CODE

Developing Hard Skills in the STEM/ICT Field for Young Graduates

(Code Handbook for VET)

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INTRODUCTION

The Essence of Digital Empowerment in Vocational Education

Welcome to the "Code Handbook for Vocational Education and Training (VET)." This handbook is an integral part of the innovative "Creating Employment Opportunities with Digital Empowerment (CODE)" project, initiated under the EU Erasmus+ Programme. Our project is driven by the crucial need to bridge the gap between the evolving digital world and the current educational frameworks, especially in the STEM (Science, Technology, Engineering, and Mathematics) and ICT (Information and Communication Technology) sectors.

Objectives of the CODE Project

The primary objective of the CODE project is to equip young graduates, particularly those in vocational education, with essential hard skills in the STEM/ICT fields. In an era where digital literacy is not just an asset but a necessity, our mission is to ensure that the upcoming workforce is proficient and adaptable to the demands of the rapidly advancing technological landscape.

The Role of Educators in Shaping the Future

Recognizing the pivotal role of educators in shaping the future of our youth, we have included an exhaustive survey for ICT teachers. This survey serves as a cornerstone of our research, aiming to gather insights into the current state of STEM education, the challenges faced by educators, and the specific needs in the ICT-teaching domain.

Methodology and Importance of the Survey

Our survey methodology is meticulously designed to capture a comprehensive view of the educators' perspectives. We encourage participants to be as detailed and precise in their responses as possible. The accuracy of your answers plays a vital role in enhancing the scientific reliability of our research and in shaping the future strategies of STEM and ICT education in vocational training.

Navigating Through the Handbook

As you navigate through this handbook, you will find a blend of theoretical frameworks, practical insights, and strategic guidelines aimed at empowering educators and students alike in the realm of digital technology. The contents are structured to provide a holistic understanding of the current educational landscape, the emerging trends in digital technology, and the pathways to integrate these advancements effectively into vocational training.

Conclusion and Invitation to Participate

We invite you to embark on this transformative journey with us. Your participation, insights, and feedback are not just valuable; they are essential in shaping a future where digital empowerment is not a privilege but a fundamental right accessible to all.

Welcome to the future of vocational education and training — a future where empowerment, innovation, and digital literacy pave the way to success.

ANNEX – 1: QUESTIONNAIRE FOR TEACHERS

STEM LITERACY LEVEL DETERMINATION SURVEY OF ADULT EDUCATORS

Dear Participants,

This research is carried out in line with the project called **Creating Employment Opportunities with Digital Empowerment (CODE**) that we are conducting within the scope of the EU Erasmus+ Programme (KA220-VET – Cooperation partnerships in vocational education and training). With this survey, it is aimed to learn ICT teachers' points of view on STEM education and to analyze the needs in ITC-teaching field. It is important that you select the most suitable option for you in the questions and that you state your opinions in as much detail as possible in terms of both the scientificity and reliability of the study. Your answers will only be used for scientific purposes and no information that will reveal your identity is requested. Your participation in the survey is voluntary. It will take you about 20-25 minutes to answer the survey.

Thank you for your time and help.

CODE Project Consortium

1. SECTION: DEMOGRAPHIC INFORMATION

1. **Your age:**

☐ 30 years or younger
☐ 31-35
☐ 36-45
☐ 46-55
☐ 56 years and older

2. **Your Gender:**

☐ Female
☐ Male
☐ Don't want to mention

3. **Field/course you are teaching:** [........]

4. **How many years have you been teaching courses at any institution, including this academic year?**

☐ Less than 1 year

☐ 1-3 years

☐ 4-10 years

☐ 11-20 years

☐ 21-30 years

☐ 31-40 years

☐ More than 40 years

2. SECTION: STEM LITERACY LEVEL

5. **To what extent do you use the following aspects of information and communication technologies while teaching?**

	All the time	**Often**	**Rarely**	**Once**	**Never**
I present and explain scientific information to the whole class.					
Students work on their own at their own pace					
Students work on exercises or assignments individually at the same time					
I demonstrate scientific knowledge to the whole class.					
Students conduct experiments					
Students discuss lesson topics with other students and the teacher					

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Students can make decisions on their own about how to learn a course topic					
Students carry out scientific review and research activities on their own					
Students work to learn course topics in groups with clearly defined tasks					
Students collaborate collaboratively to study course topics and work together to find solutions to the questions they ask					
Students think about and evaluate the level at which they have learned the course topics					
I support and explain to each student in their learning process					
I use different types of (visual, audio, written) course teaching materials in my classes					
When explaining scientific concepts, I also use the information about that concept in other course subjects.					
I invite other STEM course teachers to work together in a coordinated manner in teaching students some common course topics.					
I organize trips/visits to museums/companies for students to learn scientific					

concepts in their real environment					
Students participate in the examination and assessment processes					
I give feedback to my students as they do their learning activities					
Students participate in activities to evaluate their own course work and the work of their friends					
Students make presentations about lesson activities to the whole class					
I also incorporate Art activities into STEM education processes to increase students' interest.					

6. What learning resources or materials do you use during the training?

	All the time	**Often**	**Rarely**	**Once**	**Never**
Written and printed materials					
Audio/video materials					
Presentations (MS Power Point, Libre Office Impress, Sway...)					
Robots					
Sensors, electronic data collectors and loggers					
Calculators					
Scientific function calculator that draws G rafik					

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Experimental or research laboratory activities					
Web-based or computer-based simulations					
Software specific to STEM education (eg. Geogebra, Function Plotter...)					
Datasets / Spreadsheet software (MS Excel, Libre Office Calc,...)					
Word processors (eg. MS Word, LibreOffice Write, OneNote, Notepad...)					
Online collaboration and collaboration tools/software (Padlet, Mentimeter, Tricider, Kahoot...)					
Course materials published by private companies operating in STEM professions					
Course materials for students with special educational needs					
Course materials designed for individualized learning					

7. **What teaching resources/materials do you want to use in your teaching processes but do not have at your disposal?**

	I Never Use	**Maybe I'll Use It**	**I need**	**Ineed it with** inspiration	**There is this resource available**
Robots					
Sensors, electronic data collectors and loggers					

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Calculators					
Calculator with scientific function that draws graphs					
Test laboratory materials/materials					
Web-based or computer-based simulations					
Software specific to STEM education (eg. Geogebra, Function Plotter, Remote Labs...)					
Augmented reality/Virtual reality tools (e.g. Virtual Labs)					
Individualized learning materials					
Materials for students with special educational needs					
Materials from private industrial companies operating in STEM fields					

8. In which of the following activities do you expect more support from private industrial companies operating in STEM professional fields or from organizations working on this subject, from projects to schools?

	I never want to	**I rarely want**	**I have no idea**	**I'd Like A Little**	**I Want It So Much**
Facilitating visits of students and teachers to industry companies					
Presentation of STEM professions specialists to students in schools (at work or online, via webinars)					

Provision of educational internship opportunities for teachers					
Provision of educational internship opportunities for students					
Provision of teaching materials to schools					
Allowing students and teachers access to equipment and equipment					
Providing professional development training to teachers					
Financial support					

9. Is your STEM course teaching affected by the following?

	Not affected at all	**Very little affected**	**I'm undecid ed**	**Slightly affected**	**Very Impresse d**
Insufficient number of computers					
insufficient number of computers connected to the Internet					
Insufficient Internet bandwidth or speed					
Insufficient number of interactive lesson tools (such as smart boards)					
Insufficient number of portable computers (laptops/notebooks)					
School computers that are out of date and/or need to be repaired					
Inadequate training of teachers					

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Insufficient technical support for teachers					
Insufficient pedagogical support for teachers					
Lack of course content in the mother tongue					
Lack of pedagogical education model that is interesting to students in STEM education processes					
Failure to make time arrangements at school (fixed course durations that cannot be changed, etc.)					
Lack of adequate space arrangement in the school (insufficient class sizes and furniture, etc.)					
Pressure on students to prepare for exams and tests					
Lack of interest from teachers					
Lack of curricula or interdisciplinary support from colleagues at school					
There is no definite benefit or no benefit from the use of information and communication technologies in STEM education					
The use of information and communication technologies in education and learning is not a goal of our school					
Restrictions of the school administration in accessing					

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the content/material required in the teaching processes					
Limited budget for access to content/material required in teaching processes					

10. Do you use computers/tablets/smartphones and the Internet to increase your knowledge of the subjects you teach or for your personal or professional development in any course (which may or may not be related to the course area you are teaching)?

	I don't use it at all	**I rarely use it**	**I'm undecided**	**I use** it a bit	**I use it all the time**
To actively search for information and update topics you have already learned (educational materials, news, etc.)					
To attend professional development courses					
To join online communities (mailing lists, Twitter, Facebook, blogs...) over the Internet					
Materials for personal use (eg. Calendar, personal website, personal blog) or new materials for my lessons (eg. To create my own digital course materials for students)					

11. To what extent do you receive support from the following groups to improve your STEM teaching?

	I don't get any support	**I mostly get technical support**	**I mostly receive pedagogical (teaching method) support**	**I receive both technical and pedagogical support**	**I'm undecided**

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Other teachers teaching the same course as me					
Other teachers teaching another STEM course					
Other teachers teaching courses other than STEM courses					
School information and communication technology (ICT) or technology coordinator					
Non-school STEM field experts					
An online helpdesk, community, or website related to teaching processes					
Teachers or staff of other schools					

12. How do you usually become aware of the teaching materials you use during training? (You can select more than one option).

- ☐ It is shared by the educational institutions or authorities of my country
- ☐ Shared by the network of my colleagues
- ☐ I search for resources/materials by myself from educational material pools (eg. Scientix)
- ☐ I search the internet myself for relevant teaching resources/materials
- ☐ I subscribe to the social sharing and information channels (social media, newsletters...) of national and international STEM education projects carried out with public funding resources.
- ☐ I search the internet myself for relevant teaching resources/materials
- ☐ I subscribe to social sharing or information channels (social media, newsletters...) of private companies that publish STEM education material
- ☐ Other (................)

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13. Do your colleagues and headmaster at your school share with you a positive vision of innovative STEM teaching?

- ☐ Yes
- ☐ No

14. Is it mandatory in your country to study STEM teachers for teachers in your field of study?

- ☐ Imperative
- ☐ Not mandatory, recommended
- ☐ Depends on our own preference

15. Do you think that innovative STEM education methods (the use of information and communication technologies and innovative pedagogical approaches) have a positive impact on:

	No effect at all	**Has a Little Effect**	**It has a lot of impact**	**No idea**
Students focus more on learning				
Students put more effort into learning				
Students feel more independent in their learning processes (they can repeat exercises if necessary, research topics that interest them in more detail, etc.).				
Easier for students to understand what they are learning				
Students remember what they've learned more easily				
Development of students' critical thinking abilities				
Students are more interested in STEM professions				
Information and communication technologies facilitate cooperation and cooperation among students				

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Information and communication technologies improve the classroom learning environment (for example, students are more engaged)				

16. To what extent do you agree with the following statements about the use of information and communication technology tools in STEM education in school?

	I strongly disagree	**I'm not getting hooked**	**I'm undecided**	**Agree**	**I Strongly Agree**
Information and Communication Technologies should be used for students to practice *and practice*.					
Information and Communication Technologies should *also* be used for students to *obtain information about the course content*.					
Information and Communication Technologies should be used for students to*work in cooperation with their* colleagues.					
Information and Communication Technologies should be used for students *to learn independently*.					
The use of information and communication technologies in teaching and learning processes has positive effects on students in the following subjects.					

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The use of information and communication technologies in teaching and learning processes has positive effects on increasing *motivation and desire to learn on* students.					
The use of information and communication technologies in teaching and learning processes has positive effects *on the increase of success in* students.					
The use of information and communication technologies in teaching and learning processes has positive effects on *the development of higher-order thinking skills (deeper/deeper understanding) on* students.					
The use of information and communication technologies in teaching and learning processes is the *development of learning skills (learning to learn, social skills, etc.) that can be used in all areas on students (transversal) has* positive effects on it.					
The use of information and communication technologies in teaching and learning processes is necessary *to prepare students for current life and work/working life*.					
The use of information and communication technologies in teaching and learning processes is essential *for the development of students' 21st century skills*.					

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ANNEX – 2: QUESTIONNAIRE FOR COMPANIES

SURVEY ON THE LEVEL OF AUTOMATION IN MANUFACTURE/SERVICE SECTOR AND EDUCATIONAL NEED FOR STEM/ICT QUESTIONNAIRE

1: Totally dissatisfied 2:dissatisfied 3:moderate 4:satisfied 5:totally satisfied

Statement	1	2	3	4	5
LEVEL OF AUTOMATION RATE THE LEVEL IN YOUR DOMAIN OF PRACTICE:					
where you consider alternatives, make and implement decision					
Where computer offers you a set of alternatives which you may ignore in making decision					
Where computer offers a restricted set of alternatives, and you decide which one to implement					
Where computer offers a restricted set of alternatives and suggests one, but you still make and implement final decision					
Where computer offers a restricted set of alternatives and suggests one, which it will implement if you approve					
Where computer makes decision but gives you option to veto prior to implementation.					
Where computer makes and implements decision, but must inform you after the fact.					
Where computer makes and implements decision, and informs you only if asked to.					
Where computer makes and implements all the procedural control of all traffic. Unaided decision-making; Voice communication.					
RATE THE BRANCHES IN MANUFACTURING THAT ARE AFFECTED:					
Computer-aided process planning.					

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Computer-supported design and manufacturing.					
Computer numerical control machine tools.					
Computerized production and scheduling control.					
Automatic storage and retrieval systems.					
Flexible machine systems.					
Automated material handling systems, e.g. robots.					
RATE THE NEED OF AUTOMATION AND TOOLS:					
Regarding your self empowerment in workplace					
Regarding your social and transversal skills					
LEVEL OF IDENTIFICATION ON AUTOMATION TRENDS IN MANUFACTURE AND SERVICE SECTOR:					
Fixed automation (completes a set of tasks repeatedly)					
Programmable automation (commands given by computer program)					
Flexible automation (both human intervention and computer code)					
Integrated automation (totally automated)					

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ANNEX – 3: GOOD PRACTICES TEMPLATE

[Title] [What is the name that best describes the good practice?]	
[Date] [When (month and year) was the good practicedocumented published?]	***[Authors]*** *[Who wrote the good practice document?]*
Element	**Guiding questions**
Type of document (optional)	*To include in the subtitle, for example.* *Specify if the document is a good practice fact sheet, an information sheet, anexperience sheet, a case study, a manual or guidelines?*
Publisher (optional)	*Is the good practice published by FAO or together with partners, in which caseplease specify the names of the partner organizations.*
Target audience	*To whom is this document addressed?*
Objective	*What is the aim/objective of this document?*
Location /geographical coverage	*What is the geographical range where the good practice has been used? Please specify, when possible, the country, region, province, district, town and village. If possible, add a map to show where the practice was implemented.*
Introduction	*What is the context (initial situation) and challenge being addressed? Providea short description of the good practice being addressed and specify theperiod during which the practice has been carried out (timeframe)?* *Explain how gender was taken into account in both the challenge being addressed and the good practice itself.*
Stakeholders andPartners	*Who are the beneficiaries or the target group of the good practice? Who are the users of the good practice? Who are the institutions, partners, implementing agencies, and donors involved in the good practice, and what is the nature of their involvement?*
Validation*	*Confirmation by the beneficiaries that the practice addresses the needs properly. Has the good practice been validated with the stakeholders/final users? Provide a brief description of the good practice validation process.*

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Impact	*What has been the impact (positive or negative) of this good practice on the beneficiaries' - both men and women - livelihoods? Please explain how the impact may differ between men and women. Have these beneficiaries' livelihoods been environmentally, financially, and/or economically improved (and if applicable, become more resilient), and if yes how?*
Innovation	*In what way has the good practice contributed to an innovation in the livelihoods of the target group?*
Lessons learned	*What are the key messages and lessons learned to take away from the goodpractice experience?*
Sustainability	*What are the elements that need to be put into place for the good practice to be institutionally, socially, economically and environmentally sustainable?*
Replicability and/orup-scaling	*What are the possibilities of extending the good practice more widely?*
Contact details	*What is the address of the people or the project to contact if you want moreinformation on the good practice?*
URL of the practice*	*Where can one find the good practice on the Internet?*
Related Web site(s)*	*What are the Web sites of the projects under which the good practice wasidentified and reproduced?*
Related resources thathave been developed*	*What training manuals, guidelines, technical fact sheets, posters, pictures, video and audio documents, and/or Web sites have been created and developed as a result of identifying the good practice?*
**Optional*	

CHECKLISTOFMETADATA

Metadata is commonly defined as data about data. Broadly, this means information about a document and its content. Metadata makes it easier to archive and retrieve the document. This is useful if the good practice is part of a database or is published on a Web site.

Most of the metadata needed is already included in the Good Practices Template (Title, Date, Authors, Type of document, Publisher, Target Audience, Objective, Location / Geographical coverage, Contact details, URL of the practice, Related Web site(s), Related resources that have beendeveloped.) The following elements are metadata that are also useful to include:

Element	Guiding questions
Title	What is the name that best describes the good practice?
Publication date	When (month and year) was the good practice documented/published?
Author(s)	Who wrote the good practice document?
Summary	What is the context (initial situation) and challenge being addressed? Please provide a short description of the good practice being addressed and specify the period during which the practice has been carried out? Explain how gender was taken into account in both the challenge being addressed and the good practice itself.
Keywords	What are a few keywords and/or tags that best describe the key issues being addressed and processes being applied by the good practice? (For example, AGROVOC subjects like good practices, resilience to shocks, and gender).
Language(s)	In which language(s) is the good practice document available?
Format (optional)	Is the document in a PDF, Word, PPT, jpg, html or some other format? Knowing the format can be used to determine the software, hardware or other equipment needed to in order to access the document.
Resource size (optional)	How many pages long is the document? If it is available as a file, how large is it? If it is a video or an audio file, how long does it last, and again how large is the file?

TÜRKİYE

STEM LITERACY LEVEL DETERMINATION SURVEY REPORT

1 INTRODUCTION

This research is carried out within the scope of the EU Erasmus+ CODE Project. The aim of the study is to determine the STEM literacy levels of teachers. The descriptive method was used as the research method. Questionnaire was used as data collection technique.

2 DEMOGRAPHIC INFORMATION

100% of the participants are from Turkey. When the age conditions are examined, it is understood that the majority of the participants (51.3%) are between the ages of 36-45. This rate is 38.5% for participants aged 46-55, 7.7% for participants aged 31-35, and 2.5% for participants aged 56 and over.

According to gender, it is seen that the majority of the participants (74.4%) are men. This rate is followed by female participants with 23.1% and participants who do not want to specify their gender with 2.5%.

Majority of the participants are information technology teachers. In addition, teachers from branches such as machinery, machine design, machine technology, and motor vehicles also participated in the research.

When the participants are asked how many years they have taught in any institution, including this academic year, it is understood that the majority of them (46.2%) have 11-20 years of experience. 38.5% of population also said they have been working for 21-30 years.

3 STEM LITERACY

The participants were asked to what extent they use the following aspects of information and communication technologies while giving training. Accordingly, the majority of the participants (87.8%) said I use different types of (visual, auditory, written) course teaching materials in my lessons. As it can be seen in Figure 1, the rate of participants who said I give feedback to my students while they are doing learning activities is 78%. The least used information and communication technologies aspects by the participants were to organize trips/visits to museums/companies for students to learn scientific concepts in their real environments (14.6%).

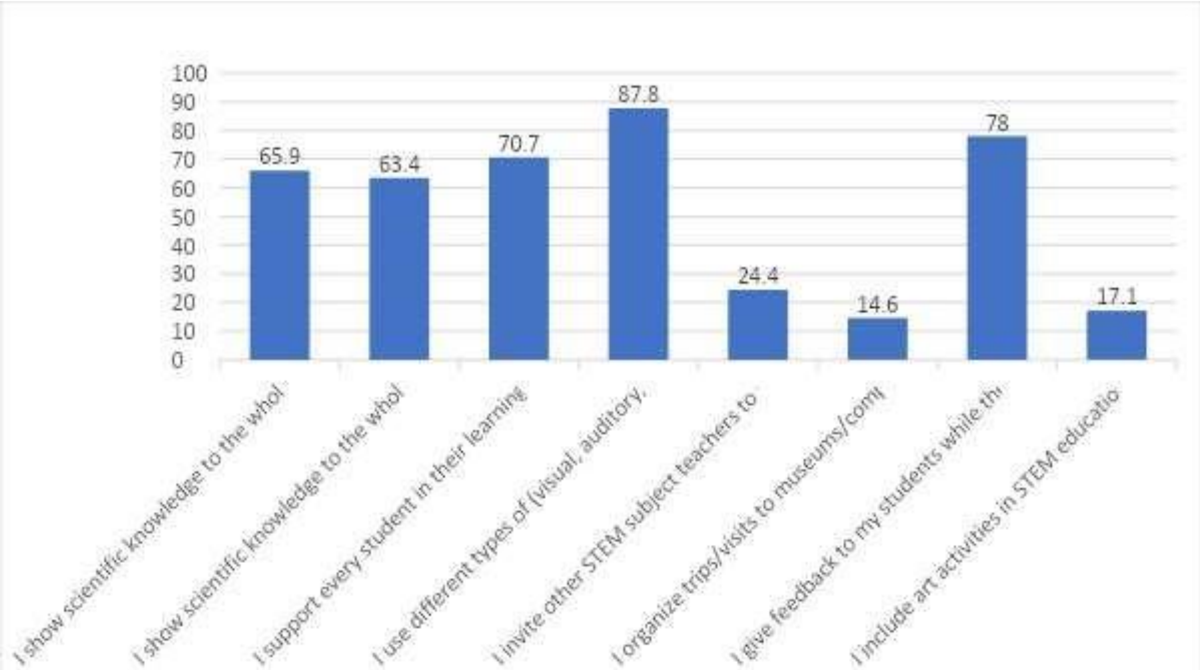

Figure 1. Frequency of ICT use

It was instructed to the participants to think about your lessons and mark the options that your students do regularly, not just once. Figure 2 demonstrate that the most popular activity of students is that they participate in the examination and evaluation processes (65,9%). It is followed by 51,2% of that students work individually on exercises or assignments at the same time.

It is understood that the least preferred activity by the students is conducting scientific investigation and research activities on their own with 14.6%. Other activities are implemented by students at an average level.

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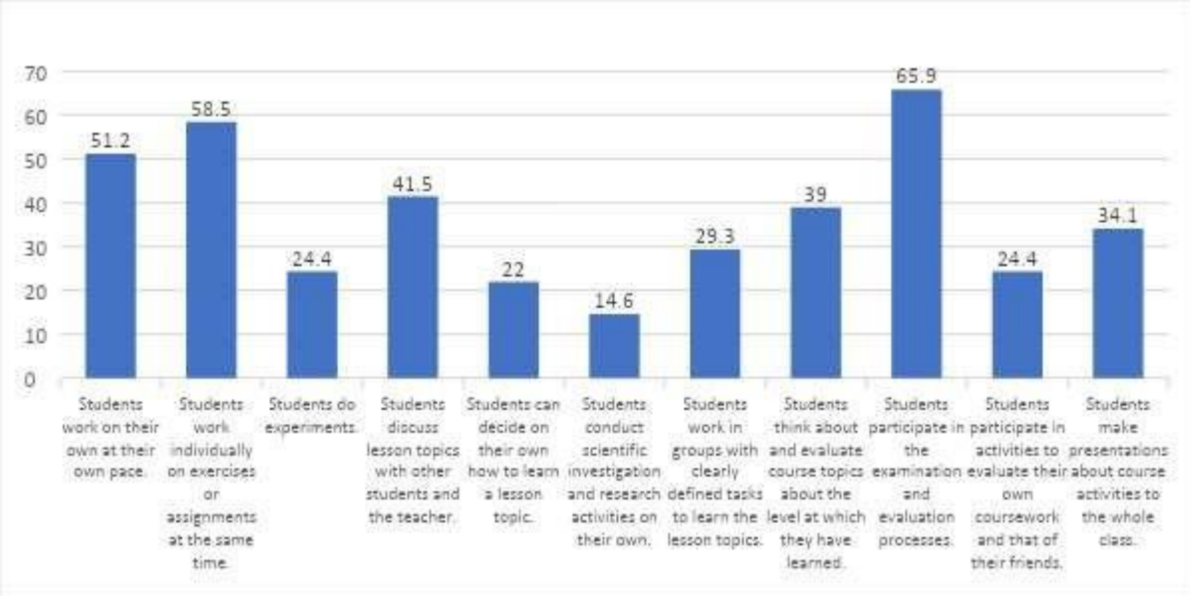

Figure 2. Activities that students do regularly

Participants were asked which learning resources and materials do you use during the training. The most used learning resources by teachers were written and printed materials (95.1%) and audio/video materials (90.2%). 78% of the participants stated that they benefited from presentations (MS Power Point, Libre Office Impress, Sway, etc.) (Figure 3).

On the other hand, the least preferred learning resources by the participants are scientific function calculator that draws graphs (9.8%), STEM education specific software (Geogebra, Function Plotter etc.) (9.8%) and for students with special education needs. course materials (9.8%).

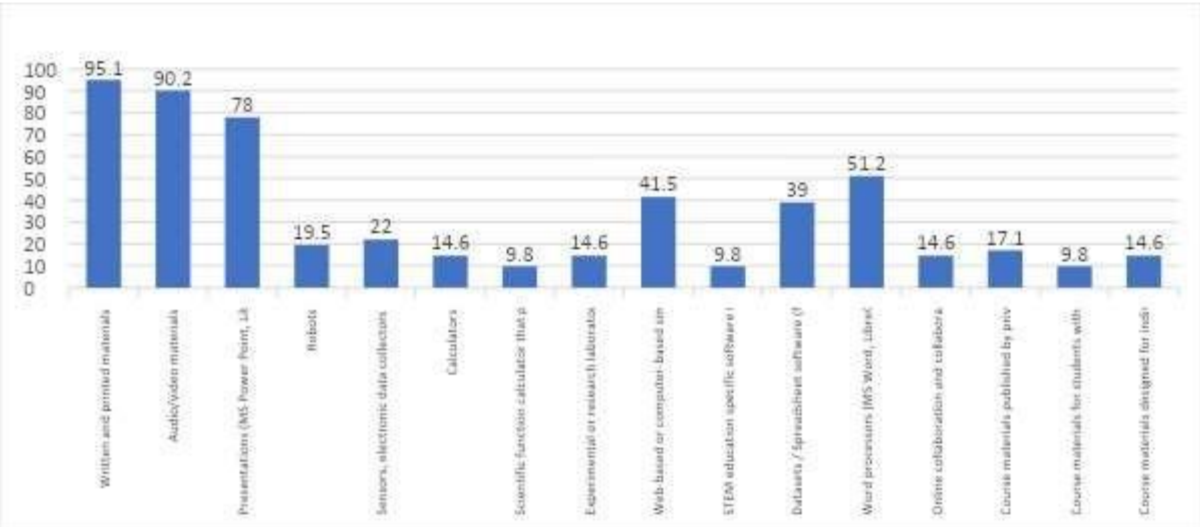

Figure 3. Learning resources and materials

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The participants were asked which teaching resources/materials there are that you want to use in your teaching processes but cannot access (Figure 4). Augmented reality/Virtual reality tools (Virtual Laboratories etc.) were the learning material most wanted to be used by teachers (53.7%).

This is followed by robots with 46.3%, laboratory materials with 43.9%, sensors, electronic data collectors and recorders with 36.6%, and individualized learning materials with 36.6%.

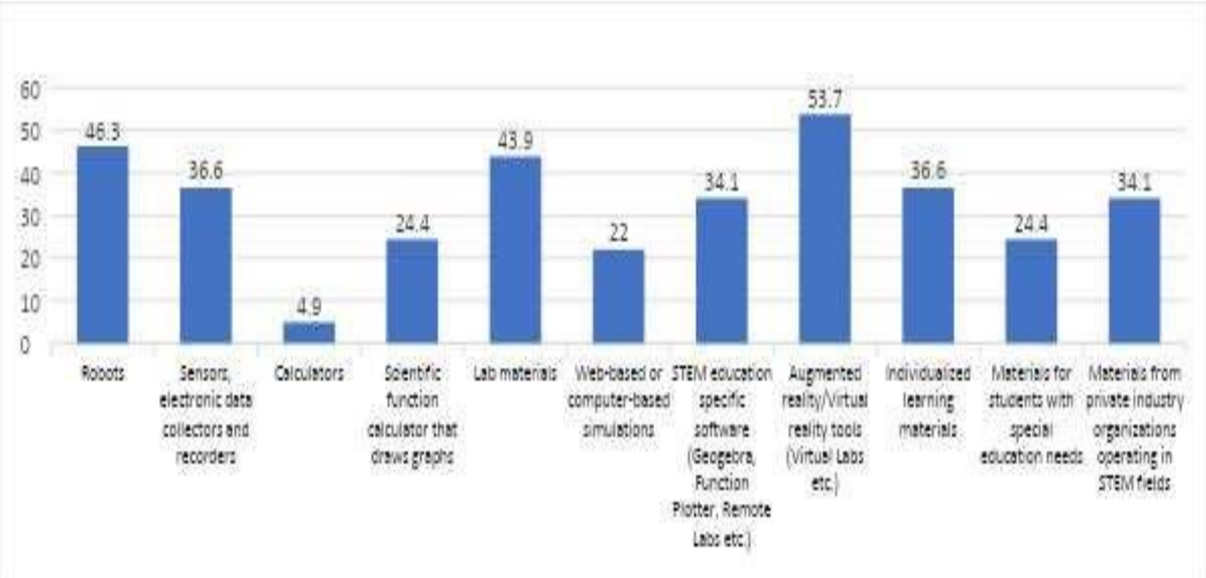

Figure 4. Teaching resources/materials participants want to use

Participants were asked in which of the following activities you would expect more support, from private industrial companies operating in STEM professional fields or from organizations and projects working in this field to schools. When Table 5 is examined, it is possible to state that the participants expect support in many areas.

The areas where the most prominent support is expected are facilitating the visits of students and teachers to industrial companies (70.7%), providing teaching materials to schools (68.3%) and providing professional development training to teachers (68.3%).

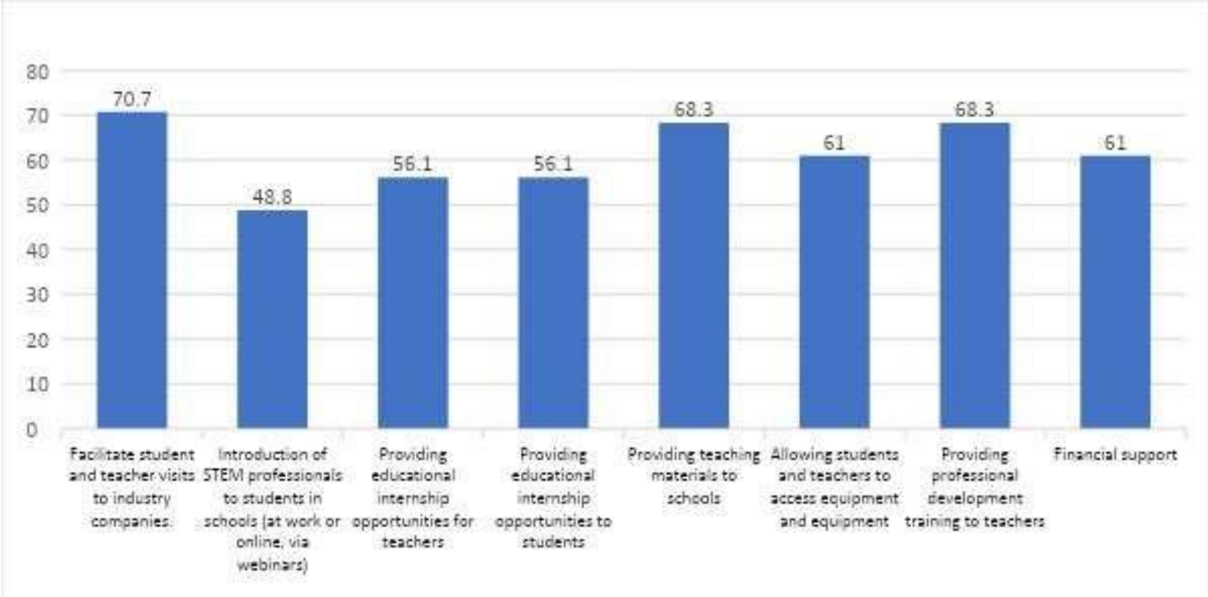

Figure 5. Areas expected for support

Respondents were asked if their STEM course teaching to students is affected by the following (Figure 6).

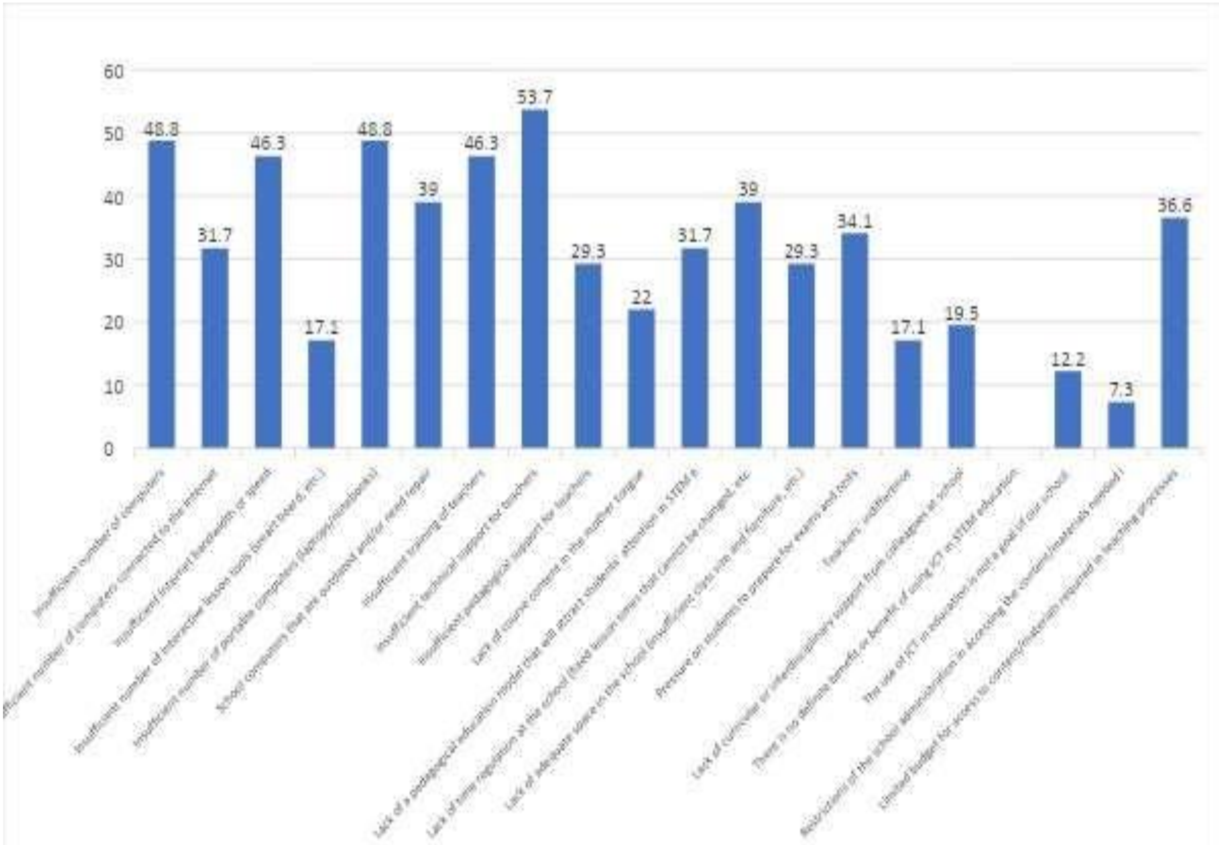

Figure 6. Impacts to STEM classes

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When Table 6 is examined, it is seen that the participants stated that the inadequate technical support for teachers (53.7%) affected their STEM course teaching the most. It is also worth emphasizing that none of the users (0%) chose the option “There is no definite benefit to using ICT in STEM education”.

Participants were asked whether they use computers/tablets/smartphones and the internet to increase your knowledge of the subjects you teach in a course or for your personal and professional development (Figure 7). The vast majority of the participants (82.9%) stated that they use computers/tablets/smartphones and the internet in their classes to actively seek information and update the topics they have learned (educational materials, news, etc.). 78% of teachers to attend professional development courses, 53.7% of them to join online communities (mailing lists, Twitter, Facebook, blogs, etc.) over the internet and 51.2% of them to create materials for personal use. uses computer/tablet/smartphone and internet in lessons.

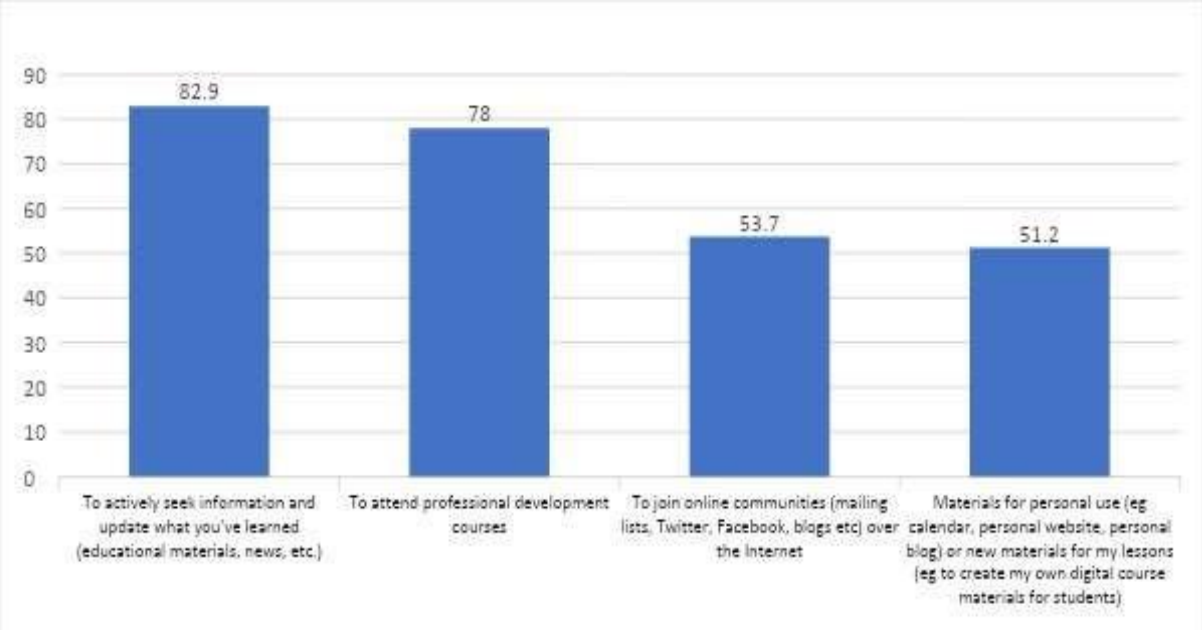

Figure 7. The use of computers/tablets/smartphones and the internet

Respondents were asked to what extent they received support from the following groups to improve your STEM teaching (Figure 8). Participants stated that they mostly benefited from other teachers who teach the same course as them to improve themselves in STEM teaching (53.7%). Getting help with teaching processes from an online help desk, community or website follows this at 31.7%. The least supported areas were School ICT or technology coordinator with 17.1% and out-of-school STEM field experts with 22%.

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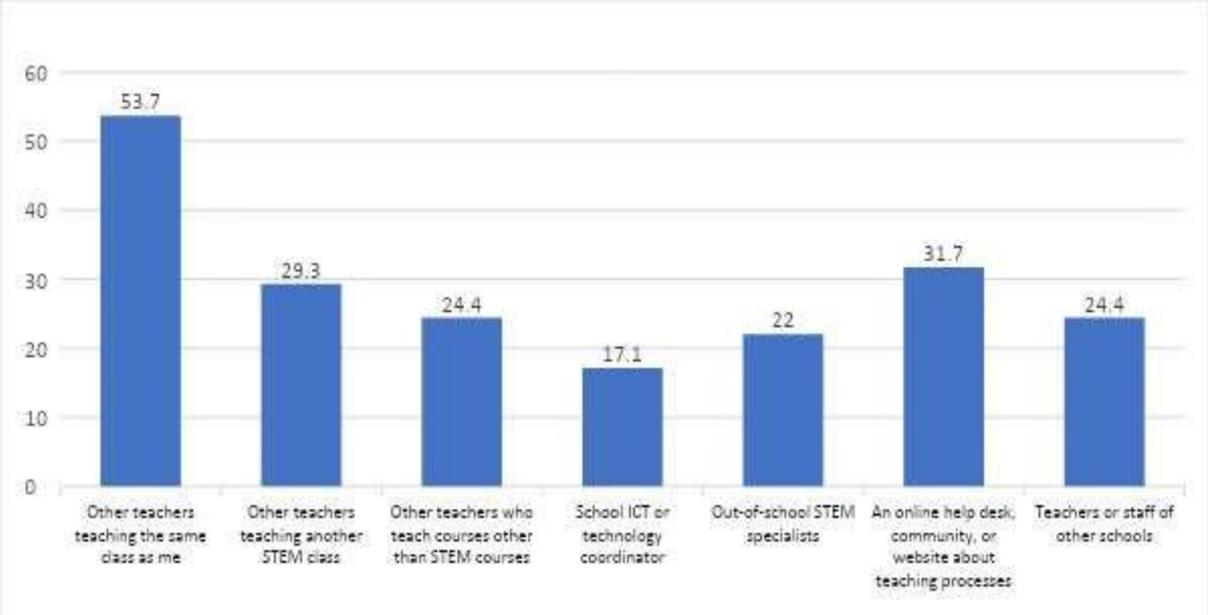

Figure 8. Supported groups for STEM education

The participants were asked how they usually stay informed about the teaching materials you use during the training (Figure 9). The vast majority of respondents (61%) stated that they were aware of the information and materials shared by my colleagues' network. 58.5% of the teachers stated that they searched the internet for related teaching resources and materials by themselves. The least preferred method was the form of being informed by subscribing to social sharing or information channels (social media, newsletters, etc.) of private companies that publish STEM education materials with 12.2%.

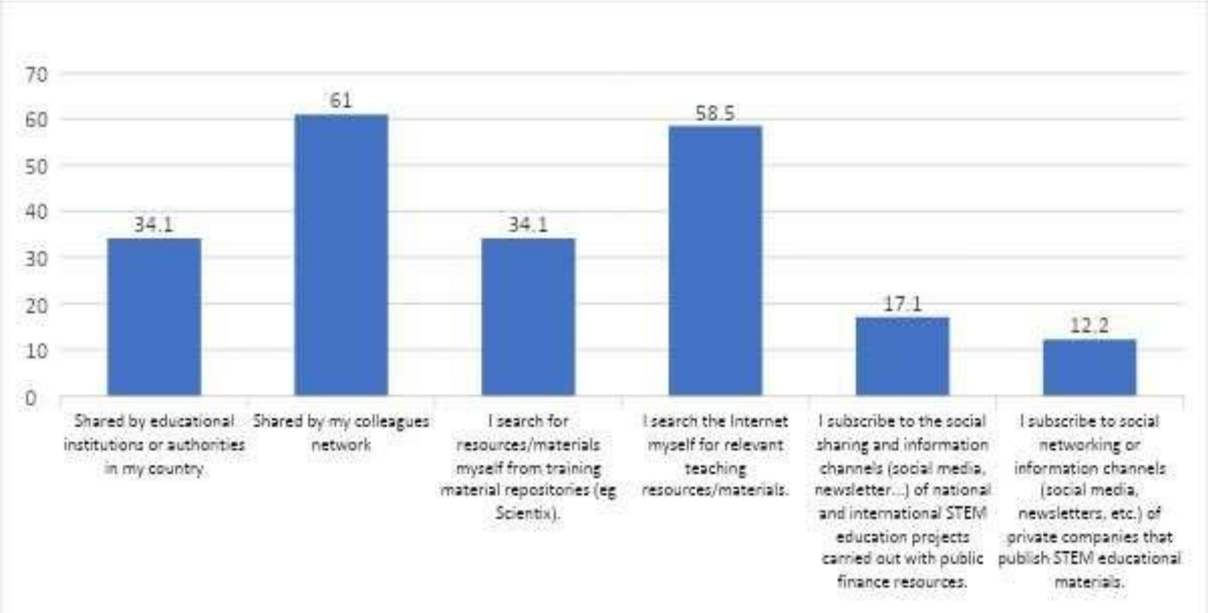

Figure 9. Ways to be aware of teaching materials

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Respondents were asked whether their colleagues and principals at their school shared with them a positive vision of innovative STEM teaching (Figure 10). While 51.3% answered yes to this, 48.7% of the participants stated that their colleagues and school principals did not share a developing vision for STEM teaching with them.

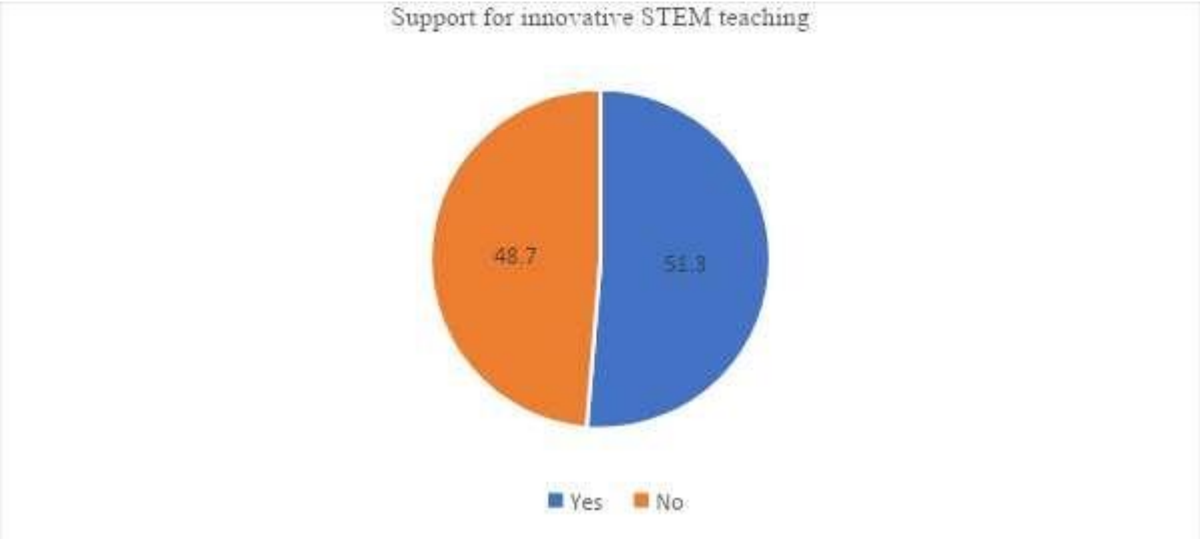

Figure 10. Support for innovative STEM teaching

Participants were asked whether it is compulsory to take STEM education in their field in their country (Figure 11). While 48.7% of the participants stated that such an application is not mandatory but recommended, 48.7% of the participants stated that taking STEM education is left to their own will. Only 2.6% of the participants stated that STEM education is compulsory.

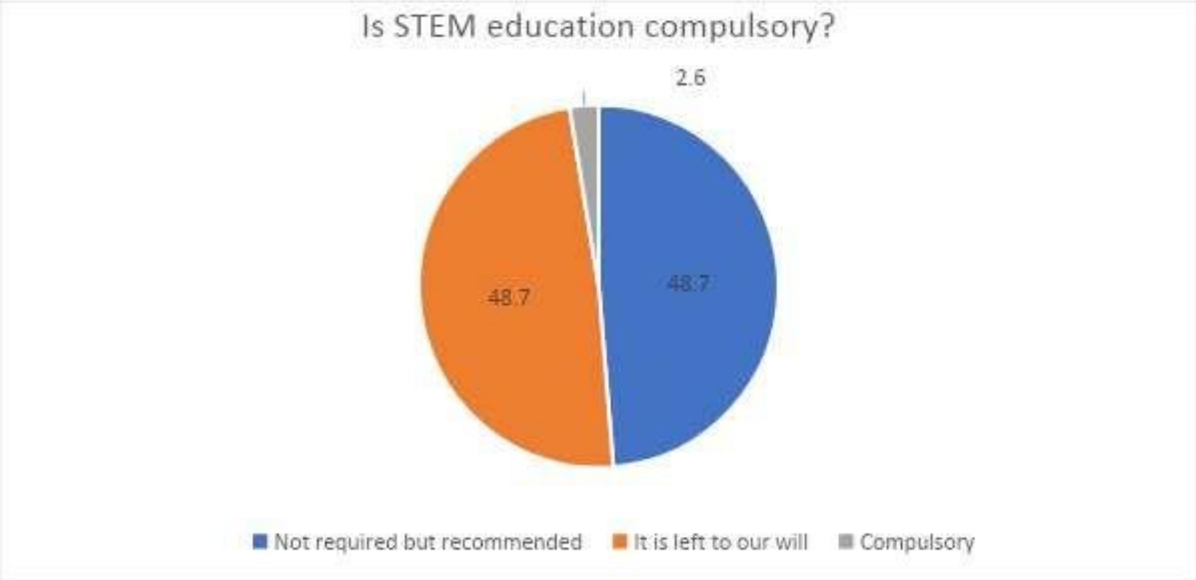

Figure 11. Is STEM education compulsory?

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Participants were asked if they think that innovative STEM education methods (use of ICT and innovative pedagogical approaches) have a positive effect (Figure 12). Most teachers (65.9%) think that innovative STEM education methods contribute the most to students' focus on learning. However, 53.7% of respondents claimed that innovative STEM education made it easier for students to understand what they learned, and 51.2% of respondents claimed that information and communication technologies facilitated collaboration among students.

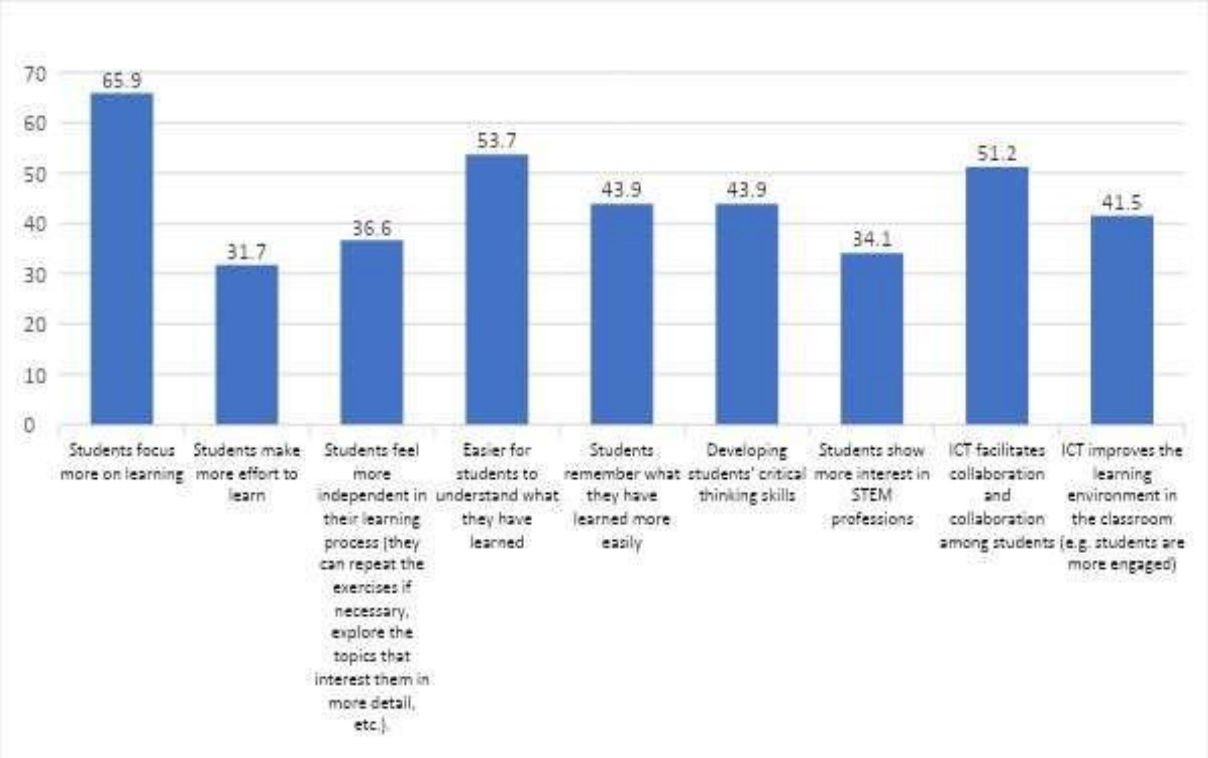

Figure 12. Opinions on innovative STEM education methods

It was stated to the participants that you choose the statements you agree with regarding the use of information and communication technology tools in STEM education at school (Figure 13).

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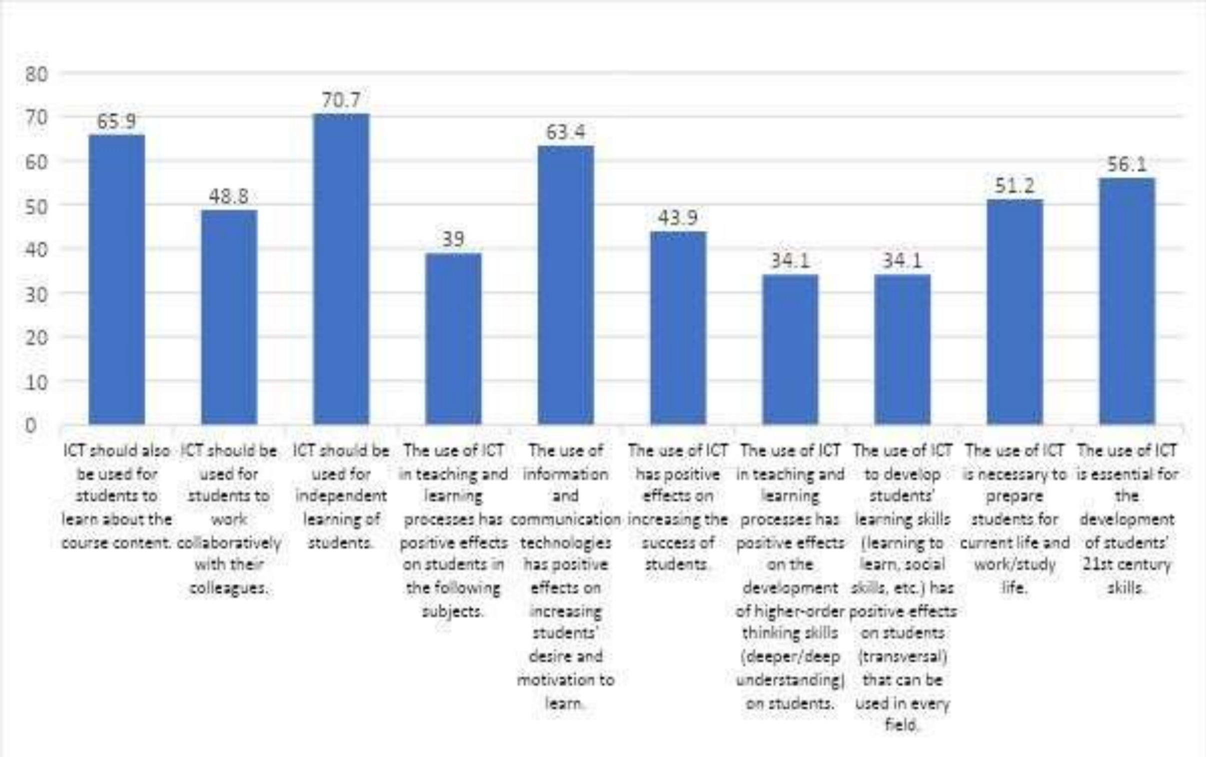

Figure 13. Opinions on innovative STEM education methods

The majority of the participants (70.7%) stated that information and communication technologies should be used for independent learning of students. 65.9% of them suggested that ICT should be used for students to learn about the course content. In addition, 63.4% of the teachers stated that the use of information and communication technologies had positive effects on increasing students' desire and motivation to learn, while 56.1% of the participants stated that the use of ICT was essential for the development of students' 21st century skills.

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Analysis of the Survey on the Level of Automation in Manufacture/Service Sector and Educational Need for STEM/ICT Questionnaire

Academics with various titles from various engineering fields participated in the research.

Results

Table 1. Level of automation rate the level in your domain of practice

	Totally Dissatisfied		Dissatisfied		Moderate		Satisfied		Totally Satisfied		TOTAL	
	n	%	n	%	n	%	n	%	n	%	n	%
Where you consider alternatives, make and implement decision	1	4,5	5	22,72	4	18,18	9	40,90	3	13,63	22	100
Where computer offers you a set of alternatives which you may ignore in making decision	2	9,09	5	22,72	4	18,18	9	40,90	2	9,09	22	100
Where computer offers a restricted set of alternatives, and you decide which one to implement	6	27,27	2	9,09	5	22,72	18	81,81	2	9,09	22	100
Where computer offers a restricted set of alternatives and suggests one, but you still make and implement final decision	6	27,27	6	27,27	5	22,72	5	22,72	0	0	22	100
Where computer offers a restricted set of alternatives and it will implement if you approve	6	27,27	5	22,72	5	22,72	6	27,27	0	0	22	100
Where computer makes decision but gives you option to veto prior to implementation	6	27,27	7	31,81	4	18,18	5	22,72	0	0	22	100

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Where computer makes and implements decision, but must inform you after the fact	5	22,72	10	45,45	3	13,63	4	18,18	0	0	22	100
Where computer makes and implements decision, and informs you only if asked to	6	27,27	11	50	1	4,5	4	18,18	0	0	22	100
Where computer makes and implements all the procedural control of all traffic. Unaided decision-making; voice communication	7	31,81	8	36,36	2	9,09	5	22,72	0	0	22	100

Participants were asked to rate their level of automation rate the level in your domain of practice.

40,90% (n=9) of participants indicated that they are satisfied of their level on where they consider alternatives, make and implement decision and 13,63% (n=3) said they are totally satisfied, which is about the half of the participants survey applied. 18,18% (n=4) of participants were moderate, while only 22,72% (n=5) of them said they are dissatisfied.

Similarly, 40,90% (n=9) of participants indicated that they are satisfied of their level on where computer offers them a set of alternatives which they may ignore in making decision and 13,63% (n=3) said they are totally satisfied, which is about the half of the participants survey applied. 18,18% (n=4) of participants were moderate, while only 22,72% (n=5) of them said they are dissatisfied.

81,81% (n=18) of participants which is more than the half of the responders, indicated that they are satisfied of their level on where computer offers a restricted set of alternatives, and they decide which one to implement and 22,72% (n=5) said they are moderate.

Unlike other categories, 27,27% (n=6) of participants indicated that they are totally dissatisfied of their level on where computer offers a restricted set of alternatives and suggests one, but they still make and implement final decision and 27,27% (n=6) said they are dissatisfied. 22,72% (n=5) of participants were moderate, while only 22,72% (n=5) of them said they are satisfied.

27,27% (n=6) of participants indicated that they are totally dissatisfied of their level on where computer offers a restricted set of alternatives and suggests one, but they still make and implement final decision and 27,27% (n=6) said they are dissatisfied. 22,72% (n=5) of participants were moderate, while only 22,72% (n=5) of them said they are satisfied.

Similarly, 27,27% (n=6) of participants indicated that they are totally dissatisfied of their level on where computer offers a restricted set of alternatives and suggests one, which it will implement if they approve and 22,72% (n=5) said they are dissatisfied. 22,72% (n=5) of participants were moderate, while only 27,27% (n=6) of them said they are satisfied.

27,27% (n=6) of participants indicated that they are totally dissatisfied of their level on where computer makes decision but gives them option to veto prior to implementation and 31,81% (n=7) said they are dissatisfied. 18,18% (n=4) of participants were moderate, while only 22,72% (n=5) of them said they are satisfied.

22,72% (n=5) of participants indicated that they are totally dissatisfied of their level on where computer makes and implements decision but must inform them after the fact and 45,45%

(n=10) said they are dissatisfied. 13,63% (n=3) of participants were moderate, while only 18,18% (n=4) of them said they are satisfied.

27,27% (n=6) of participants indicated that they are totally dissatisfied of their level on where computer makes and implements decision and informs, they only if asked to and 50% (n=11) said they are dissatisfied. 4,5% (n=1) of participants were moderate, while only 18,18% (n=4) of them said they are satisfied.

31,81% (n=7) of participants indicated that they are totally dissatisfied of their level on where computer makes and implements all the procedural control of all traffic and 36,36% (n=8) said they are dissatisfied. 9,09% (n=2) of participants were moderate, while only 22,72% (n=5) of them said they are satisfied.

Table 2. Rate the branches in manufacturing that are affected

	1		2		3		4		5		TOTAL	
	n	%	n	%	n	%	n	%	n	%	n	%
Computer-aided process planning	0	0	7	31,81	4	18,18	8	36,36	3	13,63	22	100
Computer-supported design and manufacturing	0	0	8	36,36	3	13,63	4	18,18	4	18,18	22	100
Computer numerical control machine tools	2	9,09	7	31,81	3	13,63	8	36,36	2	9,09	22	100
Computerized production and scheduling control	1	4,5	9	40,90	4	18,18	5	22,72	3	13,63	22	100
Automatic storage and retrieval systems	3	13,63	10	45,45	2	9,09	5	22,72	2	9,09	22	100
Flexible machine systems	5	22,72	9	40,90	1	4,5	6	27,27	1	4,5	22	100
Automated material handling systems, e.g. robots	6	27,27	6	27,27	2	9,09	4	18,18	4	18,18	22	100

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Participants were asked to rate the branches in manufacturing that are affected. Their ratings show an average level of impact regarding computer-aided process planning. 36,36% (n=8) of them scored the impact at 4 and 31,81% (n=7) of them at 4. Only 18,18% (n=4) participants scored the impact at 3, while 13,63% (n=3) participant scored at 5.

Likewise, computer-supported design and manufacturing scored by responders at the average level. 36,36% (n=8) of them scored the impact at 2, 13,63% (n=3) of them at 3, 18,18% (n=4) participants scored the impact at 4, and 18,18% (n=4) participants scored at 5.

36,36% (n=8) of participants scored the impact of computer numerical control machine tools at 4 and 31,81% (n=7) of them at 2. Only 9,09% (n=2) participants scored the impact at 1 and 5, while 13,63% (n=3) participant scored at 3.

40,90% (n=9) of participants scored the impact of computerized production and scheduling control at 2 and 22,72% (n=5) of them at 4. In addition to this, 13,63% (n=3) participants scored the impact at 3 and 13,63% (n=3) of them scored at 5, while only 4,5% (n=1) participant scored at 1.

45,45% (n=10) of participants scored the impact of automatic storage and retrieval systems at 2 and 22,72% (n=5) of them at 4. Then, 9,09% (n=2) participants scored the impact at 3 and 5, while 13,63% (n=3) participant scored at 1.

40,90% (n=9) of participants scored the impact of flexible machine systems at 2, 27,27% (n=6) of them at 4, and 22,72% (n=5) participants scored the impact at 1. Also, 4,5% (n=1) participant scored at 3 and 5.

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The less affected branch seems automated material handling systems, e.g. robots according to participants. 27,27% (n=6) of participants scored the impact of automated material handling systems at 1 and 2, while 18,18% (n=4) of them scored at 4 and 5.

Table 3. Rate the need of automation and tools

Needs	1		2		3		4		5		TOTAL	
	n	%	n	%	n	%	n	%	n	%	n	%
Regarding your self-empowerment in workplace	1	4,5	0	0	1	4,5	9	40,90	11	50	22	100
Regarding your social and transversal skills	1	4,5	0	0	1	4,5	6	27,27	14	63,63	22	100

Participants were asked to rate the need of automation and tools. They rated their need regarding their self-empowerment in workplace at quite high level. Almost all participants claimed that there is a huge need for it. 50% (n=11) of them scored their need at 5 and 40,90% (n=9) of them at 4. Only 4,5% (n=1) scored the need at 1, while 4,5% (n=1) participant scored at 3.

Similarly, they rated the need of their social and transversal skills at the high level. Almost all participants claimed that there is a huge need for it. 63,63% (n=14) of them scored their need at 5 and 27,27% (n=6) of them at 4. Only 4,5% (n=1) scored the need at 1, while 4,5% (n=1) participant scored at 3.

Table 4. Level of identification on automation trends in manufacture and service sector

	Totally Dissatisfied		Dissatisfied		Moderate		Satisfied		Totally Satisfied		TOTAL	
	n	%	n	%	n	%	n	%	n	%	n	%
Fixed automation (completes a set of tasks repeatedly)	4	18,18	6	27,27	4	18,18	0	0	7	31,81	22	100

Programmable automation (commands given by computer program)	7	31,81	5	22,72	3	13,63	0	0	7	31,81	22	100
Flexible automation (both human intervention and computer code)	5	22,72	8	36,36	3	13,63	0	0	5	22,72	22	100
Integrated automation (totally automated)	8	36,36	6	27,27	2	9,09	2	9,09	4	18,18	22	100

Participants were asked to rate the level of identification on automation trends in manufacture and service sector.

18,18% (n=4) of participants indicated that they are totally dissatisfied of their level of fixed automation (completes a set of tasks repeatedly) and 27,27% (n=6) said they are not satisfied, which is about the half of the participants survey applied. 18,18% (n=4) of participants were moderate, while only 31,81% (n=7) of them said they are totally satisfied.

Most of the respondents claimed that they are either dissatisfied or totally dissatisfied of their level of programmable automation (commands given by computer program). 31,81% (n=7) of them were totally dissatisfied and 22,72% (n=5) were dissatisfied. 13,63% (n=3) of participants were moderate, while only 31,81% (n=7) of them said they are totally satisfied.

In terms of flexible automation (both human intervention and computer code), 22,72% (n=5) of them were totally dissatisfied and 36,36% (n=8) were dissatisfied.

Similarly, participants found themselves mostly totally dissatisfied on integrated automation (totally automated). 36,36% (n=8) of them stated that they are totally dissatisfied, 27,27% (n=6) of them are dissatisfied, and 9,09% (n=2) of them are moderate. Only 9,09% (n=2) of them said that they are satisfied and 18,18% (n=4) of them are totally satisfied.

CONCLUSION

From the results of the survey, it can be said that there is a need to improve STEM skills of academics. There is a huge gap between knowledge and practice of the participants. Participants are aware of their knowledge level of computerized and automated systems. There is also a need to improve participants' level of social and transversal skills through workshops.

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Presidential National Library Education Center

22 February 2020	*Tubanur BUYUKCOLPAN*

Element	Guiding questions
Type of document (optional)	*Website*
Publisher (optional)	*The Presidency of the National Library*
Target audience	*The target audience of the events varies across the workshops and generally appeals to a target audience that includes children and young people between the ages of 5-17.*
Objective	*The general purpose of the applications is to increase the awareness level of children and young people on science and technology through various workshops and activities within the scope of the subject.*
Location /geographical coverage	*Since the Presidential National Library serves in Ankara (Turkey), it primarily serves the target groups in Ankara, and then the participants in the target group profile who want to participate from all over Turkey.* *Plus code of the map is: WRF2+R7 Yenimahalle, Ankara*
Introduction	*The events were held in May 2023. The main challenge that the app aims to solve is the low STEM literacy skill levels of children and youth.* *The aim of the Dream Buildings workshop is to enable children to develop a perception of architecture and architectural structures. The event was held at the Presidency National Library Discovery Workshop (Training Center and Workshops) on 03.05.2023 between 16.30-17.00. Made with children aged 5-6 years.* *The aim of the My Sense Organs workshop is to develop children's observation skills. The event was held at the Presidency National Library Discovery Workshop (Training Center and Workshops) on 07.05.2023 between 13.00-13.30. Made with children aged 5-6 years.* *The aim of the Robotic Coding (Happiness Machine) workshop is to provide children with coding skills. By manipulating the LED matrix in the*

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littleBits Code Kit, students were able to understand the basic premise of coding. The event was held at the Presidential National Library Technology Workshop (Training Center and Workshops) on 07.05.2023 between 14.00-15.00. It was made with children in the 7-8 age group.

The purpose of the Mbot Coding (Line Follower Robot) workshop is to program a line follower to make a robot go forward and follow the determined black line using the line tracking feature. The event was held at the Presidential National Library Technology Workshop (Training Center and Workshops) on 07.05.2023 between 15.30-16.30. It was made with children in the 10-11 age group.

The Microscope Workshop (Let's Examine Food) aims to enable us to examine living or inanimate objects that are too small to be seen with the naked eye. The event was held at the Presidential National Library Technology Workshop (Training Center and Workshops) on 10.05.2023 between 16.00-17.00. It was made with children in the 9-15 age group.

Wooden Honey Spoon Making, woodworking workshop aims to enable students to make prototyping with woodworking technique. The event was held at the Presidential National Library Design and Production Workshop (Training Center and Workshops) on 17.05.2023 between 16.00-17.00. It was made with children in the 15-17 age group.

The aim of the Color Games workshop is to enable children to gain awareness of the concept of color. The event was held at the Presidency National Library Discovery Workshop (Training Center and Workshops) on 20.05.2023 between 11:00 and 11:30. Made with children aged 5-6 years.

The aim of the Da Vinci Bridge workshop is to enable children to develop a perception of architecture and architectural structures. In this direction, children design an architectural structure of their dreams in three dimensions through a picture story book. The event was held at the Presidency National Library Discovery Workshop (Training Center and Workshops) on 20.05.2023 between 11.45-12.15. It was made with children in the 10-11 age group.

(Wood Workshop) In the Human Figure Making workshop, it is aimed that students can make prototyping with woodworking technique. The event was held at the Presidential National Library Design and Production Workshop (Training Center and Workshops) on 20.05.2023 between 12.30-13.30. It was made with children in the 15-17 age group.

The aim of the Parachute Building Workshop is for children to feel the air resistance and discover how they can benefit from it. The event was held at the Presidency National Library Discovery Workshop (Training Center

	and Workshops) on 24.05.2023 between 16.30-17.00. Made with children aged 5-6 years. *(Wood Workshop) In the Woodworking workshop, it is aimed that students can make prototyping with the woodworking technique. The event was held at the Presidential National Library Design and Production Workshop (Training Center and Workshops) on 31.05.2023 between 16.00-17.00. It was made with young people in the 15-17 age group.*
Stakeholders and Partners	*The studies of the education office established within the Presidency of the National Library were realized with the cooperation of the Ministry of Industry and Technology (TÜBİTAK), Turkcell and the Digital Transformation Office.*
Validation*	*Good practice has been verified with stakeholders/end users. The good practice validation process consisted of conducting workshops and evaluating feedback from participants and their parents. Accordingly, all of the participants (100%) stated that they got efficiency from the workshops; All of the parents (100%) stated that they expected the continuation of the workshops.*

Impact	*What has been the impact (positive or negative) of this good practice on the beneficiaries' - both men and women - livelihoods? Please explain how the impact may differ between men and women. Have these beneficiaries' livelihoods been environmentally, financially, and/or economically improved (and if applicable, become more resilient), and if yes how?*
Innovation	*In what way has the good practice contributed to an innovation in the livelihoods of the target group?*
Lessons learned	*What are the key messages and lessons learned to take away from the goodpractice experience?*
Sustainability	*What are the elements that need to be put into place for the good practice to be institutionally, socially, economically and environmentally sustainable?*
Replicability and/or up-scaling	*What are the possibilities of extending the good practice more widely?*
Contact details	*Presidential National Library Presidential Complex 06560 Beştepe/Ankara/Turkey*
URL of the practice*	*https://mk.gov.tr/icerik/detay/bilim-ve-teknoloji-atolyeleri-mayis-ayi-etkinlik-takvimi-1*
Related Web site(s)*	*https://mk.gov.tr/etkinlikler/T%C3%BCm%20Etkinlikler/liste*

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Related resources that have been developed*	*What training manuals, guidelines, technical fact sheets, posters, pictures, video and audio documents, and/or Web sites have been created and developed as a result of identifying the good practice?*
**Optional*	

CHECKLISTOF METADATA

Metadata is commonly defined as data about data. Broadly, this means information about a document and its content. Metadata makes it easier to archive and retrieve the document. This is useful if the good practice is part of a database or is published on a Web site.

Most of the metadata needed is already included in the Good Practices Template (Title, Date, Authors, Type of document, Publisher, Target Audience, Objective, Location / Geographical coverage, Contact details, URL of the practice, Related Web site(s), Related resources that have beendeveloped.) The following elements are metadata that are also useful to include:

Element	Guiding questions
Title	What is the name that best describes the good practice?
Publication date	When (month and year) was the good practice documented/published?
Author(s)	Who wrote the good practice document?
Summary	What is the context (initial situation) and challenge being addressed? Please provide a short description of the good practice being addressed and specify the period during which the practice has been carried out? Explain how gender was taken into account in both the challenge being addressed and the good practice itself.
Keywords	What are a few keywords and/or tags that best describe the key issues being addressed and processes being applied by the good practice? (For example, AGROVOC subjects like good practices, resilience to shocks, and gender).
Language(s)	In which language(s) is the good practice document available?
Format (optional)	Is the document in a PDF, Word, PPT, jpg, html or some other format? Knowing the format can be used to determine the software, hardware or other equipment needed to in order to access the document.
Resource size (optional)	How many pages long is the document? If it is available as a file, how large is it? If it is a video or an audio file, how long does it last, and again how large is the file?

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The Effect of Robotics And Scratch Applications In Programming Teaching On The Computational Thinking Skills And Academic Success Of Students

June 2018	*Elif Şimşek*

Element	Guiding questions
Type of document (optional)	*A case study*
Publisher (optional)	*9 Eylül University*
Target audience	*The target audience of this document is researchers working in the field of STEM education and anyone who wants to learn about STEM education.*
Objective	*The aim of the research is to compare the computational thinking practices and academic achievement variables between the students who test and run their codes on the Scratch screen in programming education and the students who test and run their codes created in mBlock with the movements of their robots (mbot).*
Location /geographical coverage	*The universe of the research consisted of 5th and 6th grade students, that is, students in the 10-12 age group. Depending on the study universe, 5th grade students studying in Tekkeköy district of Samsun in Turkey were selected. Students are between the ages of 10-11.*
Introduction	*The aim of this research is to reveal the effects of visual programming and robotic programming activities on students' computational thinking skills and academic success in the programming teaching process. A total of sixty students, divided into two groups, participated in the study. Before the study, students' basic computer knowledge was measured. Afterwards, students were given visual programming and robotics training for a month. Then, equivalent programming achievement tests were applied in accordance with Scratch and mBlock environments. The computational thinking practices of the students*

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	were measured by the interviews with the students. Afterwards, the groups were changed and mBlock was given to the 1st group and Scratch to the 2nd group. After the training, the measurement was repeated. In the study, the posttest control group design of the quasi-experimental research method, which is one of the quantitative research methods, was used. Academic achievement tests and an interview form measuring computational thinking practices were used as data collection tools. When the results of the research were examined, it was observed that both groups received equivalent scores in both academic achievement and computational thinking practices. The results were interpreted as both methods can be used for programming basic education. By contributing to the literature, the study revealed results that can provide guidance to information technology teachers and teachers in other branches working in the field of STEM about how to follow a path while giving programming education to their students.
Stakeholders and Partners	*The beneficiary of the case study is Nine September University.* *The users of the good practice are Tekkeköy High School.*
Validation*	*In this application, students' computational thinking practices were tried to be measured by using product-based interviews. Accordingly, computational thinking skills are measured under three dimensions. These are computational thinking concepts, computational thinking practices, computational perspectives. There are seven computational thinking concepts: sequence, loops, parallelism, events, states, operators, and data. Computational practices, on the other hand, are characterized under four main sections: trial-iteration, testing-debugging, reuse-mixing, summarizing and modularization. Finally, the computational perspective (depth) includes three elements: identification, association and questioning. In practice, the focus was on computational thinking practices among these three dimensions in order to have information about students' computational thinking skills. At the same time, academic achievement tests for programming at the end of the application formed the other basic dimension of the research. While the grade point average of the 1st group in the exam that measures the computer skills of the students is 75.80, it is 68.83 in the 2nd group. Accordingly, the grade point average of the 1st group was 81.96 in the exam administered after the training given to the 1st and 2nd groups for four weeks, while the average of the 2nd group was 69.76.*

Impact	*What has been the impact (positive or negative) of this good practice on the beneficiaries' - both men and women - livelihoods? Please explain how the impact may differ between men and women. Have these beneficiaries' livelihoods been environmentally, financially, and/or economically improved (and if applicable, become more resilient), and if yes how?*
Innovation	*In what way has the good practice contributed to an innovation in the livelihoods of the target group?*
Lessons learned	*What are the key messages and lessons learned to take away from the good practice experience?*
Sustainability	*What are the elements that need to be put into place for the good practice to be institutionally, socially, economically and environmentally sustainable?*
Replicability and/or up-scaling	*What are the possibilities of extending the good practice more widely?*
Contact details	*What is the address of the people or the project to contact if you want more information on the good practice?*
URL of the practice*	*Where can one find the good practice on the Internet?*
Related Web site(s)*	*What are the Web sites of the projects under which the good practice was identified and reproduced?*
Related resources that have been developed*	*What training manuals, guidelines, technical fact sheets, posters, pictures, video and audio documents, and/or Web sites have been created and developed as a result of identifying the good practice?*
**Optional*	

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CHECKLISTOF METADATA

Metadata is commonly defined as data about data. Broadly, this means information about a document and its content. Metadata makes it easier to archive and retrieve the document. This is useful if the good practice is part of a database or is published on a Web site.

Most of the metadata needed is already included in the Good Practices Template (Title, Date, Authors, Type of document, Publisher, Target Audience, Objective, Location / Geographical coverage, Contact details, URL of the practice, Related Web site(s), Related resources that have been developed.) The following elements are metadata that are also useful to include:

Element	Guiding questions
Title	What is the name that best describes the good practice?
Publication date	When (month and year) was the good practice documented/published?
Author(s)	Who wrote the good practice document?
Summary	What is the context (initial situation) and challenge being addressed? Please provide a short description of the good practice being addressed and specify the period during which the practice has been carried out? Explain how gender was taken into account in both the challenge being addressed and the good practice itself.
Keywords	What are a few keywords and/or tags that best describe the key issues being addressed and processes being applied by the good practice? (For example, AGROVOC subjects like good practices, resilience to shocks, and gender).
Language(s)	In which language(s) is the good practice document available?
Format (optional)	Is the document in a PDF, Word, PPT, jpg, html or some other format? Knowing the format can be used to determine the software, hardware or other equipment needed to in order to access the document.
Resource size (optional)	How many pages long is the document? If it is available as a file, how large is it? If it is a video or an audio file, how long does it last, and again how large is the file?

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GREECE

STEM LITERACY LEVEL DETERMINATION SURVEY REPORT

1. INTRODUCTION

This research is carried out within the scope of the EU Erasmus+ CODE Project. The aim of the study is to determine the STEM literacy levels of teachers. The descriptive method was used as the research method. Questionnaire was used as data collection technique.

2. DEMOGRAPHIC INFORMATION

100% of the participants are from Greece. When the age conditions are examined, it is understood that half of the participants (50%) are between the ages of 46-55. The other rates are 20% for participants aged 31-35, 20% for participants aged 36-45% and 10% for participants aged 56 and over.

According to gender, it is seen that the majority of the participants (60%) are men. This rate is followed by female participants with 40% and participants who do not want to specify their gender with 0%.

Majority of the participants are information technology teachers. In addition, teachers from branches such as chemistry, maths, physics and literature also participated in the research.

When the participants are asked how many years they have taught in any institution, including this academic year, it is understood that 30% have 4-10 years of experience, 30% have 11-20 years of experience and 30% have 21-30 years of experience. 5% of population also said they have been working for 1-3 years and also 5% for 31-40 years.

3. STEM LITERACY

The participants were asked to what extent they use the following aspects of information and communication technologies while giving training. Accordingly, the majority of the participants said "*I use different types of (visual, auditory, written) course teaching materials*

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in my classes" and "*Present and explain scientific information to the whole class*", with 85% and 80% respectively.. As it can be seen in Figure 1, the rate of participants who said I give feedback to my students while they are doing learning activities is 70%. The least used information and communication technologies aspects by the participants were to invite other STEM course teachers in order to work together (5%).

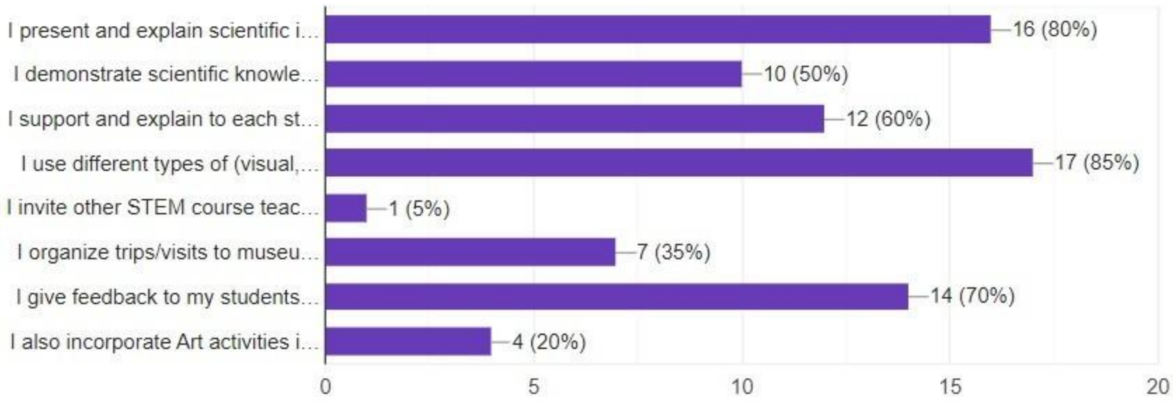

Figure 1. Frequency of ICT use

It was instructed to the participants to think about their lessons and mark the options that their students do regularly, not just once. Figure 2 demonstrates that the most popular activities of students is that they work on their own at their pace (70%) and participate in the examination and assessment processes (70%). These are followed by 65% of the students who prefer to conduct their experiments.

It is understood that the least preferred activity by the students is to think and evaluate the level at which they have learned the course topics. Other activities are implemented by students at an average level.

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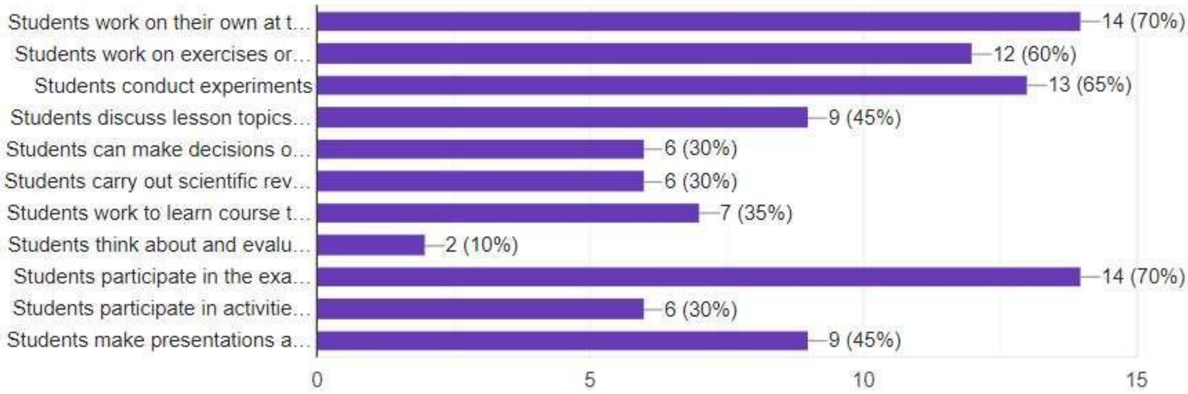

Figure 2. Activities that students do regularly

Participants were asked which learning resources and materials do they use during the training.The most used learning resources by teachers were written and printed materials (85%), presentations e.g. Power Point (85%) and audio/video materials (80%).

On the other hand, the least preferred learning resources by the participants are scientific function calculator that draws graphs (5%), calculators (5%), course materials designed for individual learning (10%), software specific to STEM education (10%).

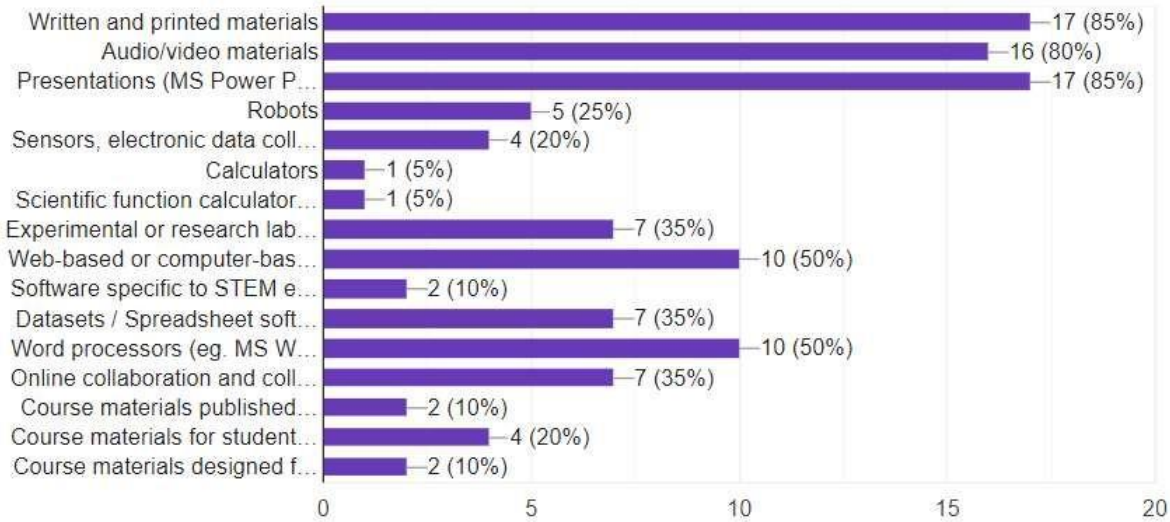

Figure 3. Learning resources and materials

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The participants were asked which teaching resources/materials there are that they want to use in their teaching processes but cannot have at their disposal). Augmented reality/Virtual reality tools (Virtual Laboratories etc.) were the learning material most wanted to be used by teachers (70%).

This is followed by software specific to STEM education with 60%, web-based or computer based simulations with 60%, sensors, electronic data collectors and recorders with 50%.

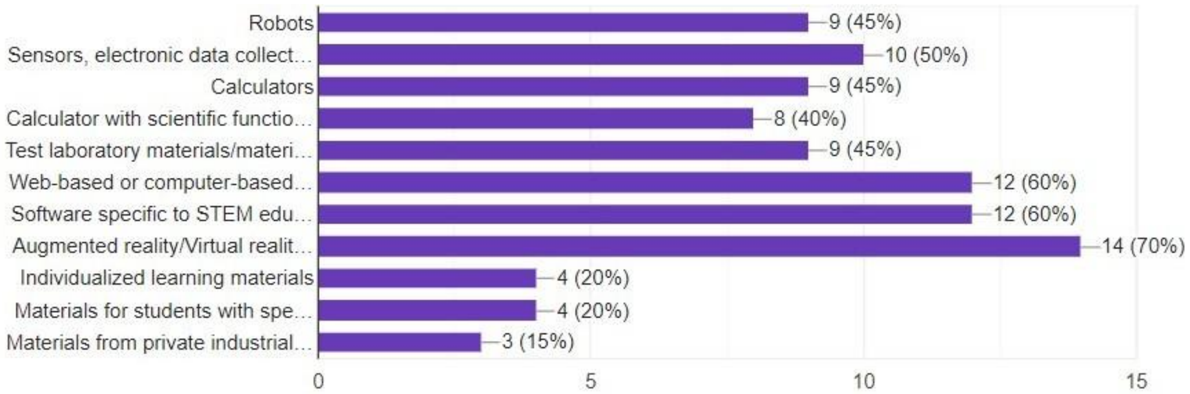

Figure 4. Teaching resources/materials participants want to use

Participants were asked in which of the following activities they would expect more support, from private industrial companies operating in STEM professional fields or from organizations and projects working in this field to schools.When Table 5 is examined, it is possible to state that the participants expect support in many areas.

The areas where the most prominent support which is expected are allowing teachers and students to have access to their equipment (90%), provision of teaching materials to schools (75%) and provision of educational internship opportunities for students (70%).

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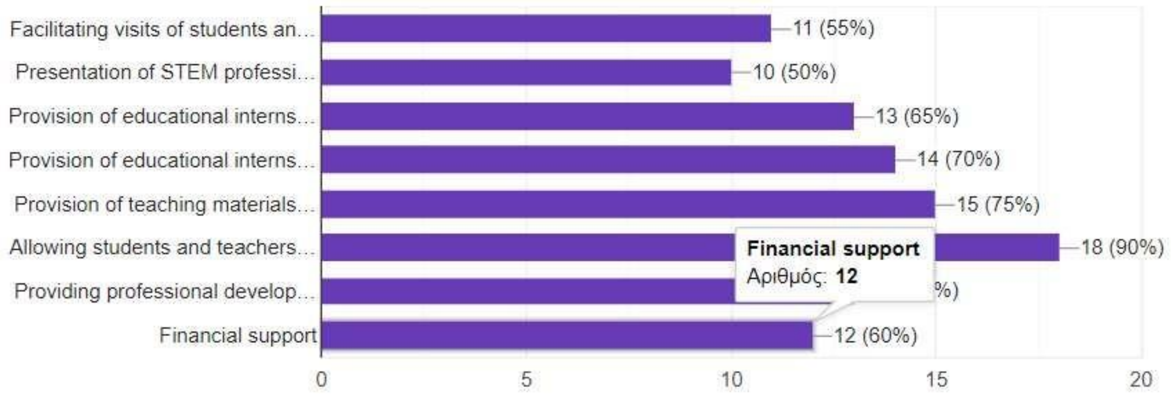

Figure 5. Areas expected for support

Respondents were asked if their STEM course teaching to students is affected by any reason (figure below).

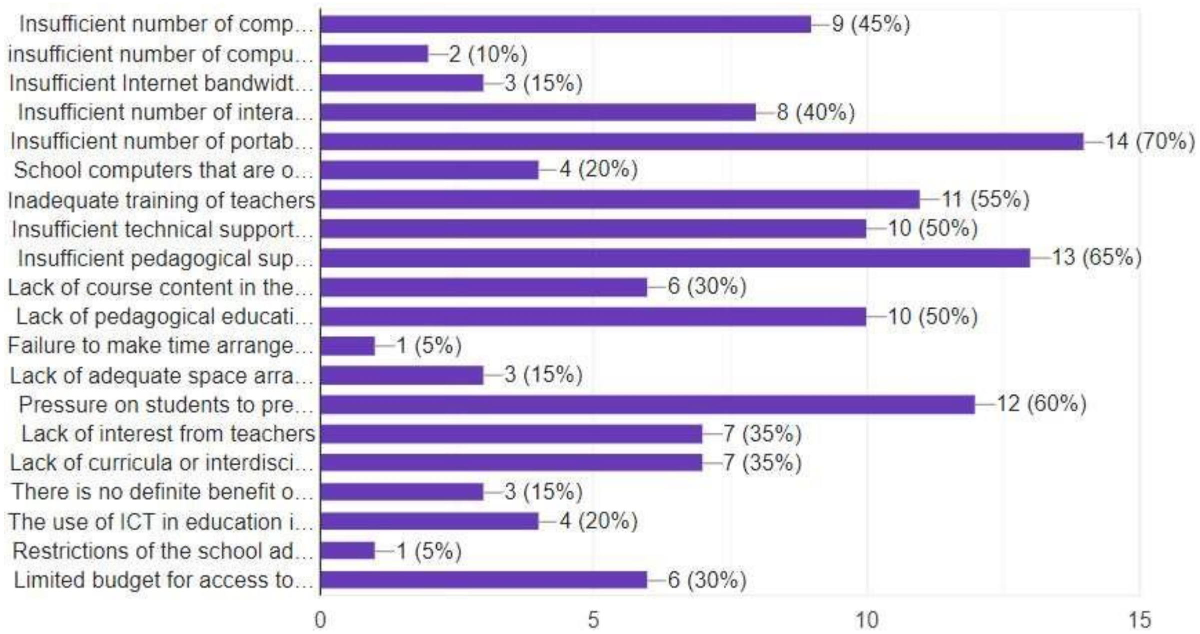

Figure 6. Impacts to STEM classes

When Table 6 is examined, it is obvious that the participants stated that the insufficient number of portable computers (70%) affected their STEM course teaching the most. Other answers had to do with insufficient pedagogical support for teachers (65%) and pressure on students to prepare themselves for the exams and tests (60%)

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Participants were asked whether they use computers/tablets/smartphones and the internet to increase their knowledge of the subjects they teach in a course or for their personal and professional development. The vast majority of the participants (85%) stated that they use computers/tablets/smartphones and the internet in their classes to join online communities over the internet (mailing lists, Facebook, blogs etc.). 70% of teachers are related to actively search for information and update topics someone have already learned, 65% to attend professional development courses and 55% to create materials for personal use. uses computer/tablet/smartphone and internet in lessons.

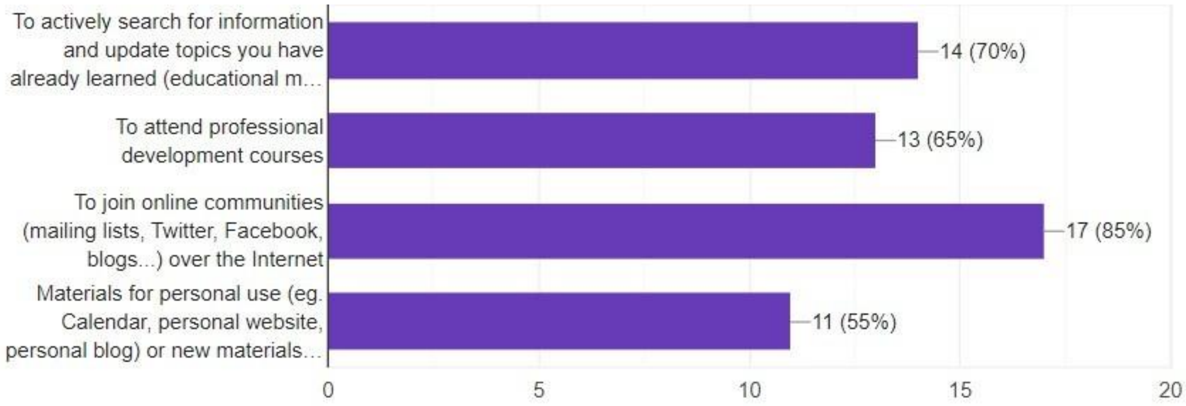

Figure 7. The use of computers/tablets/smartphones and the internet

Respondents were asked to what extent they received support from some groups to improve their STEM teaching. Participants stated that they mostly benefited from other teachers who teach the same course as them to improve themselves in STEM teaching (60%). Other teachers teaching another STEM course (40%) and school ICT and technology coordinator (40%) follow the previous percentage. The least supported areas were non-school STEM field experts with 25% and online helpdesk, community or website related to teaching processes with 25%.

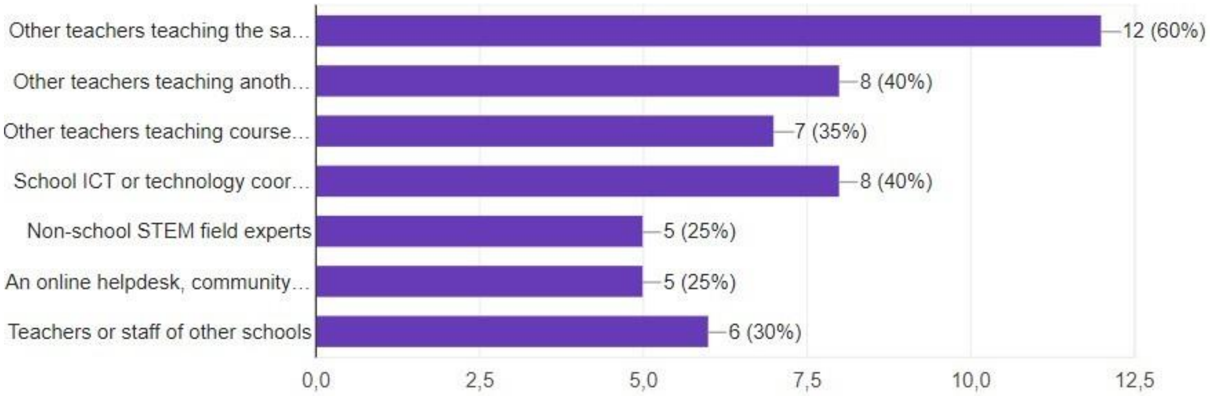

Figure 8. Supported groups for STEM education

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The participants were asked how they usually stay informed about the teaching materials you use during the training. The vast majority of respondents (95%) stated that they search the internet themselves for relevant teaching resources. 65% of the teachers stated that they shared teaching materials by the network of their colleagues. The least preferred method was the search for resources and materials by themselves from educational material tools (e.g. Scientix) with 25%.

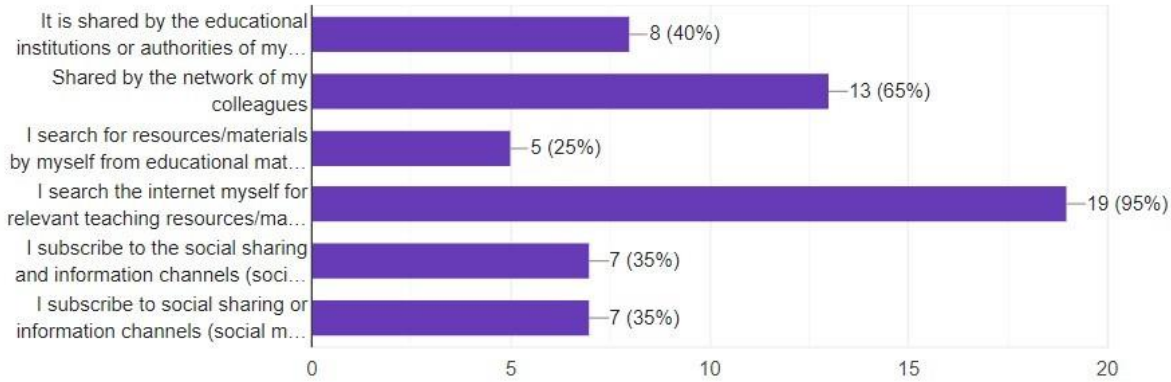

Figure 9. Ways to be aware of teaching materials

Respondents were asked whether their colleagues and headmaster at their school shared with them a positive vision of innovative STEM teaching. The difference is quite big since 85% of the participants have a positive vision while only 15% have a negative vision.

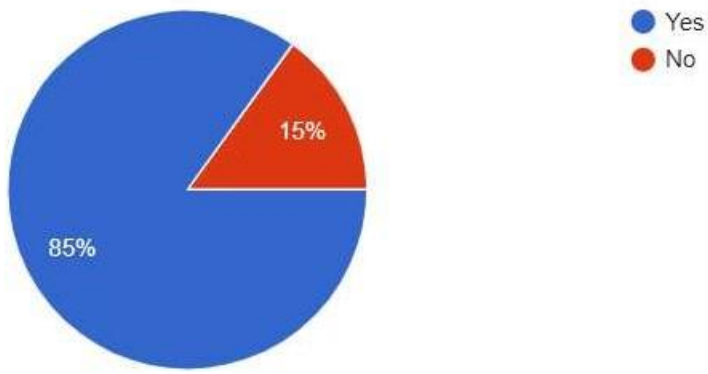

Figure 10. Support for innovative STEM teaching

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Participants were asked whether it is compulsory to take STEM education in their field in their country. A huge percent (80%) stated this is not mandatory but at the same time, recommended, 15% stated that it depends on their own preference and only 5% that it is compulsory.

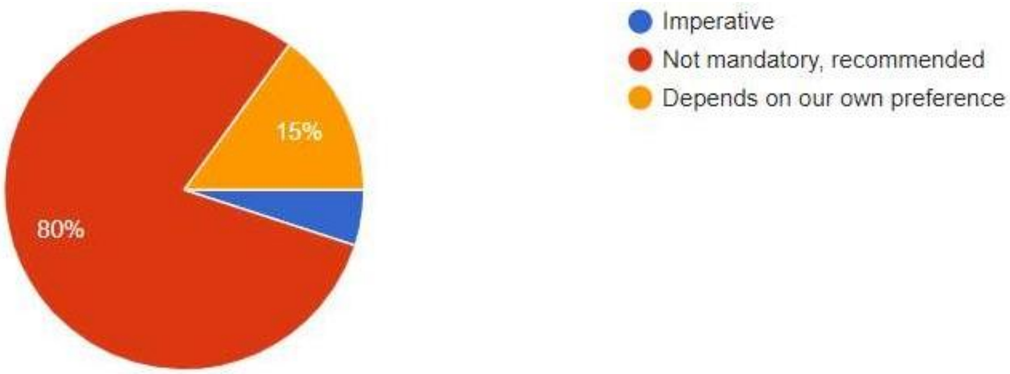

Figure 11. Is STEM education compulsory?

Participants were asked if they think that innovative STEM education methods (use of ICT and innovative pedagogical approaches) have a positive effect. Most teachers (90%) believe that ICT improve the classroom learning environment (students are more engaged) and 75% that students are more interested in STEM professions. Moreover, 60% of respondents claimed that with innovative STEM education methods students remember what they have learned more easily and 55% that students understand also easily what they learn.

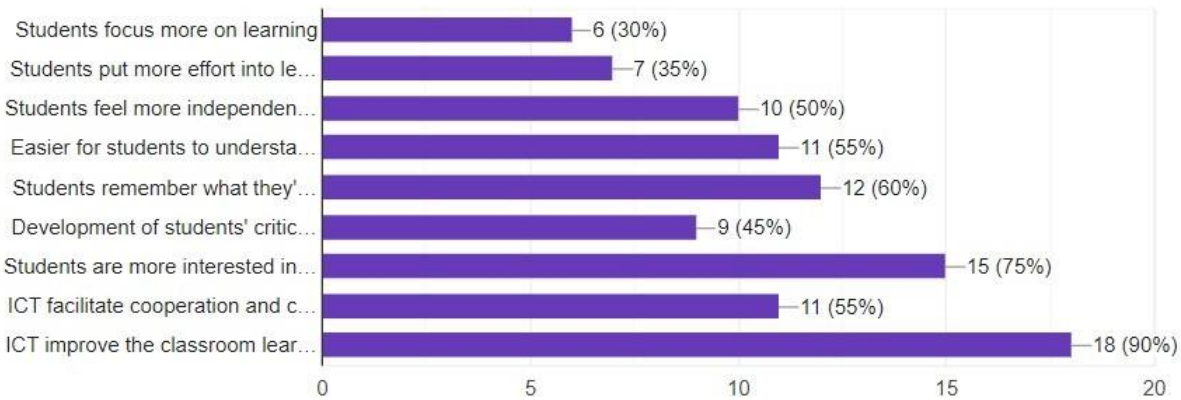

Figure 12. Opinions on innovative STEM education methods

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It was stated to the participants to choose the statements they agree with regarding the use of information and communication technology tools in STEM education at school.

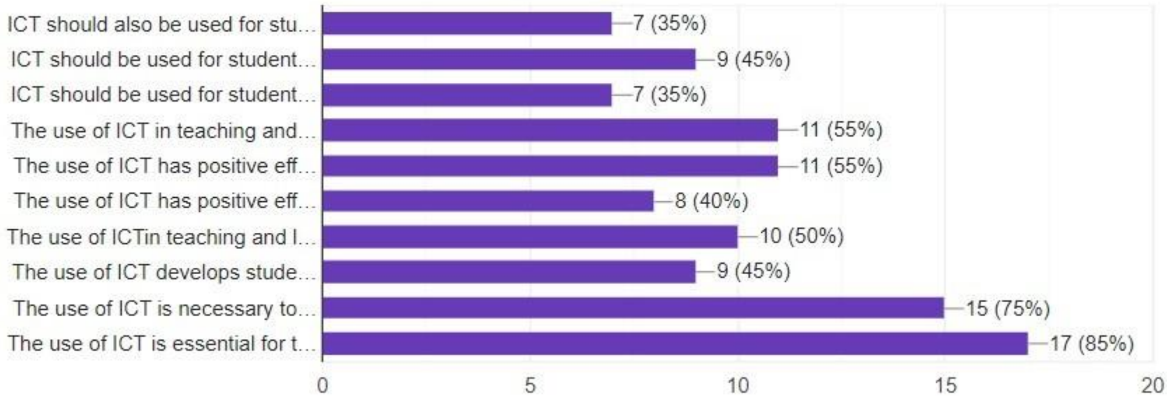

Figure 13. Opinions on innovative STEM education methods

The majority of the participants (85%) stated that information and communication technologies are essential for developing the skills of the students in the 21st century. 75% of them suggested that ICT is necessary for preparing students both for current and working life, 55% of the teachers stated that the use of information and communication technologies had positive effects on increasing students' desire and motivation to learn, while 55% of the participants again indicated that the use of ICT has positive effects on students in many subjects.

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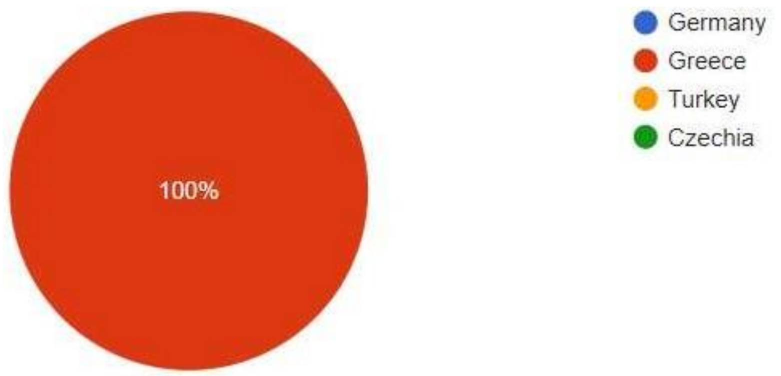
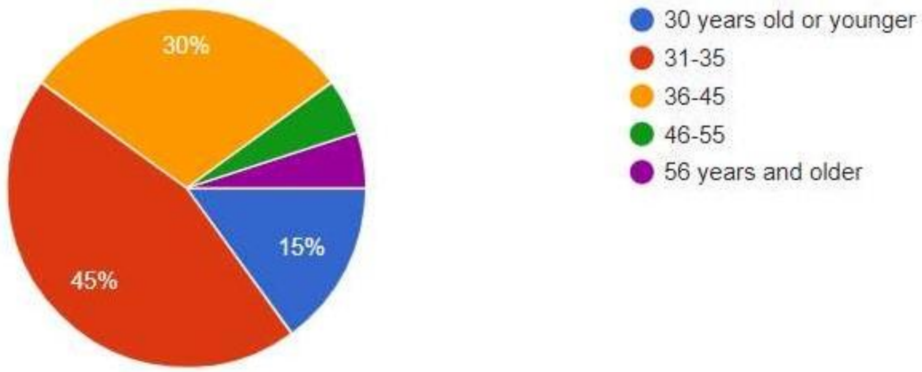
Analysis of the Survey on the Level of Automation in Manufacture/Service Sector and Educational Need for STEM/ICT Questionnaire

Partner country



All respondents (n=20) are 100% Greek since the survey was addressed exclusively to them and not to any other country, such as Germany, Turkey and Czech Republic.

Age



According to the results, 15% (n=3) of the participants in the survey are 30 years old or younger, 45% (n=9) range between 31-35 years old, 30% (n=6) range between 36-45 years old, 5% (n=1) range between 46-55 years old. The participants whose age is 56 years old and older is 5% (n=1) as well. It seems that the scale age 31-35 years old is the one which prevails.

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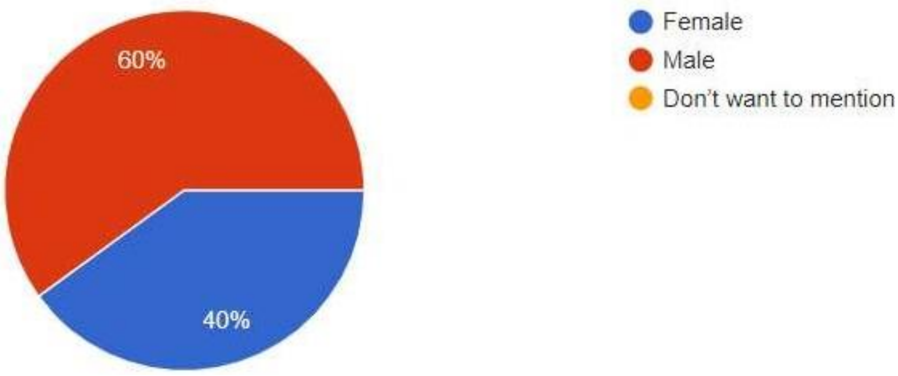
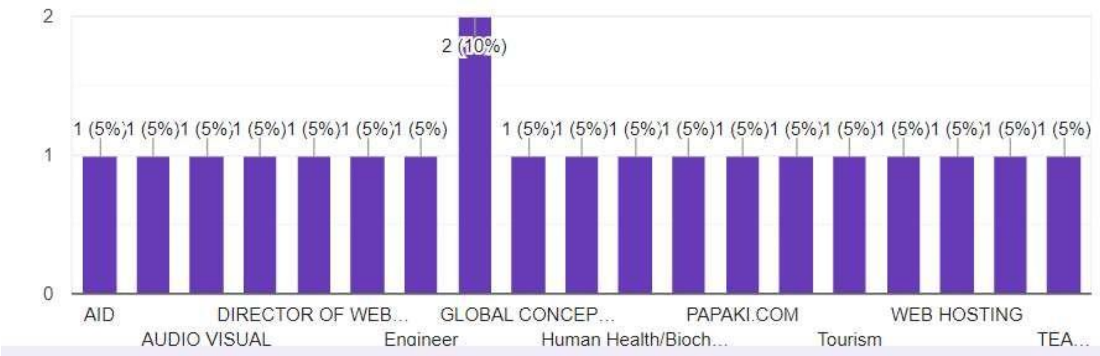
Gender



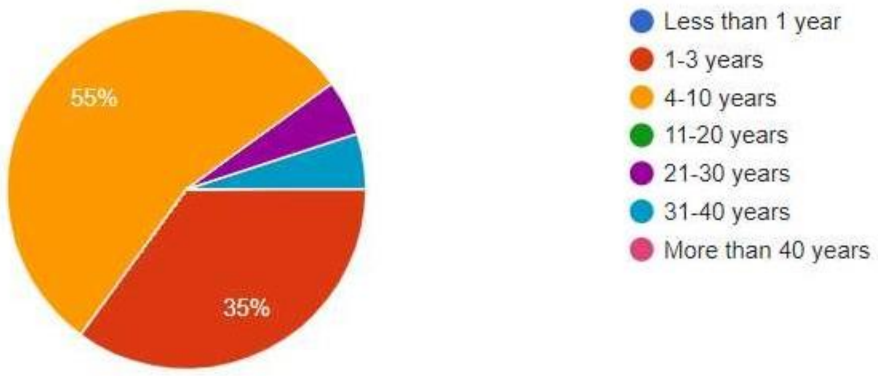
As it is obvious, gender distribution is not equal. 60% (n=12) of the participants are male while 40% (n=8) are female. The alternative "*Don't want to mention*" accumulates no percentage.

Field/Company



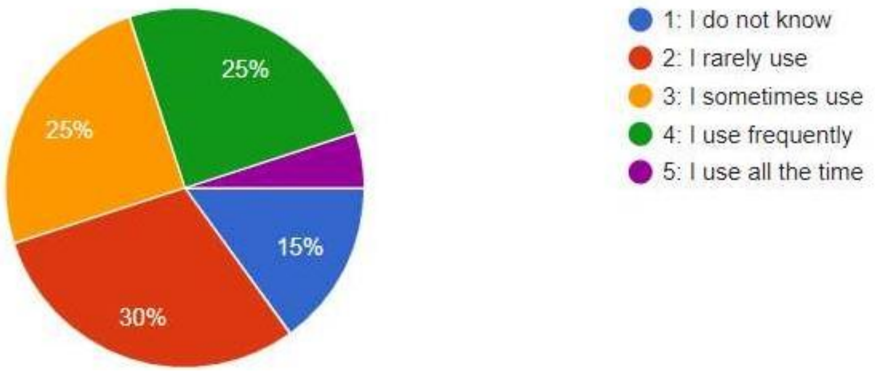
As it was expected, the job sectors are various. NGOs, tourism, engineers, web, health services are some of the working fields.

Years of working in a company



55% (n=11) of the participants declare that they have 4-10 years of work experience in any workplace. 35% (n=7) indicates that the years of experience are 1-3, while 5% (n=1) indicate that work experience is between 21-30 and 31-40 years respectively (for both of these categories). Three categories, "*Less than 1 year*", "*11-20 years*" and "*More than 40 years*", have not been chosen.

Automation systems and decision making



Regarding automation systems considering alternatives, making and implementing decisions, the percentages do not differ so much. More specifically, 30% (n=6) indicate that they rarely use automation systems, 25% (n=5) sometimes use them, 25% (n=5) frequently use them, 15% (n=3) do not know anything about them and 5% (n=1) use it all the time.

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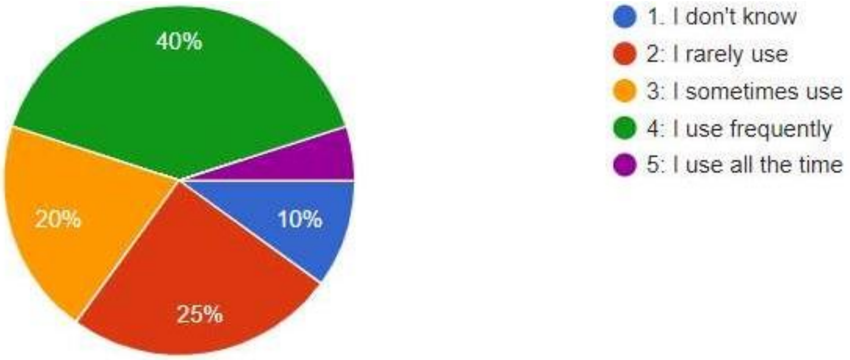
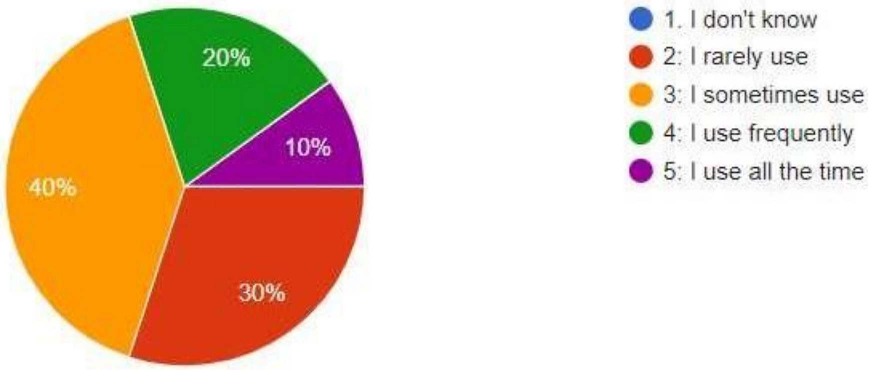
Automation systems alternatives concerning possible ignorance in decision making



Regarding automation systems concerning possible ignorance in decision making, 40% (n=8) indicate that they use them frequently, 25% (n=5) rarely use them, 20% (n=4) sometimes use them, 10% (n=2) do not know anything about them and only 5% (n=1) use it all the time.

Automation systems and restricted set of alternatives



Regarding automation systems concerning a restricted set of alternatives and their implementations, 40% (n=8) indicate that they sometimes use them, 30% (n=6) rarely use them, 20% (n=4) use them frequently while 10% (n=2) use it all the time.

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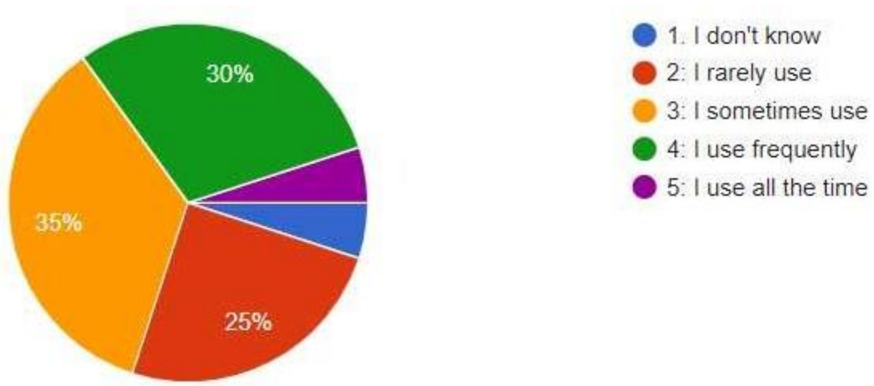
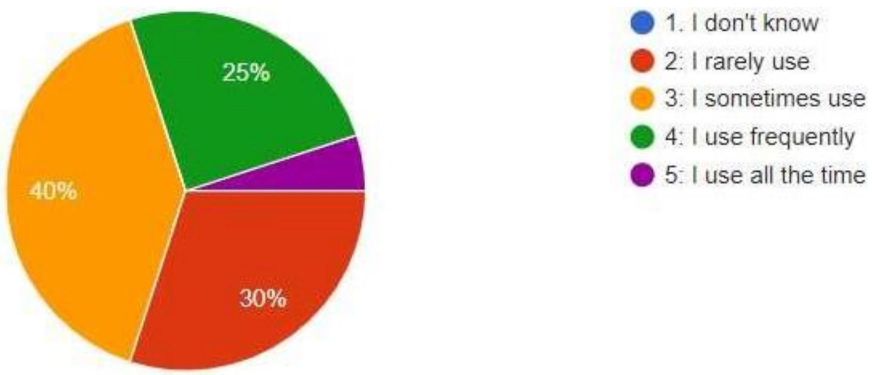
Automation systems and restricted set of alternatives, suggesting one



Regarding automation systems concerning a restricted set of alternatives where the computer suggests one but still, the individual makes the decision, 35% (n=7) indicate that they sometimes use them, 30% (n=6) frequently use them, 25% (n=5) rarely use them, while 5% (n=1) use it all the time and 5% (n=1) do not know anything about them.

Automation systems, restricted set of alternatives and approving



Regarding automation systems with a restricted set of alternatives where the computer suggests one but still, the individual makes the approval, 40% (n=8) indicate that they sometimes use them, 30% (n=6) rarely use them, 25% (n=5) frequently use them, while 5% (n=1) use it all the time.

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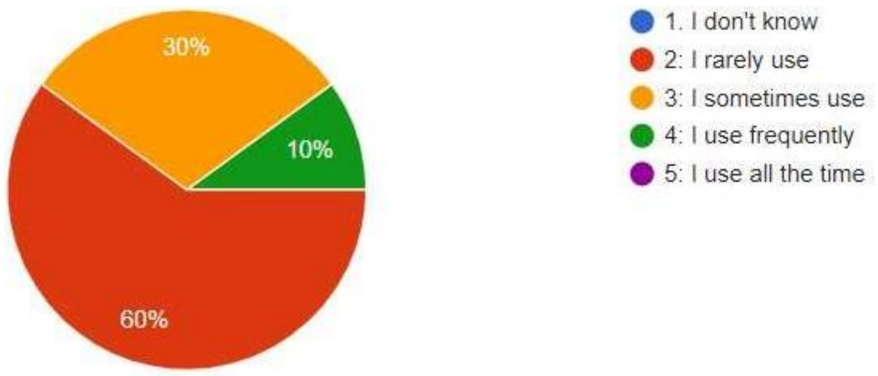
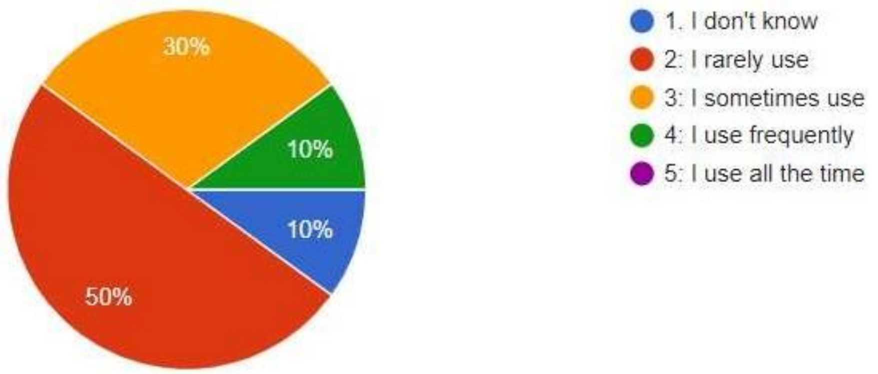
Automation systems, computer making decision and veto prior implementation



Regarding automation systems with the computer making the decision but simultaneously there is a veto prior to implementation, 60% (n=12) indicate that they rarely use them, 30% (n=6) sometimes use them, and 10% (n=2) use them frequently.

Automation systems, computer making decision and information after the fact



Regarding automation systems with the computer making and implementing the decision but also, informing the individual after the fact, 50% (n=10) indicate that they rarely use them, 30% (n=6) sometimes use them, 10% (n=2) frequently use them, while 10% (n=2) also, do not know anything about them.

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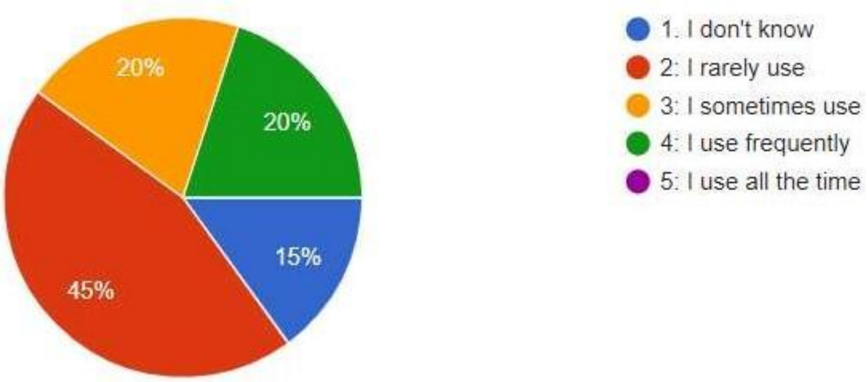
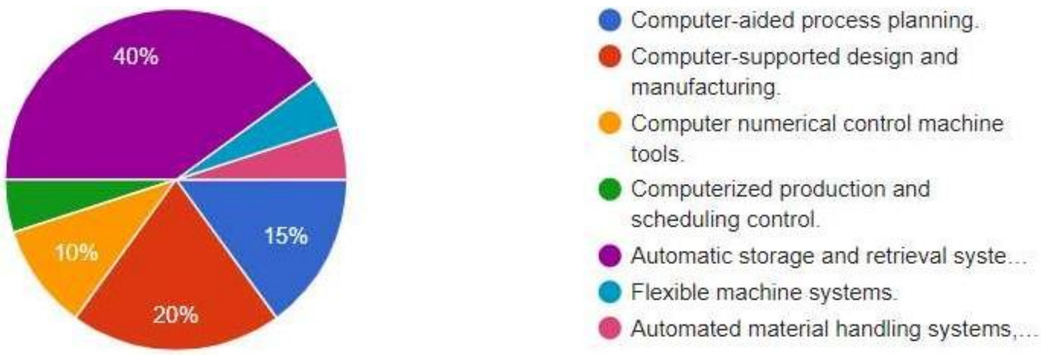
Automation systems, procedural control of all traffic, voice communication



Regarding automation systems where the computer is making and implementing all the procedural control of traffic and there is voice communication, 45% (n=9) indicate that they rarely use them, 20% (n=4) sometimes use them, 20% (n=4) frequently use them, while 15% (n=3), do not know anything about them.

Branches which are affected by automation



Regarding branches in manufacturing which are affected by automation, 40% (n=8) indicate the automatic storage and retrieval systems, 20% (n=4) computer supported design and manufacturing, 15% (n=3) computer-aided process planning, 10% (n=2), computer numerical control machine tools, 5% (n=1) computerized production and scheduling control, 5% (n=1) flexible machine systems and 5% (n=1) automated material handling systems (e.g. robots).

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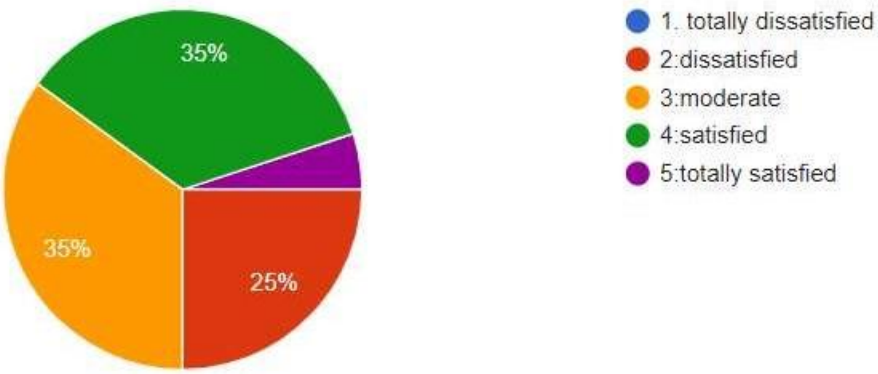
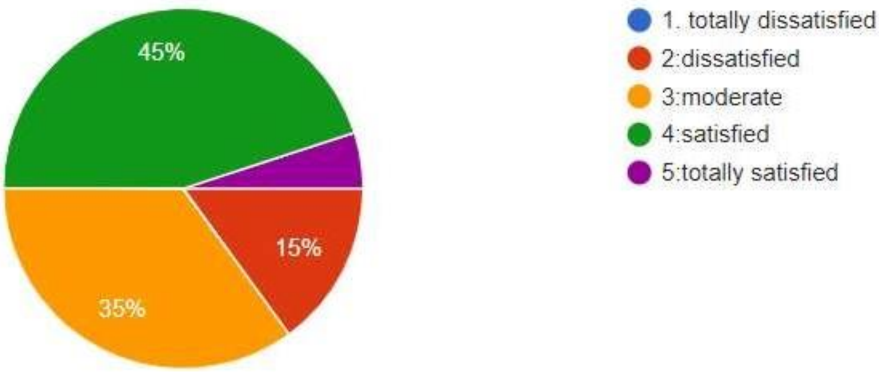
Needs of automation and self-empowerment



35% (n=7) of the participants indicate that are moderate about the needs of automation and self-empowerment while the same percentage is recorded for those who are satisfied. 25% (n=5) are dissatisfied and only 5% (n=1) are totally satisfied. It seems that no one is totally dissatisfied.

Need of automation and tools – Social and transversal skills



Almost the half of the participants 45% (n=9) indicate that are satisfied about the needs of automation and tools regarding social and transversal skills, 35% (n=7) are simply moderate, 15% (n=3) are dissatisfied while 5% (n=1) are totally dissatisfied. It seems that no one is totally dissatisfied.

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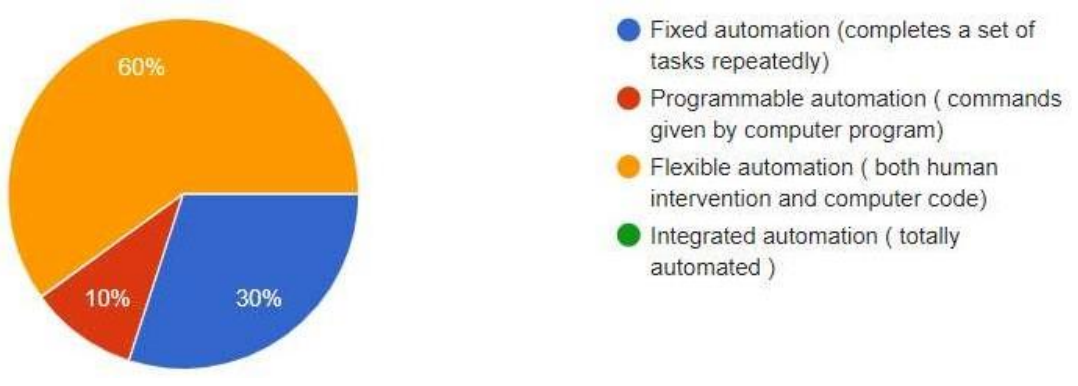
Automation trends



60% (n=12) of the participants have noticed flexible automation (both human intervention and computer code) in their fieldwork, 30% (n=6) fixed automation (completes a set of tasks repeatedly while 10% (n=2) programmable automation (commands given by computer program). Integrated automation (totally automated) gathers no percentage.

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Skills Lad 21+

2020-2021 Funded program for 2014-2020	*Theofano Papakonstantinou*

Element	Guiding questions
Type of document (optional)	*Website, Learning portal, Educational material*
Publisher (optional)	*IEP INSTITUTE OF EDUCATIONAL POLICY*
Target audience	*The target audience of the events varies across the workshops and generally appeals to a target audience that includes children and young people between the ages of 5-17. Επιμορφωτικό Πρόγραμμα «Επιμόρφωση των εκπαιδευτικών στις δεξιότητες μέσω εργαστηρίων» (MIS 5092064):*
Objective	*The aim of this program is to train educators with the goal of developing their skills to create and implement pilot STEM and robotics programs in schools of all levels. The program encompasses various thematic units, and corresponding educational materials have been created for each thematic area. Furthermore, these activities are integrated into the framework of the Institute of Educational Policy, specifically within the 'Skills 21+ Workshops,' with a focus on the 'Create and Innovate – Creative Thinking and Initiative' category.*
Location /geographical coverage	*It encompassed educators from all educational levels across Greece who participated in the educational program following an invitation to express their interest and submit a statement of participation. They engaged in the program remotely through an online platform for education, and the educational materials remain available for continued use*

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Introduction	*Skill Labs educational workshops aim to enhance the skills and professional development of educators. These workshops provide opportunities for training, education, and specialization in various areas related to education, with the goal of improving their skills and delivering high-quality educational experiences to their students.* *Skill Labs workshops focus on topics such as creative thinking, initiative, and 21st-century skills, thereby enhancing the educational abilities of educators. This helps prepare them to meet the needs of the educational system and provide high-quality education to their students.*
Stakeholders and Partners	*The beneficiaries or target group of the Skill Labs educational workshops are primarily educators, including teachers, instructors, and educational professionals at all levels of education in Greece. These educators participate in the workshops to enhance their skills and professional development in various aspects of education.* *The users of this good practice are the educators themselves, as they directly benefit from the training and educational opportunities provided by Skill Labs. The ultimate beneficiaries, however, are the students in Greek educational institutions who benefit from the improved teaching and innovative educational practices that educators acquire through Skill Labs.*
Validation*	*The program has undergone a pilot implementation, and the educational material is continuously enriched and updated. The material has been developed following thorough research involving educators and experts in the field.*

Impact	*What has been the impact (positive or negative) of this good practice on the beneficiaries' - both men and women - livelihoods? Please explain how the impact may differ between men and women. Have these beneficiaries' livelihoods been environmentally, financially, and/or economically improved (and if applicable, become more resilient), and if yes how?* *The impact of the Skill Labs educational workshops on the livelihoods of beneficiaries, both men and women, can be substantial and multifaceted. However, it's important to note that the specific impact may vary among individuals and contexts. Here's an overview of how the impact may differ and how beneficiaries' livelihoods may be environmentally, financially, and economically improved:* 1. *Professional Development and Career Advancement:* ***Positive Impact****: Both men and women educators can experience improved professional development, enhanced teaching skills, and career advancement opportunities. This can lead to higher job satisfaction and potentially better job security.* 2. *Quality of Education:* ***Positive Impact****: As educators gain new teaching skills and innovative approaches through Skill Labs, the overall quality of education can improve. This benefits both male and female students, as they receive a more engaging and effective learning experience.* 3. *Gender Equity and Empowerment:* ***Positive Impact for Women****: Skill Labs can empower female educators by providing them with equal opportunities for professional development. This can contribute to gender equity in the education sector.* 4. *Resilience and Adaptability:* ***Positive Impact****: Skill Labs may equip educators, both men and women, with the ability to adapt to changing educational environments and challenges. This resilience can enhance their job stability and economic security.* 5. *Innovation and Creativity:* ***Positive Impact****: Educators who participate in Skill Labs may become more innovative and creative in their teaching methods. This can lead to improved student engagement and learning outcomes.*

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6. *Environmental Impact (if applicable):* ***Indirect Positive Impact****: While Skill Labs primarily focus on pedagogical skills, the innovative teaching methods learned may include environmental education components. This can help raise awareness of environmental issues among students, indirectly contributing to environmental sustainability.*

7. *Financial and Economic Impact:* ***Positive Impact****: As educators enhance their skills and effectiveness, they may become more valuable in the job market, potentially leading to higher salaries or opportunities for additional income through consulting, tutoring, or curriculum development. It's essential to recognize that the impact of Skill Labs can be especially valuable for female educators, as it can promote gender equality in the education sector and provide them with opportunities for career growth. Overall, the positive impact on both men and women can contribute to the overall improvement of the education system in terms of quality, innovation, and adaptability.*

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Innovation	*The Skill Labs educational workshops have contributed to innovation in the livelihoods of the target group, which primarily includes educators, in several ways:* ***Innovative Teaching Methods****: Skill Labs introduce educators to innovative teaching methods, pedagogical approaches, and educational technologies. This empowers them to move beyond traditional teaching practices and engage students more effectively.* ***Technology Integration****: Educators learn to integrate technology and digital tools into their teaching, fostering digital literacy among students and preparing them for the digital age.* ***Creative Problem Solving****: Skill Labs emphasize creative problem-solving and critical thinking skills, which educators can then pass on to their students. This encourages a more innovative mindset among learners.* ***Adaptability****: Educators become more adaptable and resilient in response to changing educational environments and challenges. This adaptability allows them to better address the diverse needs of their students.* ***Student-Centered Learning****: Educators are encouraged to shift towards student-centered learning, where students take an active role in their education. This fosters innovation by allowing students to explore their interests and pursue self-directed learning.* ***Cross-Curricular Projects****: Skill Labs may promote cross-curricular projects and collaboration between educators from different disciplines, fostering innovative and holistic learning experiences for students.* ***Professional Development****: Skill Labs offer ongoing professional development opportunities, ensuring that educators stay updated with the latest innovations and best practices in education.* *Overall, Skill Labs contribute to an innovative educational ecosystem, empowering educators to embrace new teaching methods, technology, and pedagogical approaches. This, in turn, enhances the learning experience for students and prepares them for a rapidly changing world.*
Lessons learned	*Key Messages and Lessons from Skill Labs:* • *Lifelong Learning: Continuous professional development is essential for educators.* • *Innovative Teaching: Embrace innovative methods to enhance education quality.* • *Empowerment and Equity: Equal opportunities empower educators and promote gender equity.* • *Student-Centered Approach: Student-focused learning improves engagement and outcomes.*

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Sustainability	*To ensure the institutional, social, economic, and environmental sustainability of the Skill Labs good practice, several key elements should be put into place:* *Institutional Sustainability:* ***Curriculum Integration**: Integrate Skill Labs principles into formal teacher training programs and educational curricula to institutionalize the practice.* ***Training Infrastructure**: Establish dedicated training centers or online platforms for educators to access resources and continuous professional development.* ***Quality Assurance**: Implement mechanisms for ongoing quality assessment and improvement of the Skill Labs program.*
Replicability and/or up-scaling	*What are the possibilities of extending the good practice more widely?*
Contact details	*Create and Innovate – Creative Thinking and Initiative Institute of Educational Policy in Greece*
URL of the practice*	*http://iep.edu.gr/el/psifiako-apothetirio/skill-labs/913-dimiourgo-kai-kainotomo*
Related Web site(s)*	*http://iep.edu.gr/el/psifiako-apothetirio/skill-labs/1008-stem-steam*
Related resources that have been developed*	*What training manuals, guidelines, technical fact sheets, posters, pictures, video and audio documents, and/or Web sites have been created and developed as a result of identifying the good practice?*
**Optional*	

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Element	Guiding questions
Title	Skill Labs 21+
Publication date	202-2021
Author(s)	Theofano Papakonstantinou
Keywords	STEM Education, schools, robotics, educators
Language(s)	Greek
Format (optional)	Html - Website
Resource size (optional)	It’s a website that provides information and you can access the learning lessons and download them. There are categories and specific lessons plans.

CZECHIA

REPORT ON THE SURVEY

The "STEM Literacy Level Determination Survey of Adult Educators" is a comprehensive survey designed to assess various aspects of STEM literacy among educators. Here is a detailed report based on the survey findings:

1. INTRODUCTION

- **Objective**: This survey aims to understand the current levels of STEM literacy among adult educators, their teaching practices, challenges they face, and their perspectives on innovative teaching methods in STEM.

2. DEMOGRAPHIC INFORMATION

- **Partner Country Responses**: The majority of the responses (81.8%) came from Germany, with Greece and Turkey each contributing 9.1%.

- **Age Distribution**: The age range of respondents varied, with 45.5% being 30 years or younger, 9.1% in the 31-35 and 36-45 age groups, 36.4% in the 46-55 age range, and 9.1% being 56 years or older.

- **Gender**: 63.6% of the respondents were female, 36.4% were male, and none opted to not mention their gender.

3. PROFESSIONAL BACKGROUND

- **Field of Teaching**: Respondents teach a variety of subjects, including IT, Electrical Engineering, Math, Chemistry, Computer-Aided Design, and other STEM-related fields.

- **Teaching Experience**: The teaching experience of the educators varied, with 27.3% having less than 1 year of experience, 36.4% having 1-10 years, 9.1% having 11-20 years, 9.1% having 21-30 years, and 18.2% having more than 40 years of experience.

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STEM LITERACY LEVEL

- **Teaching Practices**: Educators reported various regular practices, such as presenting scientific knowledge, supporting students, using diverse teaching aids, organizing trips, and incorporating art activities.

- **Student Engagement**: The survey indicated that students regularly work on their own projects, conduct experiments, discuss lesson topics, and participate in activities that enhance their understanding and interest in STEM.

1. RESOURCES AND SUPPORT

- **Learning Resources Used**: A range of resources are utilized, including audio/video materials, presentations, electronic data collection tools, web-based resources, and software specific to STEM.

- **Desired Resources**: Educators expressed a need for additional resources such as robots, advanced calculators, lab materials, augmented reality tools, and individualized learning materials.

- **Support from Industrial and Educational Organizations**: Educators seek more support from industries and organizations in facilitating student visits, providing educational materials, and offering professional development opportunities.

2. CHALLENGES AND ICT UTILIZATION

- **Challenges in STEM Teaching**: Various challenges were highlighted, including insufficient classroom and computing resources, inadequate teacher training, and limited budgets.

- **Use of ICT for Professional Development**: A significant number of educators use computers, tablets, and smartphones for professional development, including searching for information, attending courses, and joining online communities.

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3. PERCEPTIONS AND POLICIES

- **Positive Vision of Innovative STEM Teaching**: About half of the respondents reported a positive vision shared by their colleagues and headmasters regarding innovative STEM teaching.

- **Mandatory STEM Study**: In terms of policy, 45.5% indicated that studying STEM is imperative in their field, another 45.5% said it's not mandatory but recommended, and 9.1% stated it depends on personal preference.

4. IMPACT OF INNOVATIVE METHODS

- **Innovative STEM Education Methods**: Educators believe that these methods positively impact student focus, effort, independence, understanding, memory retention, interest, and classroom cooperation.

CONCLUSION

The survey provides a comprehensive overview of the current status of STEM literacy among adult educators. It highlights the diverse backgrounds, teaching practices, challenges, and perceptions of educators in the field of STEM. The findings suggest a growing trend towards innovative and interactive teaching methods, the integration of technology in education, and the need for continuous support in professional development and resource allocation. This survey can guide policymakers, educational institutions, and educators in further enhancing STEM literacy and education practices.

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Ministry of Education, Czechia

Element	Guiding questions
Type of document (optional)	*Workshop Report*
Publisher (optional)	*Ministry of Education, Czechia*
Target audience	*Students aged 12-15*
Objective	*To enhance students' programming skills through hands-on workshops in coding and robotics.*
Location /geographical coverage	*Nationwide workshops held in various cities across Czechia.*
Introduction	*The STEM Education Enhancement Program in Czechia focuses on providing students aged 12-15 with practical exposure to science, technology, engineering, and mathematics (STEM) subjects. As part of this program, a series of coding and robotics workshops have been conducted to enhance students' skills and interest in STEM fields.*
Stakeholders and Partners	*Ministry of Education, Czechia* *Czech Association of STEM Educators* *Local schools and educational institutions* *Tech companies providing equipment and trainers*
Validation*	*The effectiveness of the workshops was verified through participant feedback and assessments. Post-workshop surveys indicated that 95% of students reported an increased interest in STEM subjects.*

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Impact	*The program has positively impacted students' academic performance and career aspirations. It has led to a higher number of students pursuing STEM-related fields in higher education, contributing to a skilled workforce in technology sectors.*
Innovation	*The program incorporates innovative teaching methods and the use of cutting-edge technology, such as robotics kits and programming software, to make STEM education engaging and relevant to students.*
Lessons learned	*The importance of hands-on learning experiences in STEM education.* *The need for sustained support and resources to maintain student interest in STEM.* *Tailoring workshops to different age groups and skill levels enhances learning outcomes.*
Sustainability	*Ensuring the sustainability of the program requires continued collaboration between the Ministry of Education, educational institutions, and industry partners. Adequate funding and resources must be allocated to maintain the workshops and expand their reach.*
Replicability and/or up-scaling	*The program's success demonstrates its potential for replication in other countries or regions. Key factors for replication include access to trained educators, suitable facilities, and partnerships with technology companies.*
Contact details	*Ministry of Education, Czechia*
URL of the practice*	
Related Web site(s)*	
Related resources that have been developed*	*Workshop manuals and materials* *Online coding resources* *Educational videos on robotics and coding*
**Optional*	

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Element	Guiding questions
Title	Enhancing STEM Education through Coding and Robotics Workshops in Czechia
Publication date	When (month and year) was the good practice documented/published?
Author(s)	Ministry of Education, Czechia
Summary	The STEM Education Enhancement Program in Czechia focuses on providing students aged 12-15 with practical exposure to science, technology, engineering, and mathematics (STEM) subjects. As part of this program, a series of coding and robotics workshops have been conducted to enhance students' skills and interest in STEM fields.
Keywords	STEM education, coding workshops, robotics workshops, student engagement, Czechia
Language(s)	English, Czech
Format (optional)	Workshop Report
Resource size (optional)	10 pages

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ROBOTIADA

Element	Guiding questions
Type of document (optional)	*Program Information*
Publisher (optional)	*Czech Robotiáda Organizing Committee*
Target audience	*Students and educators interested in robotics and STEM education.*
Objective	*The objective of Czech Robotiáda is to promote STEM education, particularly in robotics, by organizing robotics competitions and providing educational resources. It aims to inspire young minds to explore science and technology, develop problem-solving skills, and foster an interest in robotics and related fields.*
Location /geographical coverage	*Czech Republic (primarily), but it may have participants from neighboring countries in some cases.*
Introduction	*Czech Robotiáda is an annual robotics competition that brings together students from various age groups to design, build, and program robots to complete specific tasks and challenges. It provides a platform for students to apply their STEM knowledge and creativity in a fun and competitive environment.* *Up to 4 members in teams aged 0 - 19. They compete in 7 disciplines - autonomous Line follower; autonomous or remote-controlled "salvage" of a bear; Drag Race (LEGO and NeLEGO); Freestyle and for smallest robotics Freestyle WeDo.*
Stakeholders and Partners	*Czech Robotiáda collaborates with educational institutions, schools, local governments, and sponsors. Partners may include universities, companies, and organizations with an interest in STEM education.* *Competition partners:* *Helceletova Children's and Youth House, Robotárna branch* *www.robotikabrno.cz* *VIDA! science center* *www.vida.cz* *Artin* *www.artin.cz* *NXP* *www.nxp.com* *Kyndryl* *www.kyndryl.com* *FabLab Brno* *www.fablabbrno.cz*

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Validation*	*The success of Czech Robotiáda is measured by the number of participating teams, the quality of the projects presented, and the engagement of students and educators. Evaluation criteria include the performance of robots in the competition, teamwork, and problem-solving abilities.*

Impact	*Czech Robotiáda has a positive impact on STEM education in the Czech Republic by fostering interest and skills in robotics and related fields among students. It encourages teamwork, critical thinking, and creativity, which are valuable skills for future careers in STEM.*
Innovation	*Czech Robotiáda innovates by continually updating competition challenges to reflect advancements in technology and industry trends. It also provides online resources and support for participants, enhancing their learning experience.*
Lessons learned	✓ *The effectiveness of hands-on, project-based learning in fostering STEM skills and knowledge.* ✓ *The importance of creating a supportive and competitive environment that motivates students to excel in STEM fields.* ✓ *Strategies for engaging educators, students, and the community in STEM education initiatives.* ✓ *The benefits of collaboration between educational institutions, local governments, and industry partners in advancing STEM education.* ✓ *The value of promoting STEM education as a means of preparing students for future careers in technology and engineering.*
Sustainability	*Czech Robotiáda aims to maintain its sustainability by building long-term partnerships, seeking sponsorships, and continuously evolving its program to meet the changing needs of students and educators in the field of robotics.*
Replicability and/or up-scaling	*The Czech Robotiáda model can potentially be replicated in other regions or countries to promote STEM education through robotics competitions. It has the potential for upscaling by expanding to involve more schools and students.*
Contact details	*Mgr. Jitka Svobodová* *+420 602 617 056* *robotiada@helceletka.cz*
URL of the practice*	*https://robotiada.cz/*
Related Web site(s)*	*https://robotiada.cz/*
Related resources that have been developed*	
***Optional**	

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Element	Guiding questions
Title	Czech Robotiáda: Promoting STEM Education Through Robotics Competitions
Publication date	February 24, 2023,
Author(s)	Czech Robotiáda Organizing Committee
Summary	Czech Robotiáda is an annual robotics competition in the Czech Republic that engages students in STEM education by challenging them to design, build, and program robots to complete various tasks. This initiative aims to inspire interest in science and technology, enhance problem-solving skills, and promote collaboration among students.
Keywords	STEM education, robotics competition, Czech Republic
Language(s)	English, Czech
Format (optional)	Website, Competition Program, Educational Resources
Resource size (optional)	

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GERMANY

STEM LITERACY LEVEL DETERMINATION SURVEY REPORT

This survey is part of the Creating Employment Opportunities with Digital Empowerment (CODE) project, conducted within the EU Erasmus+ Programme. It aims to understand ICT teachers' perspectives on STEM education and analyze needs in the ICT-teaching field.

The questionnaire covers various topics, including demographic information, the extent of information and communication technology use in teaching, learning resources and materials used, the need for additional teaching resources, support expectations from private companies and organizations, the impact of insufficient resources on teaching, personal and professional development activities, support received for improving STEM teaching, sources of teaching materials, and perspectives on innovative STEM teaching methods.

Upon reviewing three more questionnaires from the STEM Literacy Level Determination Survey of Adult Educators, I have identified consistent themes and patterns across the responses. These surveys are part of the CODE project under the EU Erasmus+ Programme and aim to gather ICT teachers' perspectives on STEM education.

The main themes that have emerged from the analysis of these additional questionnaires include:

1. **Demographic Information**: Respondents from various age groups, predominantly male, with diverse years of teaching experience, have participated in these surveys.
2. **Usage of ICT in Teaching**: There's a notable emphasis on using various ICT aspects in teaching, such as presenting scientific information, conducting experiments, and using different teaching materials. This indicates a high level of integration of ICT in teaching methodologies.
3. **Learning Resources and Materials**: The responses show a wide range of learning resources being used, including written materials, audio/video materials, and specialized software. However, there are also expressed needs for additional resources like robots, simulations, and augmented reality tools.
4. **Support from Industrial and Educational Entities**: Teachers expect more support in the form of visits to industry companies, presentations by STEM professionals, and provision of teaching materials from private companies and organizations.

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5. **Impact of Resource Limitations**: The teaching experience is affected by factors like insufficient computers, lack of internet bandwidth, and inadequate pedagogical support. This highlights the challenges faced due to resource limitations.
6. **Personal and Professional Development**: Teachers actively use digital tools for their professional development and to enhance their subject knowledge. This includes searching for information, attending courses, and participating in online communities.
7. **Support for STEM Teaching**: Responses indicate that teachers receive support mainly from other teachers, ICT coordinators, and non-school STEM experts.
8. **Sources of Teaching Materials**: Teachers rely on various sources for their teaching materials, including educational institutions, internet resources, and self-searched materials.
9. **Vision of Innovative STEM Teaching**: Responses reflect a positive vision of innovative STEM teaching among colleagues and headmasters, though it's not mandatory in some countries.
10. **Impact of Innovative STEM Education Methods**: There's a strong belief that innovative methods in STEM education positively impact students' learning focus, effort, independence, understanding, and critical thinking skills.
11. **Use of ICT Tools in Education**: There is a strong agreement on the positive impact of using ICT tools in education, including enhancing students' learning skills, motivation, success, and preparation for work life.

These consistent themes across the surveys provide a comprehensive view of the current state of STEM education from the perspective of ICT teachers. They highlight the importance of ICT integration, the need for more resources and support, and the positive impact of innovative teaching methods on student learning.

Analysis of the Survey on the Level of Automation in Manufacture/Service Sector and Educational Need for STEM/ICT Questionnaire

General Structure of the Questionnaires

Each questionnaire appears to have a similar structure, focusing on:

- The level of automation in the respondent's domain of practice.
- The impact of automation on various manufacturing branches.
- The need for automation and tools in the workplace.
- Identification of automation trends in manufacturing and service sectors.

Analysis Process

The analysis will involve several steps:

1. **Data Aggregation**: Combining data from all questionnaires to form a comprehensive dataset.
2. **Data Cleaning**: Ensuring data consistency and handling any missing or outlier values.
3. **Descriptive Statistics**: Analyzing basic statistics like mean, median, mode, etc., for various responses.
4. **Trend Analysis**: Identifying patterns or trends in the responses, such as common levels of automation or areas needing more educational resources.
5. **Comparative Analysis**: Comparing responses across different sectors or questions to identify contrasts or similarities.
6. **Graphical Representation**: Creating charts or graphs to visually represent the data for easier interpretation.

Potential Insights

The analysis might provide insights into:

- The current state of automation in different sectors.
- Specific areas where educational resources are most needed.

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- Trends in automation technology adoption.
- Potential gaps between existing automation levels and the educational resources available.

To begin the analysis, I will need to extract the data from each questionnaire and compile it into a unified format. This will enable a comprehensive analysis of the overall trends and patterns in the responses. Let's start by extracting the data from each document.

I have reviewed the first questionnaire document, "questionnaire for companies (2)". Here is a summary of its structure and content:

1. **Level of Automation in the Domain of Practice**: Respondents are asked to rate the level of automation in their domain of practice, with options ranging from human decision-making with computer assistance to full computer control and decision-making.
2. **Manufacturing Branches Affected by Automation**: The questionnaire includes a section where respondents rate the impact of automation on different branches of manufacturing, such as computer-aided process planning, computer-supported design, and automated material handling systems.
3. **Need for Automation and Tools**: This section focuses on the respondent's perception of the need for automation and tools in the workplace, particularly in relation to self-empowerment and social and transversal skills.
4. **Identification of Automation Trends in Manufacturing and Service Sectors**: The last section asks respondents to identify their level of agreement with different types of automation trends in both manufacturing and service sectors, such as fixed, programmable, flexible, and integrated automation.

The second questionnaire, "questionnaire for companies (3)", follows a similar structure to the first one but with specific questions and rating scales. Here's a summary of its content:

1. **Level of Automation in the Domain of Practice**:
    - Participants rate the level of automation in their domain, ranging from manual decision-making to full computer control and decision-making. This includes various degrees of computer assistance in decision-making processes.
2. **Manufacturing Branches Affected by Automation**:
    - The questionnaire asks about the impact of automation on branches like computer-aided process planning, computer-supported design and manufacturing, computer numerical control machine tools, and more.

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3. **Need for Automation and Tools**:
    - Respondents rate the need for automation and tools in the workplace, focusing on aspects like self-empowerment and social and transversal skills.
4. **Identification of Automation Trends in Manufacturing and Service Sectors**:
    - Participants identify their level of agreement with different types of automation trends, such as fixed, programmable, flexible, and integrated automation.

This questionnaire uses a 5-point scale (from "totally dissatisfied" to "totally satisfied") for ratings, suggesting that it measures satisfaction or agreement levels with the statements provided.

The third questionnaire, "questionnaire for companies (4)", maintains the same structure and types of questions as the previous ones. It includes:

1. **Level of Automation in the Domain of Practice**: Respondents rate their domain's level of automation, considering different levels of computer assistance and decision-making.
2. **Manufacturing Branches Affected by Automation**: Participants rate the impact of automation on various manufacturing branches like computer-aided process planning, computer-supported design, and automated material handling systems.
3. **Need for Automation and Tools**: This section asks about the necessity of automation and tools regarding self-empowerment in the workplace and social and transversal skills.
4. **Identification of Automation Trends in Manufacturing and Service Sectors**: Respondents provide their level of agreement with different automation trends, such as fixed, programmable, flexible, and integrated automation.

The questionnaire uses a 5-point satisfaction/agreement scale, similar to the previous one.

With the consistent structure and questions across these questionnaires, it's clear that a unified analysis approach can be applied.

The fourth questionnaire, "questionnaire for companies (5)", is consistent with the previous documents in terms of its structure and content. It includes:

1. **Level of Automation in the Domain of Practice**: Respondents rate the level of automation in their domain, considering different degrees of computer assistance and decision-making.

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2. **Manufacturing Branches Affected by Automation**: Participants rate the impact of automation on various manufacturing branches, including computer-aided process planning, computer-supported design, and automated material handling systems.
3. **Need for Automation and Tools**: This section asks about the necessity of automation and tools in relation to self-empowerment in the workplace and social and transversal skills.
4. **Identification of Automation Trends in Manufacturing and Service Sectors**: Respondents provide their level of agreement with different automation trends, such as fixed, programmable, flexible, and integrated automation.

The questionnaire uses a 5-point satisfaction/agreement scale, which is consistent with the previous ones.

With this pattern established across multiple questionnaires, the data analysis can be streamlined to identify trends and insights.

These questionnaires, numbered from 2 to 5, as well as others in the series, are meticulously designed to gauge the level of automation in various manufacturing and service sectors, alongside the educational needs in STEM and ICT domains. My analysis focuses on the uniformity of structure across these questionnaires, the relevance of their content to current industry trends, and the potential insights that can be derived from their findings.

Uniform Structure and Consistency

Each questionnaire exhibits a consistent structure, which facilitates a streamlined analysis. This uniformity is key in ensuring that the data collected can be compared and contrasted effectively. The questionnaires primarily focus on:

1. **Level of Automation in Practice**: They seek to understand the extent of automation within the respondent's domain, ranging from minimal computer assistance to complete computer control and decision-making.
2. **Impact on Manufacturing Branches**: A critical aspect examined is how different branches of manufacturing, such as computer-aided process planning and automated material handling systems, are influenced by automation.
3. **Need for Automation Tools**: These surveys delve into the perceived necessity of automation in enhancing workplace empowerment and social skills.
4. **Trends in Automation**: A significant portion is dedicated to identifying trends in automation within manufacturing and service sectors, covering aspects from fixed to integrated automation.

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Relevance to Industry Trends

The questionnaires are notably aligned with current industry trends. They not only assess the level of automation but also explore the broader implications on workforce skills and organizational needs. This is crucial in understanding the evolving landscape of manufacturing and service sectors, where automation is not just a technological upgrade but a transformative force reshaping skills, jobs, and industry practices.

Potential Insights and Applications

The aggregated data from these questionnaires promise valuable insights. For instance, they can reveal patterns in the adoption of automation technologies across different sectors, highlight specific areas where educational resources are most needed, and provide a nuanced understanding of the gap between current automation levels and available educational resources. These insights are vital for stakeholders, including policymakers, educational institutions, and industry leaders, to make informed decisions about workforce development, technological investment, and strategic planning.

Conclusion

In conclusion, these questionnaires represent a well-thought-out effort to capture the nuances of automation in the contemporary industrial landscape. The uniformity in their structure assures the reliability of the data, while their content remains highly relevant to ongoing industry shifts. The analysis of this data will not only provide a snapshot of the current state of automation but also guide future strategies for education, workforce development, and technological advancement.

Wendelstein 7-X stellarator

12 September 2023	*Hatice UZUĞ*

Element	Guiding questions
Type of document (optional)	
Publisher (optional)	
Target audience	*The primary audience for the Wendelstein 7-X project includes researchers, scientists, and engineers working in the fields of plasma physics, nuclear fusion, and energy research.* *The project also aims to inform policymakers, the general public, and the international scientific community about advancements in fusion research and its potential impact on future energy solutions.*
Objective	*The main objective of Wendelstein 7-X is to explore the feasibility of nuclear fusion as a clean and sustainable energy source. It seeks to achieve a stable and controlled fusion reaction, demonstrating the potential for harnessing fusion for electricity generation.*
Location /geographical coverage	*Wendelstein 7-X is located at the Max Planck Institute for Plasma Physics in Greifswald, Germany.* *The project's geographical coverage extends internationally through collaborations with research institutions and experts from various countries.*
Introduction	*Wendelstein 7-X is a stellarator fusion device designed to confine and study high-temperature plasma, with the ultimate goal of achieving a sustained nuclear fusion reaction.* *Construction began in 2005, and the device became operational in 2015.*

	It is one of the largest and most advanced stellarators in the world, featuring a unique three-dimensional magnetic field configuration.
Stakeholders and Partners	*the German federal government, the European Union, and international collaborators.* *Collaboration with international partners, such as the United States, Japan, and others, enhances the scientific and technical expertise involved.*
Validation*	*Validation involves conducting experiments to test the stability of the plasma and the effectiveness of the stellarator design.* *Experimental data is rigorously analyzed and validated using advanced computational models.*

Impact	*The Wendelstein 7-X project has a significant impact on the field of fusion research, contributing to scientific understanding and potential breakthroughs in controlled nuclear fusion.* *If successful, the project could pave the way for the development of a new, sustainable, and virtually limitless source of energy.*
Innovation	*The three-dimensional stellarator design represents an innovative approach to magnetic confinement, aiming to overcome some of the challenges associated with traditional tokamak designs.* *The project incorporates cutting-edge technology in diagnostics, materials science, and computational modeling.*
Lessons learned	*Lessons learned from Wendelstein 7-X include insights into plasma behavior, magnetic confinement, and the challenges associated with achieving and maintaining controlled nuclear fusion.* *Continuous refinement of the experimental and design approaches based on acquired knowledge.*
Sustainability	*While the primary focus is on the sustainability of energy production, the Wendelstein 7-X project itself adheres to sustainable practices in terms of resource use and environmental impact.*

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Replicability and/or up-scaling	*The lessons learned from Wendelstein 7-X contribute to the broader field of fusion research, potentially informing the design and operation of future stellarators and fusion devices.* *The knowledge gained can be applied to other fusion projects worldwide, supporting the global effort to develop practical fusion energy.*
Contact details	*Max Planck Institute for Plasma Physics* *Wendelsteinstraße 1, 17491 Greifswald, Germany*
URL of the practice*	
Related Web site(s)*	https://dzlm.de/en/international-visitors
Related resources that have been developed*	*Research papers, publications, and technical documentation related to Wendelstein 7-X are available through the Max Planck Institute for Plasma Physics and scientific journals.* *The official website of the Wendelstein 7-X project provides updates and resources.*
**Optional*	

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MINT	
12 September 2023	*Hatice UZUĞ*
Element	**Guiding questions**
Type of document (optional)	
Publisher (optional)	
Target audience	*Students of All Ages: MINT education is designed to cater to students at various educational levels, including primary, secondary, and tertiary education.* *Educators and Teachers: Professional development programs target educators to enhance their capabilities in delivering effective STEM education.*
Objective	*Fostering Interest and Proficiency: The primary objective is to foster interest, curiosity, and proficiency in Mathematics, Computer Science, Natural Sciences, and Technology.* *Preparation for Future Careers: MINT education aims to prepare students for future careers in STEM fields, addressing the demand for a skilled and diverse STEM workforce.*
Location /geographical coverage	*MINT education is implemented across Germany, covering schools and educational institutions in various regions.* *The approach is not limited to specific geographic locations and is part of the national education strategy.*

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Introduction	*MINT is an acronym in German that stands for "Mathematik, Informatik, Naturwissenschaften, und Technik," which translates to Mathematics, Computer Science, Natural Sciences, and Technology.* *MINT education emphasizes a hands-on, inquiry-based learning approach to make STEM subjects engaging and relevant to students.* *Early Exposure: MINT education starts early in the curriculum, with a focus on hands-on and inquiry-based learning methods to make STEM subjects engaging for young learners.* *Curricular Integration: STEM subjects are integrated into the regular curriculum, ensuring that students encounter these subjects throughout their educational journey.* *Extracurricular Activities: Beyond the classroom, students are encouraged to participate in MINT-related extracurricular activities such as science clubs, coding clubs, and science fairs.* *STEM Competitions:* *National and International Competitions: Germany hosts and participates in various STEM competitions for students, providing a plaGorm for them to showcase their skills and innovations.* *Recognition and Rewards: Competitions often come with recognition and rewards, motivating students to excel in STEM subjects.* *Digitalization and Technology Integration:* *Use of Technology: Integration of technology, including digital tools and simulations, is emphasized to enhance the learning experience.* *Coding Education: There is a focus on teaching coding and computer science skills, recognizing their increasing importance in various industries.* *Gender Equality in STEM:* *Promoting Diversity: Efforts are made to encourage girls and underrepresented groups to pursue STEM education and careers, promoting gender equality in these fields.*

	University and Industry Pathways: *Clear Educational Pathways: Clear pathways are established for students to transition from school to university and, ultimately, to careers in STEM fields.* *Internships and Apprenticeships: Opportunities for internships and apprenticeships provide practical experience and connections with potential future employers.*
Stakeholders and Partners	*Government: The German government plays a crucial role in supporting and promoting MINT education through policies, funding, and educational initiatives.* *Educational Institutions: Schools, universities, and research institutions are key stakeholders involved in implementing MINT education.* *Industry Partners: Collaboration with industries and businesses is essential for providing real-world context, resources, and support.*
Validation*	*Assessment Methods: Continuous monitoring and assessment methods are used to evaluate the effectiveness of MINT education programs.* *Standardized Testing: National and international standardized testing may be used to assess students' proficiency in STEM subjects.*

Impact	*Increased Interest: MINT education has contributed to an increased interest in STEM subjects among students.* *Preparation for Careers: Students exposed to MINT education are better prepared for pursuing careers in STEM fields, contributing to a skilled workforce.*
Innovation	*Hands-On Learning: The innovative aspect lies in the emphasis on hands-on and practical learning experiences.* *Digitalization: Integration of digital tools, coding education, and technology in MINT programs represents an innovative response to the evolving needs of the digital age.*

Lessons learned	*Continuous Improvement: Lessons learned from the implementation of MINT education contribute to continuous improvement in curriculum design, teaching methods, and overall program effectiveness.* *Flexibility: Adapting to changes in technology and industry demands requires a flexible approach to MINT education.*
Sustainability	*Integration into Curriculum: The integration of MINT subjects into the regular curriculum ensures the sustainability of STEM education over the long term.* *Teacher Professional Development: Ongoing professional development for teachers ensures that they stay updated with the latest advancements in STEM education.*
Replicability and/or up-scaling	*The success of MINT education in Germany allows for potential replication and upscaling in other educational systems.* *The MINT education model has influenced STEM education initiatives in other countries, showcasing its potential for global relevance.*
Contact details	*The contact details for specific MINT education initiatives may vary. For broader inquiries, the German Federal Ministry of Education and Research (BMBF) is a key contact point.*
URL of the practice*	
Related Web site(s)*	
Related resources that have been developed*	*The BMBF and educational institutions provide resources such as curriculum guidelines, teaching materials, and information about MINT education initiatives.* *Educational websites, publications, and conferences focused on MINT education offer additional resources for educators and stakeholders.*

**Optional*

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