ICSE ACADEMY

European Workshop Series

STEM TEACHING:
RELEVANT FOR OUR STUDENTS AND FOR OUR SOCIETY

Course guide 2024

ICSE Academy
International Centre for STEM Education

Content

Co-funded by
the European Union

ICSE Academy workshop series - overview

The focus of this European workshop series is bringing participants up to date in research and teaching in the STEM subjects (Science, Technology, Engineering and Mathematics) in connection with European priorities such as fostering sustainability, digital skills and intercultural learning. The workshop series aims at refreshing and deepening the knowledge of meaningful and relevant educational practices. Topics will include inquiry-based learning and interdisciplinarity, cultural diversity and inclusion, curriculum development and assessment, and the use and impact of technology on STEM education.

The workshop series will offer a blend of seminars and workshops in the fields of primary and secondary education. The program will be tailored towards the diverse interests of teachers and student-teachers. The workshop series is organized by the ICSE Academy (International Centre for STEM Education). https://icse.eu/icse-academy/

Clusters of topics

The program of the workshop series is organized in four clusters. Each cluster addresses one main topic. Participants are expected to at least follow all sessions related to a cluster. Student-teachers are invited to attend the whole course. The four clusters are:

1. Tools and approaches to deal with sustainability issues in STEM education
2. Diversity and inclusion in STEM
3. STEM in a digital era
4. Innovative Assessment in STEM education

General learning goals

The main outcome here is that pre- and in-service STEM teachers exchange interculturally, get to know teaching styles from multi-country perspectives, learn about European priorities and develop the competences, skills and attitudes to bring new and societally relevant topics and learning styles into their STEM classrooms. https://icse.eu/icse-academy/workshops/

Practical information

Tentative program 2024

Time is CET.

Date	Topic	
Cluster 1: Tools and approaches to deal with sustainability issues in STEM education		
March 5 * **16:00 – 18:00**	Local introduction to the workshop series	
March 12 **16:00 – 18:00**	1. Sustainability and socio-scientific issues in STEM education	
March 19 **16:00 – 18:00**	2. Inquiry-based STEM learning	
April 9 **16:00 – 18:00**	3. Argumentation and decision making in STEM education	
Cluster 2: Diversity and inclusion in STEM		
April 16 **16:00 – 18:00**	1. Introduction to diversity and inclusion in STEM education	
April 23 **16:00 – 18:00**	2. Analysing and designing STEM tasks for diversity and inclusion	
April 30 **16:00 – 18:00**	3. Analysing inclusive classroom practices (based upon try-outs)	
Cluster 3: STEM in a digital era		
May 7 **16:00 – 18:00**	1. Digital Competencies, Skills and Technology in STEM Fields	
May 14 **16:00 – 18:00**	2. Escape Games in STEM Education and VR	
May 21 **16:00 – 18:00**	3. Computational Thinking	
Cluster 4: Innovative Assessment in STEM education disciplines		
May 28 **16:00 – 18:00**	1. Innovative assessment in STEM disciplines	
June 4 **16:00 – 18:00**	2. Preparing innovative assessment practices	
June 11 **16:00 – 18:00**	3. Innovative assessment practices and equity	

* Date or time might be adjusted for your local session by your local organizing team.

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Working formats

The sessions will be provided online and will have a very interactive character with various working formats. All communication will be in English. Most sessions will consist of a general introduction followed by group work, either in country groups or in mixed groups. Local teams have the opportunity to join together and follow the course from one room.
In between sessions of a cluster the participants will be requested to do homework, and if possible, to try-out ideas with students in their classrooms.
The course will be implemented in Moodle in combination with Webex for online communication. Video streams of sessions will also be saved and accessible in the Moodle environment.

Required knowledge

In order to participate and obtain useful results, the following prior knowledge is required.
−   English speaking level needs to be proficient enough to engage in (small) discussion groups.
−   Experience in teaching and learning within one or more STEM subjects either in initial teacher education schooling or as a professional teacher.

Assignments and homework

Assignments will be provided during sessions and as homework. Participants will work in groups on a homework assignment during multiple sessions in a cluster. The assignment may consist of a design task that will be enriched after each session with topics addressed in the cluster, and can include reflective pieces on design choices, relations to the content of the cluster, and if possible, experiences during a try-out. The assignment descriptions in this document are examples of what can be expected during the workshop series. For participants following all clusters, an overarching task may be provided by your local organizing team.
Session leaders are responsible for organizing feedback on participants' progress, while local representatives of the course are responsible for evaluating the assignments and underpinnings.

Recognition

Recognition is organized by your local organization and credits can vary between 0,5-1 ECTS (micro-credentials) for a cluster, and between 2-5 ECTS for the whole workshop series. Credits or a participation certificate will be provided by the participating universities in each of the countries.
If this is not possible in your situation, you may utilise this offer: the University of Klagenfurt in Austria offers the European Workshop Series as a Microcredentials Course. Participants from all countries can attend for free and receive 4 ECTS for completing the course.
To apply for the Microcredentials Course, please visit this link. A guide for how to apply is also available. For any questions or if you need support, please contact Markus Messerschmidt at markus.messerschmidt@aau.at.

Further information and registration

Please contact your local ICSE Academy representative for further information on the course. No registration fee is required as the course is co-funded by the European Union under grant no. 101052670. All participants will be asked to take part in a questionnaire.
More information and a registration link can be found at:
https://icse.eu/icse-academy/workshops/

Content of sessions

Local introduction to the workshop series

March 5, 16:00 – 18:00h *
* Date or time might be adjusted for your local session by your local organizing team.

This session aims at locally introducing the European workshop series and the ways of working.

Assignment:
Check for a preparatory task for next session.

Cluster 1. Tools and approaches to deal with sustainability issues in STEM education

Cluster leader: Maria Evagorou, evagorou.m@unic.ac.cy

Session 1. Sustainability and socio-scientific issues in STEM education

March 12, 16:00 – 18:00h
Session leader: Marta Romero Ariza, mromero@ujaen.es

Learning outcomes:
During this session participants are expected to:

− Reflect about the synergies and educational potential of sustainability and STEM education.
− Analyse successful experiences combining sustainability and STEM education.
− Identify the Key features of effective activities for sustainability and STEM education.
− Explore the potential of contemporary socio-scientific contexts to enhance sustainability and STEM education.
− Learn from research and case studies about sustainability and STEM education
− Co-designing activities for sustainability and STEM education.

Assignment:

Group work (in break out rooms) on socio scientific issues related to sustainable development and current environmental and social challenges.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Session 2: Inquiry-based STEM learning

March 19, 16:00 – 18:00h
Session leaders:
Ragnhild Lyngved Staberg, ragnhild.l.staberg@ntnu.no
Jardar Cyvin, jardar.cyvin@ntnu.no

The second session aims to raise awareness about inquiry based approaches in STEM education. Participants will be enabled to explore different inquiry approaches, reflect on practices and examples from different countries. They will also get experience in how to redesign tasks.

Learning outcomes:
After completion of the session participants are expected:

– To have raised awareness of the importance of inquiry practices.
– To have an in depth understanding of the complexity of inquiry practices.
– To reflect on inquiry practices and examples from different countries.
– To know how to redesign closed tasks.

Assignment:

Preparatory task for this session is on animal footprints. Upload your comments, see Moodle. Assignment during session may require a STEM textbook used in your country for a redesign task. *Check for more specifics, deadlines and a preparatory task for next session on Moodle.*

Session 3: Argumentation and decision making in STEM education

April 9, 16:00 – 18:00h
Session leader: Metin Sardag, metinsardag@gmail.com

Within the scope of this workshop, participants will recognize the process of argument construction and argumentation, comprehend the nature of argumentation and decision-making activities in the STEM education, and experience a strong argument construction process with the data to be given on the theme of sustainability through group work.

Learning outcomes:
After the completion of the session, participants are expected:
– To know the components of an argument.
– To have an understanding the nature of the argumentation process.
– To be aware of the nature of argumentation and decision-making processes in STEM education.
– To be able to produce a strong argument.

Assignment:

Participants will be given a graph showing the effects of global warming and asked to create a strong argument after the session.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Cluster 2. Diversity and inclusion in STEM

Cluster leader: Markus Messerschmidt, Markus.Messerschmidt@aau.at

Session 1. Introduction to diversity and inclusion in STEM education

April 16, 16:00 – 18:00h
Session leader: Kyriakos Demetriou, demetriou.ky@unic.ac.cy

The first session of the cluster "Diversity and Inclusion" is an introductory one. The session aims to raise awareness about diversity and inclusion in STEM education. Participants will be enabled to explore the potential role of STEM education in teaching about diversity. Among the topics that will be discussed through interactive collaborative tasks are diversity, inclusion, exclusion, the underrepresentation of students with disabilities in STEM education, the continued underrepresentation of racial and ethnic minority students in STEM education, the gender gap in STEM education. In addition, participants are introduced to teaching strategies, inspired by critical postmodern science pedagogy, that can be used to raise awareness of diversity issues among students.

Learning objectives:
- Raising awareness about diversity and inclusion in STEM education
- Exploring the potential role of STEM education in teaching about diversity.
- Discussing about:
  o the underrepresentation of students with disabilities in STEM education.
  o the continued underrepresentation of racial and ethnic minority students in STEM education.
  o the gender gap in STEM education.
- Introducing how critical postmodern science pedagogy (CPSP) can be used effectively to raise awareness of diversity issues among students.

Outcomes:
After the completion of the session, participants are expected
- To be aware of, and active in the pursuit of, equality, diversity and inclusion in STEM education
- To appraise the potential role of STEM education in teaching about diversity.
- To criticize the underrepresentation of students with disabilities, the continued underrepresentation of racial and ethnic minority students and the gender gap in STEM education.
- To appraise the potential of critical postmodern science pedagogy (CPSP) in raising awareness of diversity issues among students in STEM education.

Assignment:
Preparation task will be a self-reflection exercise that includes filling in the PROSTEM questionnaire. During/after the session participants will do an assignment on triggering discussions on inclusion and diversity in your classroom. You will share your ideas and reflect upon the ideas of your colleagues.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Session 2. Analysing and designing STEM tasks for diversity and inclusion

April 23, 16:00 – 18:00h
Session leader: Monica Wijers, m.wijers@uu.nl

In this session we build on insights from the previous session and focus on various dimensions of diversity. Participants become familiar with (re)design strategies for selecting & developing tasks and adapting them to their context. We will discuss various formats of tasks, pedagogical approaches and relations with role models. Participants prepare an example activity for try-out including a lesson plan and expectations with respect to inclusion/diversity.

Learning objectives:
The aim of this session is to understand how tasks can be used to organize activities that take the opportunity of diversity in your classroom.

Assignment:
Participants prepare an example activity for try-out, including a lesson plan and expectations with respect to inclusion/diversity. Next session they are expected to report about this try-out and to reflect on the pedagogical/didactical practices adopted.

The task will be evaluated and feedback will be provided by the session leader.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Suggested reading:
Maass, K., Doorman, L. M., Jonker, V. H., & Wijers, M. M. (2019). Promoting active citizenship in mathematics teaching. ZDM - International Journal on Mathematics Education, 51(6), 991–1003. https://doi.org/10.1007/s11858-019-01048-6

Session 3. Analysing inclusive classroom practices

April 30, 16:00 – 18:00h
Session leader: Despina Potari, dpotari@math.uoa.gr

During this session the teachers are expected to inquire and reflect on their enacted lessons using theoretical constructs and tools coming from research on inclusive classroom practices. Through this process, the session aims to support teachers to become aware of knowledge and strategies to implement and evaluate inclusive STEM lessons as well as of the affordances, constraints and challenges of such lessons. Finally, directions will be provided for future practices, and participants will be asked to indicate two key messages from this cluster that they would like to keep practicing in their classroom.

Learning objectives:
By completion of the session participants are expected:

− To become aware of key approaches and findings of research on diversity and inclusive teaching.
− To share and justify their teaching decisions in designing and enacting inclusive lessons.
− To develop reflection strategies linking research and teaching in the area of diversity and inclusion.

Assignment:

Cluster reflection - The participants are expected to be able to design and enact inclusive teaching approaches on the basis of the existing research. They also are expected to inquire teaching collectively and become aware for their teaching choices. To reflect on this cluster, participants will write a short reflection on their individual learning experiences and share this on Moodle.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Cluster 3. STEM in a digital era

Cluster leader: Oliver Straser, oliver.straser@ph-freiburg.de

Session 1. Digital Competencies, Skills and Technology in STEM Fields

May 7, 16:00 – 18:00h
Session leader(s): Oliver Straser, oliver.straser@ph-freiburg.de

Learning objectives:
After completion of the session participants can answer:

− Why do we need a competence and skill-focused STEM education?
− What are digital competencies and skills?
− How do we incorporate competency and skill-development in STEM-teaching?
− How to use CAD and 3D-Printing to develop digital competencies and skills.
− How to use AI-based tools in STEM-teaching.

Assignment:

Participants will design a 3d-printable object and a class activity invoking the use of AI by students. Reflection of what digital competencies are needed or will be developed is part of this.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Session 2. Escape Games in STEM-Education & VR

May 14, 16:00 – 18:00h
Session leader(s): Katharina Flößer, katharina.floesser@ph-freiburg.de

The purpose of this module is to provide a thorough and detailed introduction to the integration of escape games in STE(A)M education.

Learning Objectives:

After completion of the session participants are expected to know:

− When should we use Escape Games in STE(A)M Education
− What are the main characteristics of an Escape Game?
− How can a digital Escape Game be produced with the help of Geogebra?
− What are other resources for Escape Games (ready to use escape games, toolboxes to build escape games a.s.o.)
− Developing Digital Competencies through Student-Created Escape Games

Outcomes:
− The participants we play an online escape game and analyse the structure of it
− The participants will create a puzzle for an escape game
− The participants will learn how to create digital and hybrid escape games by using Geogebra
− The participant will create a short escape game (homework)

Assignment:

Participants will use Geogebra to make an small digital STEM Escape Game.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Session 3. Computational Thinking

May 21, 16:00 – 18:00h
Session leader: Janka Medova, jmedova@ukf.sk

This sessions is about sharing experiences, being informed about research on computational thinking and several class-room activities for developing computational thinking in STEM education will be demonstrated.

Learning Objectives:

- Become aware of computational thinking and computational thinking skills
- Share and justify the teaching decisions in designing and enacting lessons focusing of computational thinking

Assignment:

To prepare for the workshop about computational thinking and Colette, please make sure you downloaded the Colette-project app, prepared the so-called 'CT marker' and explore Colette.

Participants are expected to reflect on their usual curricula and find there affordances for development of students' computational thinking skills.

Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Cluster 4. Innovative Assessment in STEM education disciplines

Cluster leaders: Josette Farrugia, Jesper Boesen, Chrissavgi Triantafillou

Session 1. Innovative Assessment

May 28, 16:00 – 18:00h
Session leader: Josette Farrugia, josette.farrugia@um.edu.mt

The first session will focus on how our assessment can be more innovative. Different countries, different curricula, different STEM disciplines and pupils of different ages may result in different needs, different challenges and different opportunities. Together we will reflect on ways and tools that will enable us to support our students in their learning.

The session proposes a series of methods and tools of assessment to help support students such as tools that help us assess student thinking, reasoning, collaboration, communication and problem-solving. We will reflect on the extent that these tools are being used or can be used in our different educational contexts.

Learning Objectives:
Participants will:

− Critically evaluate the impact of assessment practices on learners, pedagogy and curriculum
− Examine their own beliefs and expectations related to the pupils in their classroom and the impact these beliefs and expectations have on their assessment;
− Assess pupils in a way that allows them to respond to the needs of diverse pupils.

Outcomes
At the end of this session participants will:

− Use different ways of gaining information about the pupils in the classroom;
− Adapt classroom assessment to accommodate the needs and resources pupils bring to school.

Assessment:
Participants will work collaboratively on an assignment over the three sessions of the cluster.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Session 2. Preparing participants to adopt innovative assessment practices

June 4, 16:00 – 18:00h

Session leaders: Eva-Lena Jonsson, eva-lena.jonsson@ju.se, Ulrika Franke, ulrika.franke@jonkoping.se and Jesper Boesen Jesper.Boesen@ju.se.

In this session, we will present two different frameworks for assessing creative reasoning and STEM competencies. The frameworks derive from mathematics but with examples from both mathematics and other STEM subject we will broaden its use into a more integrated STEM approach.

Learning Objectives:

After completion of the session participants are expected:

- Distinguish intrinsic properties from superficial properties
- Use presented frameworks for developing tasks that assess creative reasoning
- Understand that tasks can require either creative reasoning or imitative reasoning depending on the learner's learning history

Outcomes:

- Increased awareness of how to assess creative reasoning (thinking) in STEM disciplines

Assessment:

Participants will continue to work collaboratively on an assignment over the three sessions of the cluster.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.

Session 3. Innovative assessment practices and Equity in STEM classrooms: Assessing students with diverse learning needs

June 11, 16:00 – 18:00h

Session leaders: Chrissavgi Triantafillou, chrtriantaf@math.uoa.gr, NKUA, GR; Giorgos Psycharis, gpsych@math.uoa.gr; Nikolaos Metaxas, nmetaxa@math.uoa.gr; Katerina Bogiatzi, kat.bogiatzi@hotmail.com, NKUA, GR; and Xaralambos Sakonidis, xsakonid@eled.duth.gr

In this session, the focus will be specified on equity issues in STEM contexts. The teachers are expected to reflect on the need to provide differentiated feedback to students with diverse learning needs and modify their assessment tools in these specific learning and teaching settings.

Learning objectives

- Promoting sensitivity to issues of inclusion and equity in STEM assessment practices.
- Promoting awareness about assessment tools and practices in the case of students with diverse backgrounds and learning needs and sensitize them in their actual use (i.e. affordances, constraints, challenges, barriers, tensions)
- Discussing about culturally responsive assessment in STEM classrooms;
- Reflecting on different types of assessment accommodations.

Outcomes:

- Increased awareness on how to assess in STEM disciplines by taking into consideration students with diverse backgrounds and needs.

Assessment:

Participants will finalize their collaborative work on the assignment for the module.
Check for more specifics, deadlines and a preparatory task for next session on Moodle.