ICSE International Centre for STEM Education Science Factory

D3.1

BEST PRACTICE EXAMPLES OF INTERACTIVE CAREER TALKS

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Information about the report
D3.1 / WP 3
Publication date: 29/11/2025.
Report/WP title: Best practice collection career talks / WP3 Interactive career talks

Project Information
Agreement no. 101093387
Project title: ICSE Science Factory
Project acronym: ICSEfactory
Start date of project: 01/01/2023
Duration: 38 months
Program: Horizon 2020-CSA

Contact Information
Coordinating Institution: University of Education Freiburg, International Centre for STEM Education (ICSE)
Coordinator: Prof. Dr. Katja Maaß
Project Manager: Elena Schäfer
Authors: Matija Bašić, Matea Dvoršćak, Petra Vidović
Lead partner for this report/WP: Faculty of Science / WP3
Website: https://icse.eu/international-projects/icse-factory/

This report is based on the work within the project ICSE Science Factory (ICSEfactory). Coordination: Prof. Dr. Katja Maaß, International Centre for STEM Education (ICSE) at the University of Education, Freiburg. Partners: ICSE at University of Education Freiburg, Albert-Ludwigs-Universität Freiburg, Schülerforschungszentrum Südwürttemberg, Germany, Instituto de Educação da Universidade de Lisboa, Instituto Superior de Engenharia de Lisboa, Camara Municipal de Lisboa, Portugal, Faculty of Science University of Zagreb, Sveuciliste u Zagrebu Fakultet Elektrotehnike I Racunarstva, Hrvatsko Matematicko Drustvo – Croatian Mathematical Society, Croatia, Hacettepe University, Once Ogretemen Vakfi – Teachers First Foundation, Turkey, Edex – Educational Excellence Corporation Limited – University of Nicosia, Paidagogiko Institouto Kyprou – Cyprus Pedagogical Institut, Cyprus.

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

Table of Contents

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

1. Executive summary

The ICSE Science Factory is a project supporting the EU's efforts to address the shortage of scientists and scientifically informed citizens. Our aim at ICSE Science Factory is to create partnerships to improve science education for all citizens and promote science careers as part of societal development. To achieve this overall goal, some sub-goals have been defined. We are working to provide science activities for all citizens, increase the interest of young people, especially women, in science and create networks between different organizations in society, i.e. professionals and local community members. By fulfilling these objectives, we will address the shortage of scientists across Europe who are able to engage in scientific discourse and trust in the role of science in the problem-solving processes of modern society, which is essential for our society to remain safe and healthy.

Interactive career talks are an activity aimed at raising the interest of young people in science studies and science careers. Although the aim is to influence all genders, special focus is placed on female participants. We will try to overcome the stereotypical representation of science in general and of gender roles within science in particular. Science researchers and representatives from different types of enterprises chosen among partners, act as role models. They present their jobs, highlighting the relevance of their professions for society and the community, explicitly stating benefits and challenges of their profession, and covering gender aspects. We are proposing four different formats in which interactive career talks could be organized. When selecting the guest speakers, one is advised to consider the inclusion of a wide range of interesting careers as well as speakers from different age and gender, with an emphasis on, but not exclusively female speakers. It is important to provide role models who are underrepresented in their field.

Funded by the European Union

2. Objectives and basic information

The main aim of the ICSE Science Factory is to foster improved science education for all citizens by creating new partnerships in local communities, such as between teachers, students, scientists, researchers, innovators, and professionals in enterprises. There are three objectives to achieve the main aim:

- Objective 1: collaborative science learning opportunities for all citizens on a local level that show the relevance of science for real-life challenges and add to a lifelong learning continuum
- Objective 2: raise the interest in science studies and science careers of young people (of all gender and with a particular focus on girls/women).
- Objective 3: Foster networking and the sharing and applying of research findings amongst teachers, researchers, and professionals across different enterprises as well as local communities to create, circulate and use science to benefit society.

Interactive career talks (ICaT, hereinafter) are an activity aimed at raising the interest of young people in science studies and science careers. Although the aim is to influence all genders, bearing in mind that girls and women are still critically underrepresented in STEM areas (Sanchez-Tapia & Alam, 2020), special focus is placed on female participants. We aim to overcome the stereotypical representation of science in general and of gender roles within science in particular. However, it is still possible that young people are confronted with stereotypes in their families and among their peers; therefore, we have developed a comprehensive mentoring system. Figure 1 shows the timeline for the development of Interactive Career Talks.

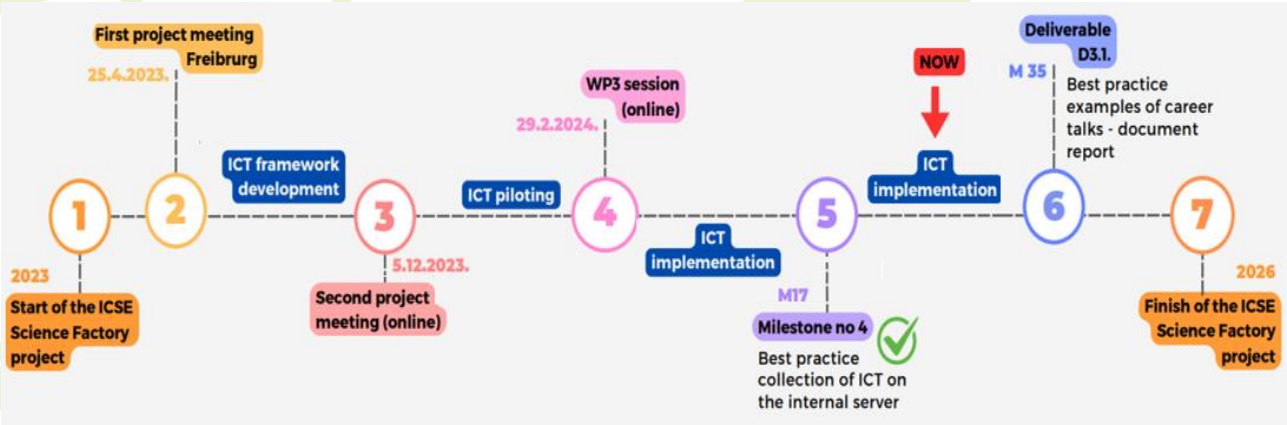


Figure 1. Timeline of developing Interactive Career talks

The leaders of this activity are consortium partners, both full and associated. Science researchers and representatives from different types of enterprises, selected from among the partners, act as role models. They present their jobs, highlighting the relevance of their professions for society and the community, explicitly stating the benefits and challenges of their profession and addressing gender aspects. Afterward, young participants are given the opportunity to engage in discussion and raise (critical) questions. The target groups include young people in the active phase of career orientation, as well as their families and community members. Table 1 shows the proposed number of implemented activities and participants per Interactive Career Talk.

Funded by the European Union

Table 1. Interactive career talks in numbers

Number of ICaT per country	10
Number of young participants per talk	10-15

With interactive career talks we aim to:

- Present a variety of science-related careers in order to expand the limited perception about diversity in STEM related occupations;
- Include role models who are underrepresented in their field, who actively combat the (gender-related) stereotypes;
- Enable young participants to express their opinions and concerns, and engage in discussions in order to help to reconstruct and overcome stereotypes;
- Emphasize the social dimensions of STEM related careers.

In the next chapter, we present the concept of interactive career talks and outline the four different formats in which **interactive career talks** could be organized.

Funded by the European Union

3. In search for ways to build science identity in ICSE Science Factory – Framework for interactive career talks

Project ICSE Science Factory aims to enhance access to science education, encourage science careers for young people and promote collaboration for societal benefit. It is based on a partnership of institutions from five countries, in which the development of science education and STEM careers is enriched by workshops, career talks, conventions, fairs and open schooling projects. These activities connect students and their science teachers to professionals and other members of their local community by providing a common goal of addressing relevant real-world challenges. The project consortium highlights the importance of science in everyday life and engages young individuals in a way that sparks further interest in pursuing STEM careers, so the role of the project is also to act as platform for activation of young people and for investigation of the quality of the interactions that might lead to it.

In choosing their university studies young people might rely on advice from their family members, teachers and peers, but also consider their own experience (no matter how limited they may consider it to be) to estimate and evaluate various positive and negative aspects of professions they aspire to, but in pursue of STEM careers one of the important factors that influence their decision is a certain sense of being a certain "kind of person", i.e. having a (developing) identity of a scientist.

The concept of **science identity** could be considered to stem from the theory of identity developed in Gee (1999) and has been a part of research in STEM education for more than two decades. The identity is, in part, defined as "the kind of person" one is seeking to be and enact in the here and (ibid, p. 13). A simple and effective model of science identity is given by Carlone and Johnson (2007) in a study on science experiences of women in colour. Considering that it develops in relation to racial, ethnic and gender identities of an individual, in this model science identity comprises of three factors: performance, recognition and competence. Performance relates to ways of working and thinking in a scientific field, which includes attitudes and norms about the procedures that scientists follow in their everyday work. Recognition is based on the values that a scientist materializes in their social environments (workplace or a wider scientific community), and also relates to perception that individuals have about themselves on a personal level. Competence is related to the understanding that a scientist has about their discipline, which comprises of concrete (although sometimes implicit) knowledge and skills.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

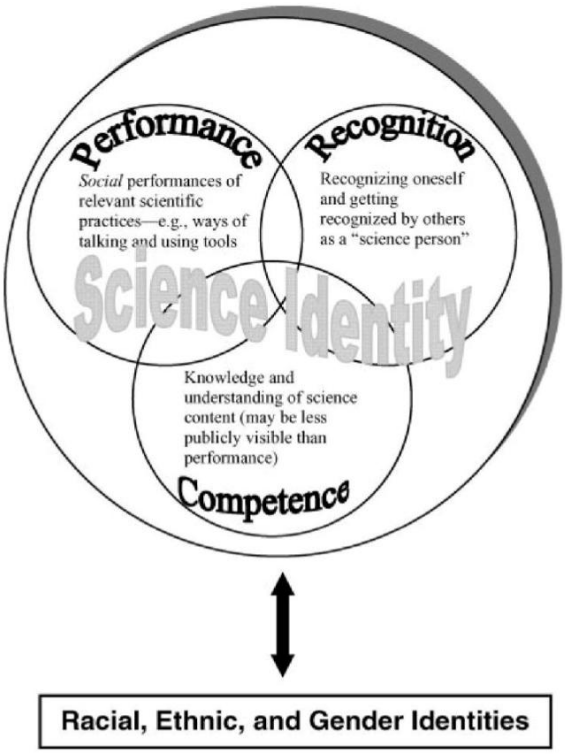


Figure 2. Model of Science Identity

Other authors have developed a variety of enhanced models more suited for specific contexts, e.g. Pfeifer et al. (2024) investigate the science researcher identity in the context of research training and justify their further development of the model by the lack of descriptive power to theorize how science identity might change when individuals are embedded within a specific science setting or is disconnected from knowledge and theory regarding how identities evolve in professional settings.

Within the ICSE Science Factory project, we are proposing to engage teachers in the exploration of the concept of science identity through reflection on their experience with various motivating activities and to organize ICaT for students that would develop various aspects of science identity (e.g. performance or recognition) through different ways of interaction with scientists and other STEM experts. We formulate different formats that are suited better for different goals and target groups, investigate examples of good practice and reflect on the challenges that appeared in the implementation of ICaT, only to arrive to more comprehensive set of insights and guidelines for future similar projects and activities.

Funded by the European Union

4. Formats for implementation of ICaT

We are proposing four different formats in which **interactive career talks (ICaT)** can be conducted (Table 2). It is proposed that from the 10 ICaT planned, at least one career day activity is organized. The rest of activities should be distributed depending on the age of young participants and the organizers' opportunities. Guest speakers serving as role models are chosen from the list of full partners (including science majoring students), attached partners (enterprises) and local community (parents). When selecting guest speakers, it is recommended to consider the inclusion of a wide range of interesting careers, as well as speakers of different ages and genders, with an emphasis on — but not limited to — female speakers. In ICaT with guest speakers, it is important to provide role models who are underrepresented in their field (OECD, 2023). For example, occupations such as a surgeon, computer programmer, electrical engineer, or chemist, are ranked as masculine professions (Couch & Sigler, 2001), therefore it would be beneficial to invite female speakers as role models for such occupations.

Table 2. Interactive career talk formats overview

	Target group	No. of guest speakers	Estimated duration	No. of participants
ICaT from a workplace	Elementary school	1-3	30-45 min	10-25
Parent scientist	Elementary school	1-3	30-45 min	10-25
Guest speaker in a school	High school	1-3	45-60 min	10-30
Career day	High school	5-10	4-6 hours	10-50

Research has shown that elementary school aged children already make important decisions about the type of career they think they are suited for and would like to have (Auger, Blackhurst & Wahl, 2005). Therefore, reaching not only young people at the stage of active engagement in job selection, but also children who are shaping their perceptions about science-related professions and finding their own footing within it, seems like an important aspect of this project. The primary emphasis of elementary school career guidance is to develop awareness and appreciation of various career choices (Magnuson & Starr, 2000), to challenge stereotypical thinking about different careers, and to help pupils see the link between their education and future employment (OECD, 2023). Consequently, the following two ICaT formats have been designed specifically for elementary school pupils.

4.1 ICaT from a workplace

ICaT from a workplace is a format of interactive career talk where young participants get introduced to a role model scientist at their place of work. This format can be implemented as a visit of a group of participants to a scientists' workplace or virtually, where participants (ideally pupils from one class) stay in their classroom, while the enterprise connects via an online communication platform. The virtual option of this ICaT model will be described in more detail below in this text.

A guest speaker establishes a video call from their workplace and starts the career talk with a short presentation of their organization and job description (max. 10 minutes). After the formal introduction, a guest speaker is invited to give a virtual tour of their workplace. For example, if the guest speaker is a scientist from the pharmaceutical sector, they can, during or after the talk, show

Funded by the European Union

the laboratory where they work, demonstrate some of the equipment they use, explain working conditions, etc., thus giving pupils the opportunity for a more visual and engaging representation of the career being presented.
Interactive career talk ends with a time reserved for pupils' questions and/or a conversation about pupils' interest in STEM careers. Questions such as:

- "What do you think that a computer programmer does?",
- "Who can be chemist?",
- "Why do you think that being employed as ecologist is important for the society?", etc.,

could be addressed during this interactive segment.

4.2 Parent scientist

Another appropriate format of ICaT for this age group is the **Parent Scientist** activity. School staff are encouraged to use parent-teacher conferences as an opportunity to learn about parents' professions and to motivate those working in STEM fields to participate in the activity.
Parents, acting as role models, attend one class and present their occupation. An additional aim of this activity is to foster a partnership between the school and the local community (i.e. parents), and to establish a foundation for a positive practice that can continue long after the ICSE Science Factory project has concluded.

4.3 Guest speaker in school

Guest speaker event at school is a short, in-person session typically organized for high school students who are actively engaged in their career orientation. The guest speaker is either an expert from our associated partners or a science student. This form of Interactive Career Talk (ICaT) is organized as a one-hour session, which includes a formal presentation by the guest speaker followed by an informal conversation with the young participants.
The expert is encouraged to prepare a 30-minute presentation covering some basic topics, such as:

- When and how their motivation for choosing a STEM career arose;
- Their study and career path;
- Projects they are currently working on or the most interesting project they have been assigned to;
- Benefits and challenges of their career choice and current employment; etc.

To assist the guest speaker in preparing for ICaT, general instructions should be provided in advance (see Appendix 1). After the formal presentation, participants are invited to join an informal conversation. It is encouraged to hold this part of the talk in a more relaxed setting, such as the school library, park, cafeteria, or similar.
The objective of this conversation is to engage young participants in an open discussion about their visions and fears, and to explore, deconstruct, and potentially overcome stereotypes and obstacles. To achieve this, both students and experts should be prepared for the discussion (see Appendices 2 and 3). Additionally, to help young participants develop relevant questions, details about the speaker's occupation, employer, and industry should be shared in advance (OECD, 2023).
An additional goal of this ICaT format is to encourage schools to continue organizing such activities beyond the ICSE Science Factory project, either by maintaining connections with our associated

Funded by the European Union

partners or, even more sustainably, by developing their own alumni system as part of long-term career guidance.

4.4 Career day

Career Day is designed as a comprehensive event organized by full partners from the consortium, with the active participation of guest speakers from our associated partners (i.e., enterprises). It is advisable to gather experts from various sectors to represent as wide a range of STEM careers as possible.

The young participants of Career Day are high school students in the active phase of their career orientation, seeking career guidance. The event follows the itinerary below:

- Short presentation by each guest speaker (10 minutes per speaker)
- Speed dating with guest speakers (5 minutes with each expert)
- Coffee break and informal conversation (60 minutes)
- Workshop (60 minutes)

For the short presentations, guest speakers are instructed to briefly cover topics such as their personal motivation for choosing their profession, their career path, and a description of their current work. Young participants are encouraged to take simple notes about each expert and to pose additional questions during the speed dating phase of the event.

If a student does not have a question for a particular expert, the expert will initiate a guided conversation using prompts such as:

- “What are your hobbies?”
- “What would you like to become in the future?”
- “Would you consider a career as a scientist or in a technology-related field?”
- “Why do you believe that science isn’t your strong suit?”

After meeting each expert during the speed dating round, students are encouraged, during the coffee break, to approach the expert they found most interesting. This allows them the opportunity to have a longer, more meaningful exchange with the role model of their choice.

Career Day concludes with a workshop for the young participants. For example, the workshop may focus on developing CV writing skills, job searching or interview techniques, expressing and deconstructing beliefs about one’s STEM skills and abilities, or exploring different occupations defined by ISCO (International Standard Classification of Occupations). Students may also be guided to identify desired occupations and articulate the reasoning behind their choices.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

5. Implementation of ICaT

5.1 The Piloting Phase

At the beginning of 2024, the piloting phase of the Interactive Career Talk (ICaT) activities **began**. Each consortium partner country selected one or more ICaT models most suitable for their context and implemented the activities in cooperation with their local partners (schools, universities, STEM-oriented enterprises, etc.).
Each ICaT event concludes with 10 minutes dedicated to filling out evaluation forms by the young participants, while the organizers—from the ranks of the international consortium—complete a reporting template (Figure 2) used to track the progress of the implemented ICaT activities.

INTERACTIVE CAREER TALK [Please add the name]

Country

Partners involved in the activity: [Please provide name of institutions involved]
[Please add the date]

- **Format:** [Please provide the format - guest speaker in a school, ICaT from a workplace, guided video activity, career day, parent scientist]
- **Name(s) and affiliation of speaker(s):** [Please provide name(s) of speaker(s)]
- **Duration of the activity:** [min]
- **Total number of participants:**
- **Number of female participants:**
- **Age range of participants:**
- **Minutes of the speech:** [Please provide a short overview of guest speakers presentation]
- **Topics of open discussion:** [Please provide topic(s) discussed during the open discussion, and questions posed]
- **Reflection:** [Please provide your reflective marks about the activity, e.g., key success factors, difficulties, reflection on participants' satisfaction]

[Please add 1-2 pictures]

Figure 3. ICaT template

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Until 31st of October 2024, 42 Interactive Career Talks were implemented across Europe (4 in Croatia, 6 in Cyprus, 12 in Germany, 13 in Portugal, and 7 in Turkey), with a total **participation of 1979 young people, of whom 1206 were female participants**. The Interactive Career Talks have been conducted with participants from different age categories (5-10, 11-14, 15-18, 19+).

The number and diversity of Interactive Career Talks conducted during the piloting period were sufficient to conclude that the partners had positive experiences regarding the organization and implementation of ICaT, and to provide a basis for guidelines for the continuation of the implementation.

5.2 General information on implemented ICaT activities

This overview provides a comprehensive insight into all ICaT activities implemented since the beginning of the ICSE Science Factory project. A summary by international consortium member is presented in Table 3 (for a comprehensive list of ICaT activities, please see Appendix 4).
Since the project began, a total of 93 ICaT activities have been organized, engaging 3,969 young participants, of whom 1,985 were female.
Given that the project originally aimed for each consortium member to implement 10 interactive career talks, with 10–15 participants per activity (approximately 120 young people per country and 600 in total across Europe), it can be concluded that the implementation has significantly exceeded expectations. This significant increase in participant numbers highlights the strong engagement and successful implementation of the ICaT activity within the broader scope of the ICSE Science Factory project.

Table 3. Distribution of ICaT Activities Across Consortium Countries

Country	Total no. of ICaT activities	Total no. of speakers	No. of female speakers	Total no. of participants	No. of participating females
Croatia	15	16	7	443	223
Cyprus	10	14	10	254	161
Germany	47	136	71	1319	690
Portugal	10	34	21	455	240
Turkey	11	24	16	1498	671
	93	224	125	3969	1985

The ICaT activities successfully engaged a diverse range of participants, with ages spanning from as young as 5 to adults up to 45 years old. While the majority of participants fell within the 12 to 18 age group, the project's reach extended beyond this core demographic, demonstrating its broad appeal across different age ranges. For instance, partners from Germany organized a series of ICaT activities combined with scientific workshops tailored specifically for younger children aged 8 to 10.

Funded by the European Union

On the other hand, colleagues from Turkey involved participants aged 25 to 45 in two of their activities, representing the oldest age group participating in the project. This wide age diversity highlights the flexibility of ICaT formats to effectively address the interests and learning needs of varied audiences throughout different stages of life.

5.6 About the guest speakers

In total, 244 guest speakers participated in ICaT activities. Most of them (125, i.e., 55.80 %) were female. The professional backgrounds of the guest speakers were highly diverse, ensuring comprehensive coverage of the project's three thematic areas and beyond. For example, within the thematic area of health, there were oral hygienists, dietitians, neuroscientists, and others. In the thematic area of digitalisation, some of the represented careers included computer engineers, mechatronics engineers, cybersecurity consultants, web designers, AI specialists, and more. Within the thematic area of the green deal and sustainability, there were university professors of agriculture, forest scientists, experts in renewable energy, and specialists in environmental education.
In addition, there were many mathematicians, physicists and astrophysicists, biologists, chemists, data analysts, and others.

5.5 Context in which ICaTs' were implemented

Most of the ICaT activities were conducted in schools (elementary or high schools), which is also evident from the fact that the "Guest speaker in the school" format was the predominant ICaT type, 72 activities were organized in this format. Not all ICaT activities from the "Guest Speaker" and "Parent-Scientist" formats (7 in total) were held in schools. Within this category, there were also a few special contexts worth mentioning, as they had a notable influence on the composition of participants or the level of engagement in the ICaT activities. For example, some ICaT activities were conducted in summer camps, such as a robotics camp. Another special context includes ICaT activities held as part of celebrations of specific days. In Croatia, for instance, one was organized to honour women who have contributed to STEM fields, particularly in recognition of Ada Lovelace. In Germany, one took place as part of a Girls' Day workshop.
The "ICaT from a Workplace" format was conducted seven times. This category also included some unique contexts. For example, one activity combined the workplace format with the guest speaker format: an astrophysicist was physically present with the participants, while his colleague joined live from a planetarium. Another notable example involved an ICaT from a workplace combined with a visit to a laboratory and hands-on research in the form of an LHA, concluding with participant interviews with professionals about their career paths, daily responsibilities, and work environment. A total of eight Career Day events were organized during the project. One particularly interesting example in this category was a Career Day organized by the students themselves. They expressed their preferences and needs regarding the selection of guest scientists, took part in sending invitations, and prepared questions for the panel. For more details, see the Best Practice example from Portugal.

Funded by the European Union

5.6 Topics of discussion

While presenting their career paths, the guest speakers also sparked engaging and thought-provoking discussions. Topics of discussion could be organized into several categories:

- **Informative topics related to the experts' fields**, such as: *Are more expensive cars necessarily safer (e.g., do they have better airbags)? What will the steering wheel of the future look like?* Current NASA missions. Interdisciplinary collaboration in space science. The future of satellite technology and its impact on society. The importance of mathematics in understanding global issues such as inflation and economic crises. *Why do we need energy?* Renewable and non-renewable energy sources. *Can we harness wave energy?* The role of digital marketing in entrepreneurship and its importance for reaching global markets. The role and potential of digitalization in global education. The impact of foreign language learning on global career opportunities. The advantages of online education platforms for students and their future potential. *What is technology transfer and how does it work? How can scientific research at universities be integrated into industry?*
- **Skills and competencies required**, such as: *What key mathematical competencies and knowledge must a project management office manager have? How are mathematical skills applied in economics and finance? What do you need to know to become a mechatronics engineer, industrial mechanic, technical draftswoman, or surgical mechanic? What key skills and strategies are needed to become a successful entrepreneur?*
- **The importance of school subjects for their work**, such as: *Given that I use computers and a calculator in my everyday work, why is mathematics important for my job?* The importance of physics in solving problems across all areas of natural sciences.
- **Discussion of different career options**, such as: Diverse employment opportunities for mathematicians (e.g., many companies from different sectors require mathematicians for process optimization). Career paths starting with a math degree. Finding the right path when having multiple areas of interest. *What can I do after graduating with a science degree?*
- **Topics related to productive disposition, motivation, and external influencing factors**, such as: *How important are discipline and studying in achieving success?* The influence of media and culture on career choices. Students discussing their personal experiences with mathematics and how it shapes their confidence. Balancing scientific work with creative thinking and business skills.
- **Topics aimed at capturing the attention of young participants**, such as: *What do Bruce Banner – Hulk, Peter Parker – Spider-Man, and Albert Einstein have in common? They are scientists.*
- **Discussion of gender stereotypes and challenges**, such as: The importance of guest speakers' interest in community engagement and gender aspects of their profession. Raising awareness about gender roles, stereotypes, and the importance of freedom in career choice. Empowering girls to freely choose careers according to their interests and talents, with a focus on girls in the energy sector. Discussing gender-based stereotypes in math-related fields. Posing questions such as: *Why do men get paid more? Why do men get promoted more easily and quickly than women? Why are men more easily recruited? Why do women accept lower-paid jobs that don't match their qualifications? How can you enhance your career while having a family and children?*

Funded by the European Union

5.7 Questions posed by young participants

Students, both from primary and secondary schools, actively participated in dialogues with scientists, asking a wide range of questions. These included inquiries about the scientists themselves, their career paths, daily work tasks, and various other topics of personal interest.
The variety of questions reflects not only the complexity of scientific fields and career paths but also the many factors that shape young people's attitudes toward certain professions. It further highlights the different aspects that spark curiosity and engagement among participants.
The questions can be grouped into the following categories:

- **Informative questions about the experts' fields**, such as: *What needs to be done to keep urban trees safe? What is the difference between rule-based arithmetic, puzzles, and mathematical research? How is AI used in your work? Why is programming important? How do you determine if a meteorite is real? What are the specialisations within geological engineering? What is the difference between chemistry and chemical engineering? Will your field of work become even more important in the future?*
- **Questions about work tasks and the organisation of work**, such as: *What does a major research project in physics look like? Do you spend a lot of time in the field? What does your typical workday look like? What are the key duties of a dietitian? Are you a doctor? What's the difference between a medical doctor and a doctor of social sciences?*
- **Questions about job satisfaction and motivation**, such as: *What do you enjoy most about your job as a physics teacher? Do you use your hobby, collecting meteorites, in your work? Is it more rewarding to work with primary school pupils or university students? What was it like to write a physics book? Do you prefer teaching or scientific research?*
- **Personal and lifestyle-related questions**, such as: *Why did you choose this profession? What do you like or dislike about your work? What inspired you to combine science and entrepreneurship? Who were your role models? How do you balance leisure time and income? Do you travel often? How much do you earn? Should we choose a career based on our interests or on how much money we can earn?*
- **Questions about career opportunities**, such as: *What industries can a biologist work in? What is the future of augmented reality? What careers are available in space science? Is it easy to be a scientist in Portugal? How important are foreign language skills for global opportunities in healthcare?*
- **Questions linking school subjects to careers**, such as: *How much physics and math do you need to become an astronaut? Do you use math in your daily work? What school subjects are most useful in your field?*
- **Questions about the next steps in education**, such as: *What math topics are covered in the first year of university? How is student life different from high school? What grades are needed to enter a trainee programme?*
- **Context-specific questions related to the students' own school projects**, such as: *How can we select a sample for our school project without surveying every student? Should we ensure gender balance among respondents? How can we improve the environmental sustainability of our school garden?*

Funded by the European Union

5.8 General atmosphere

The ICaT activities left a positive impression on the organizers. Overall feedback indicated that the sessions were well-organized and engaging. More specifically, organizers reflected on the high level of interest shown by the participants. Some examples of their key observations included: "*children are very interested and ask a lot of questions*" and "*many participants are expressing surprise and interest in math-related careers outside of teaching or academia*".
When commenting on the general atmosphere, some organizers observed that participants tend to focus more on the immediate next step, such as starting university studies, and less on long-term plans like future employment. Others noted that participants showed a higher level of engagement when the ICaT activity involved a hands-on component, that is, when it went beyond a standard lecture and included show-and-tell elements, opportunities to explore equipment directly, and chances to connect scientific concepts and skills with school subjects and prior knowledge.
Here are some examples of how organizers described the general atmosphere of the ICaT activities: *"a dynamic and inspiring experience, emphasizing the importance of inclusivity and innovation in science", "there was a great deal of involvement from the students, firstly because the presenter was a person known to the class, the father of a student, and secondly because of the story he created throughout the presentation", "the career talk was highly interactive and motivational, captivating students with insights into the latest technologies", "the level of student satisfaction was high and evident during the activity".*

5.9 Positive aspects and learning opportunities

Partners rated the ICaT activities as highly successful. Several elements were identified as particularly impactful, as they encouraged student participation, generated interest in the guest speakers and their career paths, fostered active discussions, and created meaningful learning moments. Below is a summary of the most positively highlighted aspects of the ICaT activities:

Inspiring personal stories about career choices

- Reflecting on the factors influencing career choice (e.g., hobbies and interests during elementary and high school years, such as being a math competitor).
- Sharing a personal story (e.g., a severe car accident in elementary school that caused the speaker to forget mathematics, and how they overcame the obstacles and eventually studied electrical engineering).
- Having an honest conversation about balancing personal and professional life – particularly relevant for female participants. A powerful example comes from an ICaT activity in Germany, where it was discussed how, for some women, starting a family can unfortunately mean ending their careers. However, it was also emphasized that today, women have more opportunities to build partnerships based on shared responsibility, enabling them to manage both family and career. One speaker explained how she navigated her career and the birth of her first child with support from her partner, while another shared how she coped with balancing her job and caring for her children after a divorce.

- Speaking about motivation and role models (e.g., career choices strongly influenced by a parent's profession).
- Addressing participants' concerns through personal experiences (e.g., in one ICaT activity in Germany, students expressed interest in multiple science fields and uncertainty about which path would be most fulfilling. The speaker shared her own experience of navigating similar doubts and how she eventually found clarity)

Using visual demonstrations, tools, artefacts etc.

- A presenter (physicist) showcased scientific equipment, giving participants the opportunity to examine and actively use the tools.
- A presenter (physics teacher) displayed meteorites from their personal collection (a hobby of theirs).
- A visual object was used as a conversation starter and an introduction to the speaker's profession – e.g., a guest brought an item from their daily workplace, showed it to the students, and asked: "Do you know what my job is?"

Hands-on approach and introduction of activities

- Combining the ICaT activity with simple experiments, lab work, workshops, or LHA-like activities significantly increased participants' interest and understanding of the presented career. This is supported by feedback such as:
  - *"Everyone was involved and, in turn, everyone used more specific instruments from the research laboratory, having, for a few hours, felt like 'little scientists.'"*
  - *"By actively participating in lab work, students developed a deeper connection with the scientists, enabling them to engage on a more personal level and ask pertinent questions."*

  - Including quizzes, for example, a physics quiz, proved to be a motivating tool, increasing engagement while simultaneously demonstrating how much physics knowledge students already had.

Learning opportunities, in the sense of introducing new theoretical concepts and connecting them with participants' existing knowledge

- Explaining theoretical concepts or notions familiar to participants that the presenter uses daily, e.g., in one ICaT conducted in Croatia, the guest speaker working at the National Bureau of Statistics explained the difference between a population and a sample, what types of samples exist, how to carry out sampling, etc.
- Including informative discussions on the guest speaker's field of expertise, e.g., one ICaT activity in Cyprus included a brief and informative discussion on asteroids, covering their composition, impact on Earth, and ongoing research in this area. The guest speaker, speaking from the planetarium, offered a visual demonstration that the students were able to view, enriching their understanding of asteroid science.
- Some ICaT sessions had a direct and practical impact on students' daily lives, e.g., increased attention to hand hygiene following a discussion on the role of hygiene in disease prevention.

Funded by the European Union

- Learning about different educational opportunities, especially in a digitalized world, including study options, online learning platforms, and the growing importance of digital skills in various professions.

Career growth and trajectory

- Guest speakers often shared their personal experiences of navigating non-linear career paths, helping participants understand that it is perfectly normal not to have everything figured out at an early age. These stories reassured students that uncertainty and change are part of every career journey. For example, one speaker described how they began their academic path in biology but later discovered a stronger interest in environmental science during their master's studies. Another shared their transition from studying pure mathematics to working in applied economics. Several lecturers highlighted that their CVs were far from 'straightforward'—yet they found fulfilling and meaningful work. These examples encouraged participants to stay open-minded, explore different fields, and remain confident even if their path doesn't follow a conventional trajectory.

Fun facts and interesting stories

- Including fun facts helps capture participants' attention and make the content more relatable. For example, one speaker mentioned that blue and orange M&M candies are "healthier" than those of other colours because natural dyes are used in their production.
- For very young participants, drawing connections between scientific careers and the world of superheroes proved effective. It helped students understand the wide variety of jobs that scientists can do, and reinforced the idea that science is all around us.

Including participants in the organisation of ICaT activities

- Allowing participants to express their wishes and needs regarding the selection of scientists to be invited to the ICaT activity.
- Preparing participants in advance by sharing brief information about the guest speaker.

Careful selection of guest speakers

- For example, combining speakers who represent different scientific fields, allowing students to compare areas that are mostly indoor (like mathematics) with those that are mostly outdoor (such as forest science).
- Including young guest speakers, whose age and relatable style help students connect better with their stories.

Overcoming prejudices

- For example, children from disadvantaged areas often believe that an academic career is elitist, unattainable, or that they must study in major cities. The ICaT activity, during which the guest speaker shared stories about his own family and the environment where he grew up, helped participants overcome these prejudices.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

5.10 Challenges

Although the ICaT activities were considered successful, several challenges emerged during their implementation. The following section outlines the key challenges identified by the partners:

- **Participants' interest** — it was observed that these activities tend to be more engaging for pupils already affiliated with STEM fields.
- **Asking questions** — participants were less willing to ask questions when the ICaT sessions included a large number of attendees (e.g., around 50).
- **Insufficient time allocated for ICaT** — comments included: "t*he discussion could have easily continued longer*," "*for some really interested groups, the 15 minutes allocated for questions and discussion weren't enough (many questions remained unanswered)*," and "*the greatest difficulty was actually finishing the session because of the students' enthusiasm*."
- **Organisational challenges** — for example, *"the biggest difficulty was reconciling the dates among all participants, so three gatherings were held to accommodate representatives from the largest number of courses suggested by students."* From a guest speaker's perspective: *"interaction with pupils would be easier if they wore name tags."*
- **Presenters' delivery style** — presenters showed varying levels of confidence in delivering content, engaging young audiences, and public speaking in general.
- **Gender influence** — for example, *"all the boys and none of the girls chose to interview the mechatronics technician; luckily, having a female mechatronics technician as the speaker helped counteract these biases."*

5.11 Selected insights from partners

The overview of ICaT activities implemented within the ICSE Science Factory project concludes by showcasing practices that partners have recognised as especially effective.

Partners from Cyprus concluded that the key to success has consistently been the word "interactive". Rather than traditional lectures or formal presentations, the most impactful talks were those that resembled a casual, two-way conversation between the scientist and the students. This approach encouraged active student participation and created a sense of comfort and curiosity, elements that traditional career guidance formats often lack.

Partners from Germany highlighted their long-standing practice of opening career talks with a consistent set of thought-provoking questions: "*How many already know what kind of career they want to have in the future?*", "*Making money vs. having fun at work?*", and "*Do you want to follow in your parents' footsteps?*"

They shared that it was particularly interesting to observe how well-informed some students already were about their desired career paths. Factors such as the anticipated needs of future society, economic trends, parental and peer influence, academic performance in certain subjects, and even media and films were among the motivations that shaped students' interests in specific careers.

ICSE International Centre for STEM Education · Pädagogische Hochschule Freiburg Université des Sciences de l'Education · University of Education · Funded by the European Union

6. Reflection and further perspectives

This chapter begins with an overview of the overall outcomes of the ICaT activities and the extent to which the intended goals were achieved, emphasizing both successes and areas for ongoing development. It then highlights key observations gathered during the implementation of the ICaT activities, which offer valuable insights and opportunities for enhancement in future initiatives. The chapter aims to reflect on aspects of the activities that can be further refined or expanded.

The ICaT activity successfully addressed and fulfilled all the intended objectives set out for the ICSE Science Factory project.

Firstly, **a broad spectrum of science-related careers was presented**, effectively challenging often narrow perceptions that young people may hold about professions in STEM. By showcasing a wide array of roles and professional paths, participants were exposed to the diversity and richness of STEM careers.

Secondly, **the activity featured role models who are underrepresented in their respective fields**, many of whom openly discussed their experiences and how they actively challenge (gender-related) stereotypes. Their personal stories not only provided inspiration but also gave participants real-life examples of success in the area that is often perceived as reserved only for men.

Moreover, **the ICaT sessions created a safe and open space for young participants to express their thoughts, concerns, and curiosities**. Through discussions, they were encouraged to share their opinions and even voice their fears regarding future career choices. These conversations were key in deconstruction of internalized stereotypes. The best example of this can be seen in ICaT from Turkey conducted in a school in a disadvantaged area, where many pupils hold the belief that higher education is unreachable for them. At the end of the event, one female participant stated: “I will also be a researcher at the university. I liked it very much.“

Finally, **the social dimensions of STEM careers were prominently highlighted**, illustrating how scientific work can impact communities, address societal challenges, and promote positive change. This helped participants to see STEM not just as technical fields, but as human-cantered and socially relevant domains.

These outcomes can also be understood through the lens of science identity, which emphasizes performance, recognition, and competence (Carlone & Johnson, 2007). By seeing authentic role models, challenging stereotypes, and engaging in dialogue about scientific careers, students were able to envision themselves as “the kind of person” who belongs in science. In this way, ICaT activities not only provided information about STEM careers, but also actively supported the development of students’ emerging science identities.

In conclusion, the ICaT activities provided valuable opportunities for participants to learn more about the diversity of STEM careers and the people behind them. Through open conversations and engaging interactions, the activity helped raise awareness, encourage reflection, and support a more inclusive view of science-related professions. Importantly, these outcomes resonate with the concept of science identity: by fostering recognition, performance, and competence, ICaT contributed not only to immediate career awareness, but also to the long-term development of young people’s sense of belonging in science.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Hands-On Science Careers

One important opportunity identified during the implementation of ICaT activities was finding effective ways to raise participants' interest and encourage active engagement in discussions and question-asking. This was particularly relevant for very young participants (around 10 years old or younger), whose attention span is naturally limited, especially during more traditional lecture-style sessions.
Originally, the proposed ICaT formats focused mainly on career presentations and interactive discussions with scientists. However, some partners enhanced the core ICaT activities by combining them with workshops and other hands-on experiences led by experts in their respective fields.
This combination significantly improved students' understanding of scientific careers and boosted their engagement. It also created more opportunities for meaningful interaction and dialogue between students and scientists, encouraging students to feel more comfortable asking questions and actively participating. Such hands-on experiences align with the competence and performance dimensions of science identity, as they allow students to see and practice authentic ways of working and thinking in science. By situating young learners in real scientific environments, ICaT activities helped them not only understand what scientists do, but also begin to recognize themselves as capable of engaging in these practices.

For example, partners from Cyprus reported very positive experiences with activities held in real-world environments, such as a VR lab and a biology lab. These sessions proved notably more effective than classroom-only formats. When students are physically situated in a scientist's actual working environment, the experience becomes more tangible, immersive, and inspiring. The setting itself tells a story, making students more likely to ask meaningful questions as they see science "in action." Equally important was the hands-on component: in several ICaT sessions, students participated in simple experiments, explored scientific tools, or interacted directly with digital resources. These practical, sensory experiences created a powerful bridge between theory and reality, enhancing both motivation and understanding.

A similar approach was adopted by partners from Germany when organising ICaT activities for 10- and 11-year-olds. Their sessions began with experts introducing themselves and their careers for approximately 20 minutes, followed by a question-and-answer segment for the pupils. This formal part was then complemented by a 2.5-hour workshop led by the experts, covering topics from their fields of expertise (e.g., constructing cars, programming robots). During this extended period of close collaboration, pupils had the opportunity to ask more questions about the experts' careers. The organisers observed that this integrated format works very well because being in close contact with the experts makes pupils feel more comfortable and eager to learn more about potential career paths.

Balancing Presence and Accessibility in ICaT Activities

Organizing an ICaT event offers valuable opportunities to develop flexible approaches that balance the availability of students with the busy schedules of scientists. This coordination becomes especially important during Career Days, where multiple experts need to be present simultaneously. For example, our partners in Portugal successfully adapted by splitting their Career Day across three different dates to ensure full participation from all scientists.

Funded by the European Union

ICaT activities are unique, face-to-face events that bring together participants in a specific time and place, fostering direct and meaningful interaction. While this in-person engagement remains a core strength of ICaT, exploring alternative formats that preserve interactivity can help reach a wider audience and extend the impact of these experiences.
Building on this, a few additional ICaT formats have emerged to broaden participation. Two such examples include a **guided video activity** and **a science podcast**.

A guided video activity is a form of interactive career talk in which the leader of the activity plays a pre-prepared video to the participants, segment by segment, with breaks for dialogue and the implementation of the activity (for the example of such activities see Appendix 5). This ICaT form is intended for the youngest age group, primarily children in kindergarten and primary school, although it can also be suitable for participants of higher grades of elementary school. STEM companies and scientists independently, with instructions, record video material for the presentation of a career in STEM. The material is then edited in four segments: getting to know the working environment, the profession and work tasks, the employee and his interests and final words. Depending on the age of the participants of the guided video activity, certain segments can be skipped. One video material contains the presentation of a number of different professions, while the implementation of the activity is flexible, depending on the organizer's capacity.
Guided video activities offer numerous advantages, especially when working with younger participants. Here are some of the key benefits:

- They allow participants to explore a wide range of STEM professions with minimal logistical demands, making them easy to implement in different educational settings.
- They encourage participants to reflect on and express their thoughts about various careers—sharing their views on the importance of different professions, the complexity of certain tasks, and the diversity of personal interests—thus promoting critical thinking and personal engagement.
- The combination of media—a live facilitator and pre-recorded video content—helps maintain attention and increases engagement, especially among younger children.
- The format naturally supports differentiated instruction, as it allows educators to adapt the discussion and follow-up activities based on the age, interests, and abilities of the group.
- Younger children, particularly those in kindergarten or early primary school, often struggle to maintain focus during traditional lectures. This format alternates between short video segments and interactive moments, such as questions, discussion, drawing, acting, or creative writing, which helps sustain their attention and involvement.
- It provides opportunities for creative expression, allowing children to connect with scientific content through art, storytelling, or roleplay—approaches that feel natural and enjoyable at that developmental stage.
- Because the scientist's workplace is shown in the video, children can see real-world environments and tools, helping to demystify science and make it more relatable—without the need to visit the location in person, which is often difficult to arrange for very young children. Moreover, this format allows the experience to reach children in remote or disadvantaged areas, who might otherwise have limited opportunities to engage directly with science or explore authentic scientific settings.

A science podcast is an interactive audio format where students actively participate by asking questions about topics they are curious about. During the conversation, students gain insights

Funded by the European Union

directly from experts in the field, deepening their understanding of scientific concepts. At the same time, the discussion addresses key ICaT themes such as career paths, social skills in science, gender issues, and stereotypes, making the podcast an effective format to support these objectives.
The proposed podcast format would involve a small group of students, such as four middle or high school students, engaging with a STEM professional, like an engineer or scientist. This setup encourages a dynamic exchange, where students feel comfortable expressing their curiosity and experts share their knowledge in an accessible way.
Importantly, the fact that students lead the conversation by asking their own questions ensures that their perspectives and interests remain central, fostering authentic interaction between young learners and scientists. Additionally, because podcasts can be accessed anytime and by many listeners over the years, this format significantly broadens the reach and impact beyond the originally envisioned ICaT activities.

Tips & Tricks for Engaging Young Audiences in ICaT Activities

One important opportunity identified during the implementation of ICaT activities concerns the presentational skills and engagement techniques of guest speakers. While scientists received brief guidelines on structuring their talks, it became apparent that many would benefit from additional support in knowledge-sharing and presenting, especially when working with young audiences. Most speakers had limited experience with classroom dynamics, attention management, and interactive techniques, which sometimes led to nervousness and moments of reduced student engagement.

Recognizing this, we see a valuable opportunity to equip scientists with practical tools and guidance to help them feel more confident and communicate more effectively. To support this, we have developed a concise, practical leaflet offering concrete tips on talk structure, interaction techniques, and confidence-building strategies (see Appendix 6). This resource draws on insights gathered from the analysis of ICaT activities within the project, as well as the rich experience shared by our partners. Below, we present key “Tips & Tricks” to help ensure successful ICaT sessions.

Tips & Tricks for a successful ICaT

Be Authentic and Personal

- *Share a personal story*. Real-life anecdotes always capture students’ attention and encourage more questions about your background and career path.
- *Be open about challenges*. Honest conversations about difficult topics—such as work-life balance or gender-based discrimination, spark engagement and are especially meaningful for young girls looking for relatable role models.
- *Highlight imperfect career paths*. Talking about non-linear or uncertain career journeys helps reduce pressure on participants to "have it all figured out" and shows that success can come through exploration and change.
- *Originality matters*. The most memorable talks are those where scientists speak authentically, share personal ups and downs, and reveal aspects of their work not found in textbooks. These honest moments resonate strongly, especially with girls.

Connect with Students' Reality

- *Relate science to school and everyday life.* When scientific skills and concepts are linked to school subjects or familiar topics, it enhances the relevance of the talk and boosts students' motivation.

Funded by the European Union

- *Include students in the organization*. Let students help choose the guest, write the invitation, prepare questions, or moderate the session. This increases students' sense of involvement and engagement.

Use Visual and Interactive Tools

- *Use visual aids and objects*. Tools, artefacts, or materials from the speaker's workplace can spark curiosity and serve as conversation starters—e.g., begin with: "Can you guess what my job is?" to create mystery and interest.
- *Showcase the real work environment*. Whenever possible, bring students into the speaker's world—through photos, videos, or immersive formats like VR/AR/MR experiences that encourage problem-solving and simulate real tasks.
- *Support the talk with hands-on elements*. Add a small experiment, quiz, or task that students can try themselves. These simple activities help them actively engage and better retain information.

Engage Different Age Groups Creatively

- *Adapt activities to age.* Younger participants (e.g., kindergarten or lower primary) benefit from simple creative responses—ask them to draw a picture, write a short poem, or tell a story about the scientist's job.
- *Include fun facts*. Interesting, surprising stories or lesser-known facts grab attention, especially with very young learners.

Extra "how to" for organizers:

- *Choose a speaker who fits the context.* Inviting a guest whose work aligns with the project or subject pupils are already working on increases attention and leads to more focused, thoughtful questions.
- *When selecting a guest speaker, use a following checklist:*

☑ Does the speaker work in a STEM or science-related profession?
☑ Are they willing to talk openly about struggles, doubts, or unexpected paths?
☑ Do they show interest in engaging with young participants through dialogue, not just presentation?

☑ Can they relate their job to topics familiar to students, such as school subjects or everyday experiences?
☑ Do they have access to interesting visual materials, objects, or short videos that help explain their work?
☑ Can they prepare or support a simple student activity (e.g., quiz, small challenge, short hands-on task)?
☑ Are they appropriate for the target age group (e.g., younger pupils vs. teens)?
☑ Do they represent diversity (gender, background, professional path), offering different types of role models?
☑ Are they available for preparation and coordination with the teacher or organizer before the event?
☑ Are they open to two-way communication, student questions, and a flexible, interactive format?

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

7. Best practice examples

7.1 Reports from Croatia

WOMEN IN MATHEMATICS

Croatia

Partners involved in the activity: Croatian mathematical society, V. gymnasium
8.10.2024.

- **Format**: Guest speaker in school
- **Name and affiliation of speaker**: prof. dr. sc. Vesna Županović, full professor at the Department of Applied Mathematics on Faculty of Electrical Engineering and Computing, and president of the Croatian Mathematical Society
- **Duration of the activity**: 60 min
- **Total number of participants**: 58
- **Number of female participants**: 36
- **Age range of participants**: 14-18
- **Minutes of the speech**: The lecture was held in honour of Ada Lovelace, the world's first female computer programmer. Since 2009, this international event has been celebrated on the second Tuesday in October, recognising the contributions of women in STEM fields. As part of the activity, Professor Županović shared her career journey, emphasising her commitment to societal engagement and highlighting the gender-related aspects of her profession. Following the talk, students actively participated in a discussion and had the opportunity to ask questions, aiming to reflect on and challenge common stereotypes.

- **Topics of open discussion**:
  - One female student expressed interest in Matka magazine, published by the Croatian Mathematical Society.
  - Another female student inquired about how she could get involved and co-organize workshops run by the Croatian Mathematical Society.
  - During the discussion on gender aspects, a male student shared his thoughts on why mathematics competitions are held both for all participants and specifically for girls, such as the European Girls' Mathematical Olympiad (EGMO).

- **Reflection**: The activity was thoughtfully planned, centered around an annual event celebrated on this specific day, and featured a female speaker discussing her career. More than 60% of the participants were female students, aligning well with the target audience.

Funded by the European Union

The event was organized as a voluntary school activity, attracting a large and interested group of pupils aged 14 to 18. It is possible that a smaller group might have encouraged even more questions. Notably, many students from V. Gymnasium later attend the Faculty of Electrical Engineering and Computing, so it was valuable for them to hear directly from a professor who could be part of their future academic journey. Professor Županović shared several interesting facts that are not typically covered in standard school textbooks, enriching the students' learning experience.

Funded by the European Union

The power of choice – girls in energy and other professions

Croatia

Partners involved in the activity: Society for Sustainable Development Design, Elementary school Silvije Strahimir Kranjčević
13.12.2024.

- **Format**: Guest speaker in school
- **Name and affiliation of speakers**: Miljenka Kuhar**,** executive director
- **Duration of the activity**: 45 min
- **Total number of participants**: 12
- **Number of female participants**: 12
- **Age range of participants**: 13-14
- **Minutes of the speech:** At the beginning of the lecture, students wrote down on a piece of paper what they wanted to do in the future. This was followed by a discussion about how gender stereotypes are imposed from an early age—for example, how male characters in cartoons are often portrayed as brave, strong, intelligent, and action-oriented, while female characters are depicted as passive, beautiful, emotional, and frequently limited to roles like housework or waiting for a prince. These traditional stereotypes can restrict children's ambitions and interests, whereas more modern portrayals encourage them to develop a broader range of skills and aspirations. This shift is reflected in the increasing presence of female tram drivers and male kindergarten teachers. Finally, students revisited what they had written at the start of the lecture, leading to a brief group discussion.

- **Topics of open discussion:**
  - The influence of media and culture on career choices
  - Raising awareness about gender roles, stereotypes, and the importance of freedom in choosing a career
  - Special emphasis on the energy sector, focusing on breaking down prejudices and empowering girls to pursue careers based on their own interests and talents
- **Reflection:** The workshop aimed to encourage female students to recognize and challenge gender stereotypes that may limit their career choices and to inspire them to explore opportunities in sectors like energy, which are often seen through traditional notions of "male" and "female" professions. It emphasized the importance of breaking down outdated stereotypes and demonstrating that success is possible for everyone, regardless of gender, in any field.

Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

SAMPLING

Croatia

Partners involved in the activity: Croatian Bureau of Statistics, Elementary school Silvije Strahimir Kranjčević
27.11.2024.

- **Format**: Career day
- **Name and affiliation of speakers**: Tihana Sabolek – Head of Customer Relation and Data protection Department, Ivana Levačić - Head of the Department for Sampling, Statistical Methods and Analyses
- **Duration of the activity**: 60 min
- **Total number of participants**: 30
- **Number of female participants**: 18
- **Age range of participants**: 11-14
- **Minutes of the speech:** Tihana Sabolek explained the role of the Croatian Bureau of Statistics, its collaborating institutions, and her specific duties, which include searching databases and assisting users in finding the data they need. Students had the opportunity to search for data related to their own names using the database from the last population census. Additionally, a Statistics competition for high school students was introduced. Ivana Levačić shared insights about her work at the Central Bureau of Statistics and the education required for her position. She also explained the difference between a population and a sample, the various types of samples, and how sampling is conducted.

- **Topics of open discussion:**
  - How can we select a sample for our school project without surveying every student in the school?
  - Is it important to ensure equal representation of male and female respondents in our project?
  - What advice would you give us to conduct the survey as effectively as possible?
  - Ms. Sabolek mentioned she graduated from the Faculty of Philosophy—how was she able to secure a job at the Croatian Bureau of Statistics?
  - Will there be a statistics competition organized for elementary school students?

Reflection: Students gained valuable insight into the work of the Croatian Bureau of Statistics and showed particular interest in exploring the name database, including how data protection is ensured for less common names and surnames. The statistics competition also captured their attention. Through the workshop, students learned important concepts about conducting sampling for their own projects, with many questions focusing on specific guidelines to support

their work. Additionally, participants found it engaging to hear about the diverse educational paths of the lecturers, which ultimately led them to similar career choices.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

7.2 Reports from Cyprus

Cosmic Careers: Insights into Astrophysics and the Study of Asteroids

Cyprus

Partners involved in the activity: Kition Planetarium and Observatory, University of Nicosia
Thursday, June 27th, 2024

- **Format**: Guest speaker in school, ICaT from workplace
- **Name and affiliation of speaker**: George Troullias, Avgoustinos Tsaousis, Physicists
- **Duration of the activity**: 60 min
- **Total number of participants**: 15 students
- **Number of female participants**: 6
- **Age range of participants**: 11-15 years old
- **Minutes of the speech**: Mr. Tsaousis visited the summer school and shared his journey in astrophysics, discussing both his academic background and career path. Meanwhile, Mr. Troullias connected live from the planetarium, offering insights into his own career and research in astrophysics. Both speakers reflected on the challenges and rewards of working in this field, highlighting their passion for studying the universe and encouraging students to pursue curiosity and persistence in their studies. The session also included a brief, informative discussion on asteroids—their composition, impact on Earth, and ongoing research. Mr. Troullias enhanced the experience with a visual demonstration from the planetarium, enriching the students' understanding of asteroid science.
- **Topics of open discussion**:
  - Journey into Astrophysics
  - Science of Asteroids
  - Role of Planetariums in Science Education
  - Careers in Space Science
- **Reflection**: Students actively engaged with the speakers, asking questions related to both career guidance and astrophysical topics. The interactive format of the session, especially the live connection to the planetarium, significantly boosted student interest and participation.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Women in Physics: Exploring Careers in Space and Satellite Engineering

Cyprus

Partners involved in the activity: University of Nicosia
Friday June 28th, 2024

- **Format**: Guest speaker in school
- **Name and affiliation of speaker**: Dr. Stella Manoli, Scientific Coordinator for QUEST (Quantum Computing for Excellence in Science and Technology) project at the Cyprus Institute).
- **Duration of the activity**: 60 min
- **Total number of participants**: 15
- **Number of female participants**: 6
- **Age range of participants**: 12-15
- **Minutes of the speech**: The guest speaker, Dr. Stella Manoli, a physicist specializing in satellite materials, shared her career path—from completing a PhD in Mechanics to her current work in the space sector. She spoke with students about her educational journey, the challenges she faced as a woman in physics, and her research focused on developing durable, lightweight materials for satellites, explaining the physics behind their design.

  A highlight of the session was an engaging interview led by the students, who asked insightful questions about Dr. Manoli's professional experiences, her role in the space industry, and the technical complexities of satellite material development. The interactive nature of the interview fostered open dialogue and deeper student engagement throughout the session.
- **Topics of open discussion**:
  - The Role of Physics in Space Exploration and Satellite Technology
  - Challenges and Opportunities for Women in STEM
  - Interdisciplinary Collaboration in Space Science
  - Future of Satellite Technology and Its Impact on Society
- **Reflection**: Dr. Manoli's career talk provided valuable insights into both the technical and personal dimensions of a career in physics, particularly in the area of satellite material development. Her professional journey—from earning a PhD in Mechanics to contributing to space exploration—was both informative and inspiring.
  The highlight of the session was the interactive, student-led interview, which enabled a deeper exploration of her experiences, including the challenges she faced as a woman in a traditionally male-dominated field. Her reflections on the societal impact of science offered students a broader perspective on the relevance of physics beyond the lab.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg Université des Sciences de l'Education · University of Education
Funded by the European Union

Overall, the session was dynamic and thought-provoking, encouraging students to see themselves in STEM careers and underscoring the importance of inclusivity and innovation in science.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

HEALTH, WELL-BEING AND QUALITY OF LIFE

Cyprus

Partners involved in the ICaT activity: University of Nicosia, University of Salerno

Tuesday, March 29th, 2024

- Format of interactive career talk

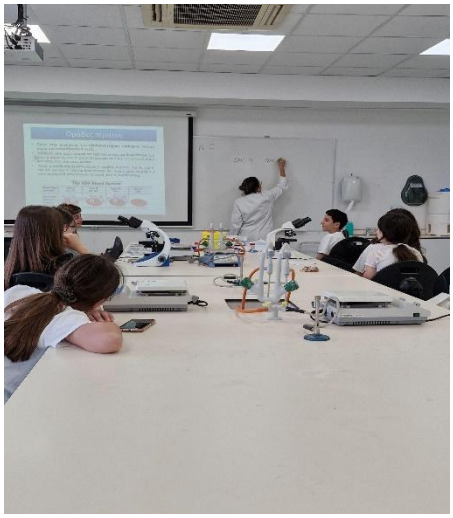
Career day	___
Guest speaker in a school	___
ICaT from a workplace	X
Parents-scientists	___

- Name(s) and affiliation of speaker(s):
  - *Dr. Myrtani Pieri, University of Nicosia, School of Life and Health Sciences, Department of Life Sciences.*
  - *Dr. Vicky Nicolaidou, University of Nicosia, School of Life and Health Sciences, Department of Life Sciences.*
- Duration of the activity: *120 min (students were divided in smaller groups to work in the lab).*
- Total number of participants: *30 students.*
- Number of female participants: *20.*
- Age range of participants: *12-14 years old.*
- Minutes of the speech: During the ICaT session, two female scientists from the Department of Life Sciences introduced Biology as a field of study, sharing insights into their professional experiences and emphasizing its importance to society and everyday life. To enrich the learning experience, students visited a biology laboratory on campus, where they took part in two interactive scientific activities: identifying blood types and extracting DNA from a banana.

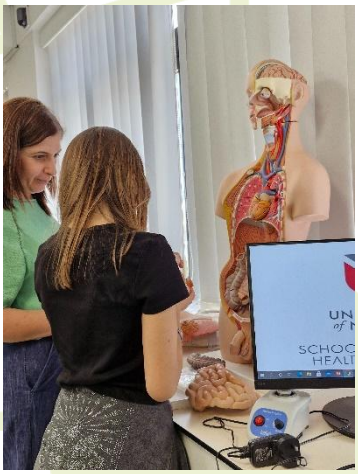
ICSE International Centre for STEM Education · Pädagogische Hochschule Freiburg Université des Sciences de l'Education · University of Education · Funded by the European Union

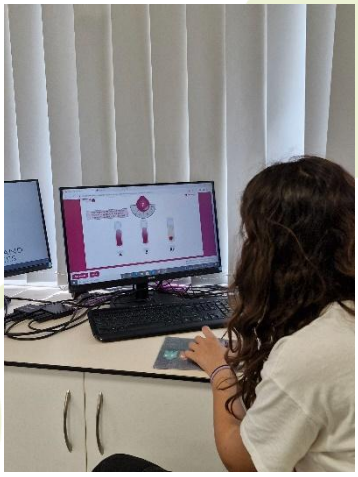
Guided by the scientists, students used microscopes and learned about essential laboratory safety procedures, gaining practical exposure to scientific methods. In addition to the hands-on activities, students had the opportunity to conduct interviews with the scientists, asking thoughtful questions about their academic paths, day-to-day work, and the challenges they face in the field of biology.

- Topics of open discussion:
  - *Describe your everyday life.*
  - *Why did you choose this profession?*
  - *What do you like about your work?*
  - *What is your career path? How do I become a researcher in Biology?*



- Reflection: This activity, which has been successfully implemented for several years in collaboration with these scientists, has proven to be highly effective. Through active participation in lab work, students formed a stronger connection with the scientists, allowing for more personal engagement and thoughtful questions.





ISE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

7.3 Reports from Germany

INTERACTIVE CAREER TALK

Germany

Partners involved in the ICT activity: PHFR, ALU
10.10.2024

- Name(s) and affiliation of speaker(s):

  Elena Süß : PH Freiburg
  Eva Seifert: Universität Freiburg
  Katharina Flüßer: PH Freiburg
  Leila Zarabi: Universität Freiburg

- Duration of the activity: 120 min
- Total number of participants: 140
- Number of female participants: 69
- Age range of participants: 8-10 years old
- Minutes of the speech:

  Elena Süß: Sports scientist specializing in health psychology, works as a research assistant at the PH.
  Eva Seifert: Forest scientist, Environmental Consultant, works as a research assistant at University of Freiburg
  Katharina Flüßer: Mathematician and physicist, works as a research assistant at the PH.
  Leila Zarabi: Forest scientist, works as a research assistant at University of Freiburg

- Topics of open discussion:

Since our target group consists of 8–10-year-olds, we chose a different, more engaging format for presenting our event.

The students were divided into five classes, and each class had a dedicated 15-minute session with a guest speaker. After each session, there was a short five-minute break before rotating to the next class.

To capture the students' attention from the start, each speaker brought an object from their daily work environment and began with the question: "Do you know what my job is?"

This approach encouraged curiosity and served as an effective conversation starter, leading students to explore various aspects of the speaker's profession. The questions that followed typically fell into two categories: general inquiries about the nature of the job, and more specific questions related to the speaker's individual career path and experiences.

- Reflection:

Less than a third of students expressed interest in pursuing a scientific career in the future. However, the majority shared that *having fun* was the most important factor in choosing a profession.
This highlights the importance of showcasing the engaging and enjoyable aspects of scientific work, as a way to challenge common negative stereotypes about science careers.
Importantly, this doesn't mean presenting science through an overly idealised lens, but rather *highlighting* the aspects that spark curiosity, creativity, and enjoyment.
The key is to encourage students to explore different activities and experiences so they can discover what excites them and where their strengths lie. Whether through volunteering, hands-on workshops, or real-world experiences, offering diverse opportunities helps them gain valuable insights and develop confidence in making informed career choices.

ISE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

INTERACTIVE CAREER TALK

Germany

Partners involved in the ICT activity: University Freiburg, PH Freiburg, Experinauten gUG

04.11.2024

- Format of interactive career talk (please indicate with an "X")

Career day	___
Guest speaker in a school	x
ICT from a workplace	___
Parents-scientists	___

- Name(s) and affiliation of speaker(s):
  Dr. Elena Süß, PH Freiburg
  Eva Seifert, Universität Freiburg
  Nikola Gepperth, Experinauten gUG
  Leila Zarabi, Universität Freiburg

- Duration of the activity: ___90___ min

- Total number of participants: ____44_____

- Number of female participants: ___44_____

- Age range of participants: ____16-17_____

- Minutes of the speech:

Elena Süß: a sports scientist specializing in health psychology and now works as a research assistant at the PH Freiburg
Eva Seifert: Studied forestry, worked as an environmental consultant, and is now a research assistant at the University of Freiburg.
Nikola Gepperth: studied biology, geography and gender studies and now explore the natural sciences together with children
Leila Zarabi: Studied Biology, MBA and forestry, worked as an environmental consultant in Shell Company, and is now a research assistant at the University of Freiburg.

- Topics of open discussion:

1. Finding the right path among multiple areas of interest
2. Enhance your career while having a family and children

Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

3. Gender pay gap/ Salary
4. Is it a problem to change jobs often?
5. Lifelong learning
6. What can I do after graduating with a science degree?

- Reflection:

Finding the right path among multiple areas of interest:
Some students mentioned that they are interested in math, chemistry, biology, etc., so they couldn't decide which direction to go, which area of science would give them the most satisfaction. The speaker explained about her own career path. She started with 3 fields of study that were of great interest to her. In this way, she could find out where different fields of science crossed her path and continue her way by following her interest.

Enhance your career while having a family and children:
It was discussed that unfortunately for some women, having a family means ending their career. These days, however, women have more opportunities to come into a commitment with their partner to manage both family and career. A speaker explains how she managed her career and the birth of her first child with the help of her partner. On the other hand, another speaker discussed how she overcame the difficulties of dealing with her children and her work after her divorce. Moreover, parental leave was discussed.

Gender pay gap:
Why do men get paid more?
Why men get promoted easier and faster than women?
Why men are easier to recruit?
Why women accept a lower paid job that does not match their qualifications?

Is it a problem to change jobs often?
The girls were reassured to hear that the lecturers did not have 'straight' CVs and still had good/fulfilling work, i.e. that you don't have to commit yourself from the start, but can also try something out

Lifelong learning:
The workplace has many components that you don't learn during your studies (e.g. administration). It was discussed about "learning by doing". Students were told by speakers that there is no such thing as a wrong choice, as long as there is learning.

What can I do after graduating with a science degree?
The girls wanted to know what you can do with certain degree courses (e.g. maths), they were surprised to hear that many have a job that no longer has much to do with their degree course or that you often develop away from your field of study.

It was also discussed that no one knows from the beginning what they are going to do. We start with our limited knowledge and resources, we develop our way in a direction that leads us to what really gives us full satisfaction.

- Reflection:
- The participants in the career talk were all girls.
- Each speaker gave a short introduction about their studies and career, and then the students had time to ask questions.
- 15 out of 44 students already know their future career path.

Funded by the European Union

INTERACTIVE CAREER TALK

Germany

Partners involved in the ICT activity: PH Freiburg, Rotteck Schule
18.12.2024

- Name(s) and affiliation of speaker(s):
  Eva Seifert,
  Nicola Gepperth
  Leila Zarabi
  Julia Klingele
- Duration of the activity: 90 min.
- Total number of participants: 14
- Number of female participants: 3
- Age range of participants: 15- 17 years old

- Minutes of the speech:

  Eva Seifert: Forest scientist, Environmental Consultant, works as a research assistant at University of Freiburg
  Nicola Gepperth: studied biology, geography and gender studies and now researches natural sciences with children
  Leila Zarabi: Forest scientist, works as a research assistant at University of Freiburg
  Julia Klingele: Dr. Habil, Diplom - Chemikerin, Chemistry teacher at Angell School

- Each speaker began with a brief self-introduction, limited to a maximum of 5 minutes. The student group was then divided into three smaller groups, each rotating through 15-minute sessions with every speaker for more focused and individual discussions. The activity concluded with a joint wrap-up session and 15 minutes dedicated to completing the evaluation form.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

- Topics of open discussion:

- As a self-employed person, the speaker was asked about: founding, purpose, fulfillment in self-employment, business model canvas, how to found, who helped, how do I know how to fund, job fulfillment, career goals, role models for studying
- Research topics
- University structure as an employee
- Career choice
- Leisure time vs. money
- How do you come to your decision?
- What our goals are?

- Reflection:

These are the same questions we always ask in our Career Talk:

- How many already know what kind of career they want to have in the future?
- Making money vs. having fun at work?
- Do you want to follow in your parents' footsteps?

It was really interesting for us to hear how well informed some of the students were about their chosen career path. Factors such as what society's needs will be in the future, what direction our economy is growing in.

Parents, friends, grades on the specific topic at school, films were some of the reasons or the resources to encourage them to be interested in some specific career.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

7.4 Reports from Portugal

Synthesis of Acetylsalicylic Acid/ Career Talk with Scientists (Chemistry)

Portugal

Partners involved in the activity: IE-ULisboa
15th December 2023

- **Format**: Guest speaker in a school
- **Names and affiliation of speakers**:
  - Pedro Mateus, ITQB
  - Ana Alves, ITQB
- **Duration of the activity**: 180 min
- **Total number of participants**: 25 students
- **Number of female participants**: 14
- **Age range of participants**: 16-17 y.o.
- **Minutes of the speech**: The researchers focused their presentation on what they do and what led them to embark on this path. While one of the researchers already had previous ideas about what he wanted to do, the other researcher confessed that it was a fluke that led her to dedicate herself to research in the area of chemistry, since she always dreamed of having an activity more linked to being a chemical engineer, just like her mother. Both spoke about their working group, as far as research is involved, including collaborative work not only with Portuguese teams but also with foreign teams. They also mentioned going to conferences as very appreciated moments in their activity. Finally, they talked about the career of researcher in Portugal which, in most cases (or at least at the beginning of one's career) is very much ensured by scholarships and, as such, a little precarious.
- **Topics of open discussion**:
  - Several questions related to the synthetic activity of acetylsalicylic acid
  - When and why did the scientists decided to become a scientist.
  - What was their academic path
  - What was their professional path
  - What do they do in a normal day
  - It is easy to be scientist in Portugal?
- **Reflection**: The initial activity was a moment for the students to get closer to the scientists (worked side by side), and the following career talk took place in a more informal atmosphere. These students are already in the scientific area, so they were very interested in science careers. As such, it was a very participated talk.

ISE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Secondary education, then what?

Portugal

Partners involved in the activity: IE-ULisboa
10th, 17th and 24th April 2024

- **Format**: Career day and guest speaker in a school
- **Names and affiliation of speakers**:
  - Ana Afonso (Dentist, Faculty of Dental Medicine, University of Lisbon)
  - Tiago Almeida (Computer Science Teacher, Ministry of Education)
  - Nuno Mendes (Physiotherapist, Sacavém Health Centre)
  - Teresa Lima (Researcher in the field of computer engineering, Instituto Superior Técnico)
  - Idalina Miranda (Doctor)
  - Vasco Dias (Cybersecurity Consultant, Self-employed)
  - Lurdes Viana (Researcher in the field of Physiology, University of Lisbon)
  - Cátia Fonseca (Communication Networks Consultant, freelancer)
  - Diana Macedo (Nurse, Hospital da Luz)
  - Carlos Dionísio (Webdesigner, freelancer)
  - Margarida Dinis (Computer Programmer, Scholarship holder at the University of Lisbon)
  - Tomás Lourenço (Postgraduate student- Advanced Trauma Care for Nurses, Escola Superior de Enfermagem de Lisboa)
  - João Vasco (Master's student in Computer Engineering, IST)
  - Rita Miranda (Master's student in Biochemistry and Biomedicine, Faculty of Sciences of the University of Lisbon)
  - Ana Toscano (undergraduate student in Biomedical Engineering, Universidade Nova de Lisboa)
  - Beatriz Almeida (Integrated Master's Student in Dental Medicine, Faculty of Dental Medicine of the University of Lisbon)
  - Rui Fonseca (Medical student, Faculty of Medicine of the University of Lisbon)
  - Alda Quintas (Undergraduate student in Computer Engineering, Universidade Nova de Lisboa)
  - Frederico Fernandes (Master's student in Pharmaceutical Engineering, IST)
  - Alice Ventura (Master's student in Medical Physics, IST)
  - Diana Cunha (Integrated Master's Student in Veterinary Medicine)
  - Ana Gonçalves (Master's student in Rehabilitation Nursing, Escola Superior de Enfermagem de Lisboa)
- **Duration of the activity**: 3 x 150 min
- **Total number of participants**: 26 students
- **Number of female participants**: 15
- **Age range of participants**: 17-18 y.o.
- **Minutes of the speech**: None of the speakers made a very structured presentation, i.e., the presentations took place in a round table, in the form of a conversation. In general terms, the speakers introduced themselves, said what they were doing and the rest of the conversation with a lot around the questions that the students asked, in a very informal way.

Funded by the European Union

- **Topics of open discussion**:
  - The activity originated from the interest and questions that 12th-grade students showed regarding their choice of higher education courses. As such, their teachers proposed to the 12th-grade students to organize a series of sessions that could clarify their academic paths.

  - The students played a very active role, as they, together with the teachers, selected the courses and themes for the discussions and also invited some speakers.
  - During the sessions, various life journeys of the speakers were presented, which led to their current situation.
  - The students engaged in conversations and gained various perspectives, advice, and information about university choices.
- **Reflection**: The success of the activity was verified by the degree of satisfaction, both of the guests and of the students who were present. At the end of each gathering, all the guests expressed great satisfaction with the initiative and mentioned how important this type of activities are. This activity was very important, as it allowed a closer contact with students and professionals of the courses of interest to the 12th grade students, it also allowed them to ask questions, listen to advice and understand what the university environment is like. The biggest difficulty was to reconcile the dates between all the participants, so 3 gatherings were held, so that representatives of the largest number of courses suggested by the students could be present.

Funded by the European Union

The role of oral hygienists in oral health

Portugal

Partners involved in the activity: IE-ULisboa
14th May 2024

- **Format**: Guest speaker in a school
- **Names and affiliation of speakers**: Two oral hygienists from the Health Center of Castelo Branco (Patrícia Melo e Catarina Rodrigues)
- **Duration of the activity**: 60 min
- **Total number of participants**: 21 students
- **Number of female participants**: 10
- **Age range of participants:** 6-7 y.o.

- **Minutes of the speech**: The hygienists began by introducing themselves and explaining what an oral hygienist does. This presentation was initially made in dialogue with the students, questioning them. Later, they explained in more detail what they do and what their daily lives were like, especially their work as patients with ages similar to those of the students. In addition to a presentation at Power Point, the hygienists also took a 3D model to exemplify how teeth should be washed.
- **Topics of open discussion**:
  - The dental hygienists began with a presentation about their profession. They raised some questions: What are hygienists? What do hygienists do?
  - Some responses from the students were:
    - They see the teeth;
    - They teach to brush the teeth;
    - They pull out the teeth;
    - They put things in their teeth because of cavities;
  - After this initial discussion, a period of dialogue followed during which the hygienists explained what they did and what their day-to-day was like.
  - Next, for the students to better understand their profession, they presented a 3D model of a denture, allowing the students to experience how to clean teeth (how to brush teeth, the importance of properly brushing teeth, the appropriate amount of toothpaste, the consequences of inadequate dental hygiene; the importance of rinsing with fluoride). Through this activity, they had the opportunity to understand what oral hygienists are and what they do.

Funded by the European Union

- **Reflection**: Students got to know about a profession that most of them did not know existed or had any contact with. There was also a manifestation from some students that this could be a profession to pursue in the future. The result of this ICaT brought positive effects: 1) understanding the profession; 2) recognizing the importance of hygienists and what they do; 3) for the students themselves, who began to change some of their practices related to tooth brushing – both at home and at school. At school, they started brushing their teeth during lunchtime and rinsing with fluoride every fifteen days.

Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

7.5 Reports from Turkey

Career Paths in Geological Engineering: An Interactive Chat with Prof. Dr. Azad Saglam Selcuk

Turkey

Partners involved in the activity: Hacettepe University
28.02.2024.

- **Format**: Guest speaker in school
- **Name and affiliation of speaker**: Prof. Dr. Azad Sağlam Selçuk- Van Yuzuncu Yıl University-Geological engineer
- **Duration of the activity**: 60 min
- **Total number of participants**: 45
- **Number of female participants**: 20
- **Age range of participants**: 14-18 years old

- **Minutes of the speech**: The session was a 15–20-minute career story in which the speaker shared how she started her business. She talked about her career choice, highlighting that her decision to enter this field went against her family's wishes. Despite their objections, she pursued her passion. She spoke candidly about the emotional journey of her career—the moments of happiness, the challenges she faced, and how she managed to overcome them. She also introduced her field of work, describing the type of work she does and what her profession entails.
- **Topics of open discussion**: At the end of the career talk, questions came from various topics, sparking a lively and mutual interaction. The invited speaker grew more relaxed as the discussion progressed and responded sincerely to the questions. The questions mainly focused on two areas:
    - The specialties and content of geological engineering (such as earthquakes and related phenomena)
    - Career details and guidance (for example, how the speaker developed professionally and what job opportunities exist in the field)

Reflection: At the end of the ICaT session, both the speakers and participants expressed satisfaction. Our guest speaker, in particular, was pleased with the students' engagement and mentioned she would be happy to support similar activities in the future—an important indicator of her positive experience. During the presentation, she used many visuals, including examples from her own field studies, which captured the students' attention and clearly illustrated what a career in her field entails.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Prior to the event, we shared a brief introduction about the speaker with the students, which encouraged some of them to come prepared with questions. This preparation enhanced the quality of interaction during the session. The talk took place in a high school, and we believe that career visits to this level are especially effective, as the university entrance exam is often the final step in students' career decision-making.

When reflecting on the overall process, it is worth noting that our speaker, a researcher in mining engineering, had limited pedagogical experience. This initially affected the interaction dynamics during the presentation. However, as questions came in from the students towards the end, the speaker became more comfortable and engaged. It is likely that her limited prior experience interacting with high school students contributed to some initial timidity.

One logistical point for improvement is the timing of questionnaire completion at the end of the career talk. This process might be better handled separately from the main session to maintain the flow and focus of the event.

Funded by the European Union

Exploring Academia and Environmental Science with Kids

Turkey

Partners involved in the activity: Hacettepe University
17.05.2024.

- **Format**: ICaT from a workplace
- **Name and affiliation of speaker**: Prof. Dr. Berat Ahi- A Social Scientist Working on Environmental Education- Kastamonu University
- **Duration of the activity**: 45 min
- **Total number of participants**: 17
- **Number of female participants**: 8
- **Age range of participants**: 12-13 years old
- **Minutes of the speech**: At the beginning of the session, the researcher introduced himself to the students and engaged them by asking what they knew about academics and the role of social scientists. He then shared his personal career story, explaining how he began his academic journey, chose the field of environmental education, and described the research he conducted for his doctoral thesis.
  Next, he showed his online profile page and illustrated his studies with concrete examples. Based on students' questions, he discussed topics such as his family background, the university environment, the process of conducting academic research, and the importance of publishing studies.
  To conclude the presentation, the students were asked to create drawings about the environment and then exchange their drawings with their classmates. Those who received the drawings analyzed them using a rubric provided by the researcher. The results of this analysis were then shared and explained on the board. The activity ended with an engaging question-and-answer session.

- **Topics of open discussion**:
  - What does a scientist do?
  - Types of science?
  - What do the positive and social sciences deal with?
  - How does a social scientist collect data?
  - How does an educational scientist collect data in schools? Where does he/she use the data
  - Conducting a simple data analysis together with the children.

Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

- A data collection tool and analysis from the speaker's PhD thesis was used. Data was collected through 'draw and tell' and analysed like a scientist working in the field of environmental education.
- Some of the questions asked by the students:
  - Are you a doctor? What is the difference between a medical doctor and a doctor in social sciences?
  - How do you become an academic? What kind of exams did you take for your master's and doctorate?
  - How do you get the titles on the career ladder? What are the differences between assistant docent, docent, professor?
  - What do the citations on the academic profile page mean?
  - Does getting a lot of citations mean being a successful researcher?
  - As an environmental educator, what do you think needs to be done to make our school garden environmentally friendly?

- **Reflection**: Satisfaction with the career talk was evident from both the researcher's and the participants' perspectives. In post-event conversations, the speaker expressed that he thoroughly enjoyed the experience, especially the opportunity to connect with children from a disadvantaged region and discuss science with them.
  One challenge he noted was overcoming students' perceptions that academic careers or university life are elitist, unattainable, or only possible in large metropolitan areas. Many students held these prejudices initially. However, by sharing his own family background and childhood environment, the speaker helped to break down these barriers, which was a significant success for the session.
  A particularly encouraging moment was when one female participant stood up and declared, "I will also be a researcher at the university. I liked it very much." This illustrates the positive impact of the talk. Another meaningful outcome was the fact that the entire class accompanied the speaker to the school gate, demonstrating their enthusiasm and respect. The presence of such dedicated researchers from their own region served as strong motivation for the students.

Funded by the European Union

Exploring Forest Industry Engineering and Wood Processing

Turkey

Partners involved in the activity: Hacettepe University
21.05.2024.

- **Format**: ICaT from workplace
- **Name and affiliation of speaker**: Assoc. Prof. Dr. Önder Tor - Forest Industry Engineer- Wood Culture Application and Research Center- Kastamonu University
- **Duration of the activity**: 75 min
- **Total number of participants**: 21
- **Number of female participants**: 7
- **Age range of participants**: 13-14 years old
- **Minutes of the speech**: As this was a career talk held at the workplace, participants were warmly welcomed at the entrance of the Wood Culture Application and Research Center by both the staff and the career speaker. Upon arrival, they were introduced to various improved woodworks and exemplary projects, accompanied by detailed explanations of how these pieces were crafted. Students also engaged in small hands-on trials, particularly exploring how wood products function as educational materials.

Next, the group toured the production and factory areas of the Wood Innovation Center. Here, the speaker provided insights into the workforce, the types of machines in use, the products manufactured, and the rewarding as well as challenging aspects of working in this environment. Each production area and machine was explained in detail, including the processes raw timber undergoes from arrival to final product. The operation of the machines and the stories behind the production lines were also shared.
The practical component of the visit involved students using a laser machine to cut wooden pieces to desired dimensions, offering a hands-on experience with the technology. Toward the end of the event, undergraduate interns currently working at the center presented their design projects, giving students additional inspiration.
The session concluded with a general summary highlighting the factory's operations and the various professions involved, providing students with a comprehensive understanding of the career opportunities within the wood industry.

- **Topics of open discussion**:
  - What does a forest industrial engineer do?
  - What are the working areas of the wood innovation center?
  - How does a wood processing factory work?
  - The effect of technological developments on the devices used.
  - Comparison of traditional and modern production methods

Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

- Difficulties and working conditions in production

These can be summarised as general discussion topics. Specific questions asked by the students are:

- What kind of skills are needed to work in such a professional field?
- Is it a profession open to development or is it gradually losing popularity?
- Is it a difficult profession?

- **Reflection**: The career talk was highly successful, largely because the students had the unique opportunity to be in a factory equipped with modern technologies. They listened attentively to the explanations and closely followed the practical demonstrations. Experiencing firsthand the journey of a tree from arrival at the factory to its transformation into a finished product made the learning process tangible and engaging.

  This ICaT activity clearly captured their attention and strengthened their connection to the applications and wooden house designs they had created in their schools. At the conclusion of the visit, the students were also presented with examples of the processed wooden products, leaving a lasting impression of the entire experience.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

8. Literature

Auger, R. W., Blackhurst, A. E., & Wahl, K. H. (2005). The development of elementary-aged children's career aspirations and expectations. *Professional School Counseling*, 8, 322–329.

Carlone, H.B. & Johnson, A. (2007). Understanding the science experiences of women of color: Science identity as an analytic lens. Journal of Research in Science Teaching, 44 (8), 1187-1218.

Couch, J. V., & Sigler, J. N. (2001). Gender Perception of Professional Occupations. *Psychological Reports*, 88(3), 693–698. https://doi.org/10.2466/pr0.2001.88.3.693

Gee, J.P. (2000–1). Identity as an analytic lens for research in education. Review of Research in Education, 25, 99–125.

Magnuson, C. S. and Starr, M. F. (2000) 'How early is too early to begin life career planning? the importance of the elementary school years', *Journal of Career Development*, 27(2), 89–101. doi:10.1177/089484530002700203.

OECD (2023), "Career talks with guest speakers: A guide to delivering an effective career development activity", *OECD Education Policy Perspectives*, No. 69, OECD Publishing, Paris, https://doi.org/10.1787/93594cb3-en.

Pfeifer, M.A. & Zajic, C.J. & Isaacs, J.M. & Erickson, O.A. & Dolan, E.L. (2024) Beyond performance, competence, and recognition: forging a science researcher identity in the context of research training. International Journal of STEM Education 11:19

Sanchez-Tapia, I., & Alam, A. (2020). *Towards an equal future: Reimagining girls' education through STEM.* https://www.unicef.org/media/84046/file/Reimagining-girls-educationthrough-stem-2020.pdf

Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education

Funded by the European Union

9. Appendix

Appendix 1. General guidelines for guest speakers[1]

Guest speakers are encouraged to: • wear their typical work attire; • bring visual aids if applicable; • reflect on a typical day at work and share it with the participants; • highlight connections between their job and the subjects they studied in school; • include some personal insights related to their profession (e.g., how they spend their free time, challenges in balancing work and personal life, etc.).

Appendix 2. List of topics and questions for an informal conversation (for experts)

Examples	**Topics and questions**
A women's circle is organized—an all-women ICaT event featuring a female speaker and participants.	Are there enough women pursuing science studies? Do women face more challenges in becoming scientists? What obstacles do female scientists encounter in the workplace?
The guest speaker has extensive experience in their field (e.g., several decades of professional practice).	How has their workplace and the nature of their job changed over time? What advice would they give to participants on staying competitive in a rapidly changing job market?
The guest speaker engages participants by posing questions aimed at identifying and addressing common stereotypes or concerns.	Can you think of a common stereotype about my profession? (The speaker may share a personal story about their own former beliefs and how their perspective has changed, or highlight a specific challenge they face in their line of work.) Do you think my job is important? Why do you think it matters for society that people do the kind of work I do?
The guest speaker recognises students who show a positive attitude toward STEM-related careers and reinforces their career aspirations.	Who is considering a career like mine? Who is thinking about pursuing another STEM-related profession? What motivates your interest in that field? What kind of work do you imagine yourself doing in the future? Are there any STEM careers you find interesting but feel unsure about? Why? What would make you more confident in choosing a STEM path?

[1] General instructions for guest speakers are comprised from OECD (2023) guidelines for career talk.

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Appendix 3. Guidelines for young participants (instructions and list of proposed questions)

GUIDELINES	EXAMPLE OF QUESTIONS
• Share your opinion about the guest speaker's career or other STEM-related professions. • • Explain why you believe you are (or are not) well-suited for a career in STEM. • • Express a concern or fear you have about choosing your future career path. • • Talk about any stereotypes you've heard about the speaker's profession.	• "Sell me" your career! What are the most rewarding or beneficial aspects of your job? • What is your favourite and most challenging part of your work? • Did you always know you wanted to pursue this profession? • Were any school subjects or skills you learned particularly helpful in your career? • What advice would you give me about choosing a career, field of study, or further education? • What can I start doing now, in high school, to prepare for a career in science? • What career-related advice do you wish someone had given you when you were my age?

ISE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union

Appendix 4. Comprehensive list of ICaT activities in the ICSE Science Factory project

ICaT no.	Name	Date	Format	Number of speakers	Number of female speakers	Total number of participants	Number of participating females	Age range of the participants
1	CROATIA	15.2.2024.	ICaT from a workplace	1	0	17	6	17-18
2		14.7.2024.	Guest speaker	1	0	22	3	11-17
3		24.9.2024.	Guest speaker	1	0	7	5	13-14
4		8.10.2024.	Guest speaker	1	1	58	36	14-18
5		25.11.2024.	Guest speaker	1	0	46	25	11-14
6		26.11.2024.	Guest speaker	1	0	72	37	12-14
7		27.11.2024.	Career Day	1	0	31	11	12-17
8		27.11.2024.	Career Day	1	0	16	9	11-14
9		27.11.2024.	Career Day	1	0	14	2	10-13
10		27.11.2024.	Career Day	2	2	30	18	11-14
11		28.11.2024.	Guest speaker	1	0	20	6	13-14
12		29.11.2024.	Guest speaker	1	1	49	25	8-14
13		29.11.2024.	Parent-scientist	1	1	26	14	10-15
14		29.11.2024.	Guest speaker	1	1	23	14	14
15		13.12.2024.	Guest speaker	1	1	12	12	13-14
16	CYPRUS	28.6.2024.	Guest speaker in summer School	1	1	15	6	12-15
17		12.3.2024.	Guest speaker	1	1	28	28	19-25
18		27.6.2024.	Guest speaker/ ICaT from a workplace	2	0	15	6	12-15

Funded by the European Union

19		29.3.2024.	ICaT from a ICaT from a workplace	2	2	30	20	12-14
20		29.3.2024.	ICaT from a workplace	1	0	30	20	12-14
21		19.9.2024.	Career Day/Guest speaker	1	1	45	27	14-16
22		19.9.2024.	Career Day/Guest speaker	1	1	45	27	14-16
23		30.1.2025.	ICaT from a workplace	2	2	20	12	7-11
24		5.5.2024.	ICaT from a workplace	2	2	13	7	12-14
25		26.3.2025.	ICaT from a workplace	1	0	13	8	12-14
26	GERMANY	22.12.2023.	Guest speaker	3	3	19	7	16
27		18.1.2024.	Guest speaker	3	3	144	71	10
28		5.2.2024.	Guest speaker	3	3	17	17	17
29		19.3.2024.	Guest speaker	3	3	5	1	15
30		25.4.2024.	Guest speaker	2	2	14	14	12
31		10.7.2023.	Guest speaker	3	3	26	13	9
32		1.12.2023.	Guest speaker	3	3	26	13	9
33		15.12.2023.	Guest speaker	3	3	26	13	9
34		24.1.2023.	Guest speaker	3	3	26	13	9
35		15.3.2023.	Guest speaker	3	3	26	13	9
36		2.5.2023.	Guest speaker	3	3	26	13	9
37		10.10.2024.	Guest speaker	4	4	140	69	8-10
38		4.11.2024.	Guest speaker	4	4	44	44	16

Funded by the European Union

39		18.12.2024.	Guest speaker	5	5	14	3	15-17
40			Guest speaker	1	1	25	14	8-10
41			Guest speaker	2	2	23	14	9-10
42			Guest speaker	1	1	22	12	9-10
43			Guest speaker	1	1	22	10	8-10
44		3.4.2025.	Guest speaker	2	2	15	15	11-14
45		8.10.2024.	Guest speaker	3	1	23	12	8-10
46		9.10.2024.	Guest speaker	3	0	21	11	8-10
47		10.10.2024.	Guest speaker	3	0	16	14	8-10
48		15.10.2024.	Guest speaker	3	0	24	12	8-10
49		16.10.2024.	Guest speaker	3	1	29	15	8-10
50		17.10.2024.	Guest speaker	3	1	28	11	8-10
51		21.10.2024.	Guest speaker	3	1	21	10	8-10
52		22.10.2024.	Guest speaker	3	1	22	9	8-10
53		24.10.2024.	Guest speaker	3	2	24	10	8-10
54		25.10.2024.	Guest speaker	3	1	23	12	8-10
55		5.11.2024.	Guest speaker	3	2	29	15	8-10
56		6.11.2024.	Guest speaker	3	1	26	12	8-10
57		7.11.2024.	Guest speaker	3	1	28	13	8-10
58		12.11.2024.	Guest speaker	3	1	26	14	8-10
59		14.11.2024.	Guest speaker	3	1	14	7	8-10
60		21.11.2024.	Guest speaker	3	0	15	2	8-17
61		3.12.2024.	Guest speaker	3	0	24	13	8-10
62		10.12.2024.	Guest speaker	3	0	25	11	8-10

Funded by the European Union

63		12.12.2024.	Guest speaker	3	0	24	12	8-10
64		30.1.2025.	Guest speaker	3	0	21	10	8-10
65		6.2.2025.	Guest speaker	3	1	18	10	8-10
66		11.2.2025.	Guest speaker	3	1	20	8	8-10
67		12.2.2025.	Guest speaker	3	1	29	14	8-10
68		24.2.2025.	Guest speaker	3	0	28	15	8-10
69		26.2.2025.	Guest speaker	3	1	27	12	8-10
70		8.4.2025.	Guest speaker	3	1	25	13	8-10
71		9.4.2025.	Guest speaker	3	0	28	15	8-10
72		28.5.2025.	Guest speaker	3	0	21	9	8-10
73	PORTUGAL	22.11.2023.	Parents-scientists	1	0	48	27	8-10
74		22.11.2023.	Parents-scientists	1	1	48	27	8-10
75		22.11.2023.	Parents-scientists	1	0	190	95	5-10
76		14.12.2023.	Guest speaker	1	1	27	17	16-17
77		15.12.2023.	Guest speaker	2	1	25	14	16-17
78		10.4.2024. 17.4.2024. 24.4.2024.	Guest speaker/ Career Day	22	13	26	15	17-18
79		14.4.2024.	Guest speaker	1	2	21	10	6-7
80		14.5.2024.	Guest speaker	2	2	21	10	6-7
81		19.2.2025.	Parents-scientists	1	1	24	15	16-17
82		17.3.2025.	Guest speaker	2	0	25	10	6-7
83	TURKEY	28.2.2024.	Guest speaker	1	1	45	20	14-18
84		24.4.2024.	Guest speaker	1	1	195	118	14-16
85		16.5.2024.	Guest speaker	1	1	190	113	14-16

Funded by the European Union

86		17.5.2024.	Guest speaker	1	0	17	8	12-13
87		21.5.2024.	ICaT from a workplace	1	0	21	7	13-14
88		18.9.2024.	Guest speaker	1	0	180	105	14-16
89		2.10.2024.	Guest speaker	1	1	180	105	14-16
90		27.02.2025.	Guest speaker	1	1	30	20	25-45
91		1.3.2025.	ICaT from a workplace	1	1	20	15	25-45
92		24.3.2025.	Guest speaker	1	1	120	80	13-15
93		24.3.2025.	Career Day	14	9	500	80	10-16

Appendix 5. ICaT activity: Guided video - examples of activities with children

ACTIVITY 1: „The round table“
Each child stands up and says: *„Career I would like to do when I am a grown up is…because … Career I wouldn't like to do when I am a grown up is … because*. When expressing and arguing their opinions, children can list their hobbies, interests, school subjects, skills they have, or believe not to be developed enough, etc.
ACTIVITY 2: „Creative expression inspired by observed careers“
A child chooses one of the careers presented in guided video activity, and uses a story, story or poem to show how they see the chosen career and their opinion of it.
ACTIVITY 3: „Role playing“
Children are enrolled into a role playing, acting as workers in careers showcased by guided video activity. Children assign roles to each other, use everyday objects as specific tools used by scientist, and recreate one work day of a specific scientist.

Funded by the European Union

Appendix 6. Tips & Tricks for successful ICaT

ISE Science Factory
International Centre for STEM Education

Funded by the European Union

8 Tips for preparation for an Interactive Career Talk

1 Know your audience

Research the age group, interests, and background of your audience. Tailor your content accordingly.

4 Use visuals and objects

Bring something from your work – a tool, an image, or an object – and ask: "Can you guess what my job is?" Build mystery and interest and make science tangible and memorable.

7 Engage the students actively

Include a short activity like a quiz, challenge, or experiment. With younger students, ask them to draw, write a short poem or story about your job.

2 Be personal and authentic

Share your real-life story – your career path, turning points, successes, and struggles. Talk about what excites you about your work Students respond best to honest, human experiences.

5 Show the „wow" moments

Pick 1–2 examples from your field that are surprising, fun, or directly connected to everyday life.

8 Focus on interaction

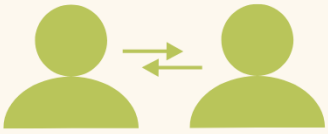
ICaT is not a lecture – it's a conversation. Encourage questions, dialogue, and curiosity throughout your talk.

3 Talk about real challenges

Topics like work-life balance, uncertainty in career choices, or gender bias are important and especially relevant for girls seeking relatable role models.

6 Make it relatable

Connect your skills and tasks with school subjects or everyday experiences, and to things young people know (health, environments, sports, etc.) to make your profession more understandable.



A Few Technical Tips

1 Plan for 15-20 minutes of speaking with 10 minutes for questions

Young audiences prefer brevity.

2 Pause every 5-7 minutes to engage with audience

Ask questions (“Who has ever thought about a career in…”), raise polls ("Raise your hand if you've ever…"), etc.

3 Summarize key takeaways & provide tips for action

Reinforce 2-3 main lessons from your career journey. Give a specific, achievable next step for audience members interested in your field.

4 Prepare starter questions for discussion

Have 3-5 questions ready to spark discussion if audience questions are slow.

5 Validate all questions

"That's a great question" encourages further participation.

6 Keep answers brief

Aim for short responses to maintain energy of interaction.

Formulations that work well:

“When I was your age…”
„In everyday life, this looks like..“
„Imagine if…“
“One funny mistake I made when I was starting out was…”
“Have you ever wondered…?”
“What do you think would happen if…?”
“Any guesses?”
„What would you do in this situation?
“You might be the ones to discover the next big thing.”

https://icse.eu/international-projects/icse-factory/

ICSE International Centre for STEM Education
Pädagogische Hochschule Freiburg
Université des Sciences de l'Education · University of Education
Funded by the European Union