive the proper effects;
- Developing programs for teachers as they play key roles in STEM approaches;

- Raising parents awareness about importance of science education;
- Providing high quality career advice in schools;
- Promoting STEM careers among young girls;
- Seeking better gender balance;
- Promoting public awareness among young people that better education leads to new science's discovery;
- Promoting the need at EU and national level for more frequent STEM programs evaluations;
- Promoting the need for innovative tools and effective methods of teaching science on a regular base in schools;
- Establishing strong links between the worlds of research and young members of the society (youngsters) in order to increase their ability to understand scientific messages and scientific language.

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