

STEAM Classroom Implementation through technology: advantages and handicaps

Castro Urdiales

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Open STEAM group



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Open STEAM Group

Open STEAM is a research Group based at UC and focused on the teaching and learning of mathematics through a STEAM-based approach. Researchers and teachers from different universities and schools collaborate aiming to promote student motivation and learning.

OPEN STEAM GROUP



Research

To what extent STEAM education impact on school learning?

Do STEAM activities influence motivation for learning?

Do STEAM activities significantly influence knowledge acquisition?

Do STEAM activities significantly influence competences development?

What are the main handicaps of STEAM implementation?

Methodological Approach



Trends of the future labour market

What professionals and what skills will be need? Big data, 3D printing, Robotics...

Incorporating those trends in the curricula

Analyzing the common contents of the curricula from participating countries

Activity design

Designing activities under an integrated approach

Activity implementation

Developing STEAM activities at high schools

Evaluation

Identifying students' Attitudes towards STEM
Knowing the opinion of the participants
Assessing how much students have learned

Trends of the future labour market

WHAT STEM PROFESSIONALS WE WILL NEED IN THE FUTURE?

Professionals must be able to develop:

- Data analytical skills (Big Data)
- Operate and maintain renewable energy projects
- Business skills to manage trust and risk (Cybercrime)
- To adapt different environmental context
- Collaborative job skills
- Network Management skills (Internet of the Things)
- Communication skills

Incorporating trends to the curricula

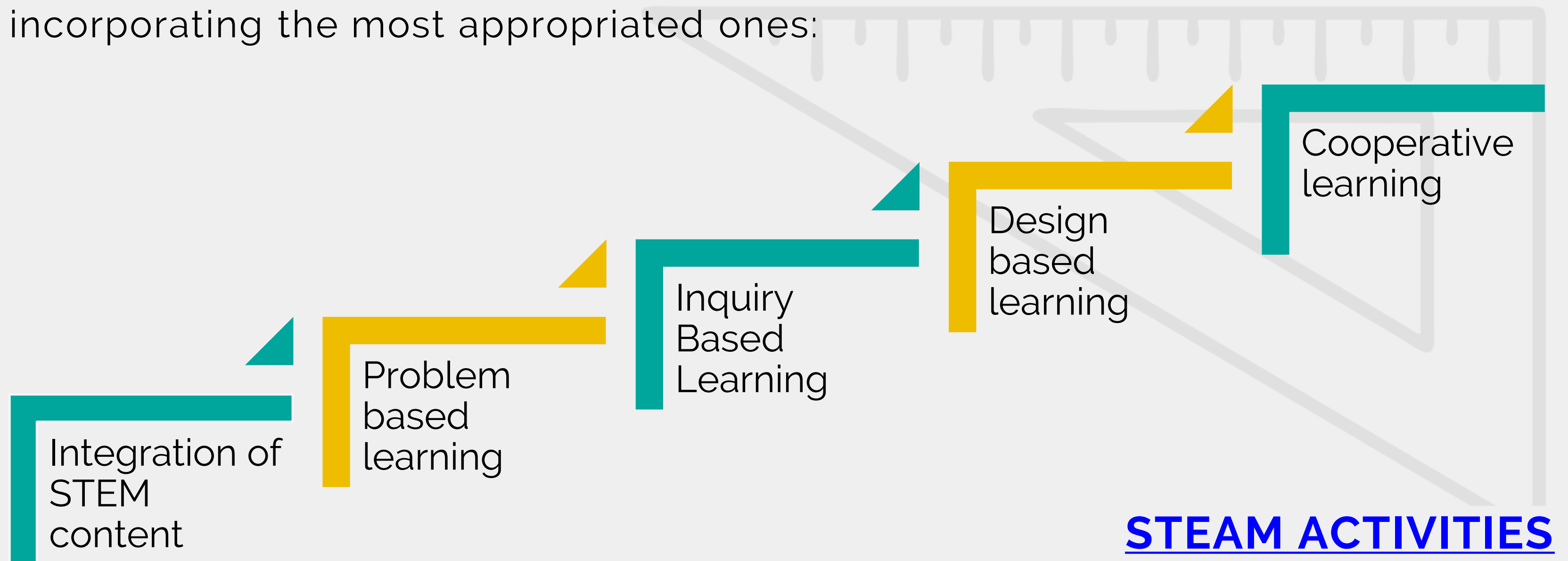
HOW INCORPORATING THE TRENDS IN THE CURRICULA?

Analysing curricular content and providing contexts to involve such content

Activity Design

HOW TO DESIGN EFFECTIVE ACTIVITIES?

Reviewing literature regarding existing learning methodologies and incorporating the most appropriated ones:



Implementation (Sample)

+ 2500 Secondary Education students

Students who follow the regular curricula

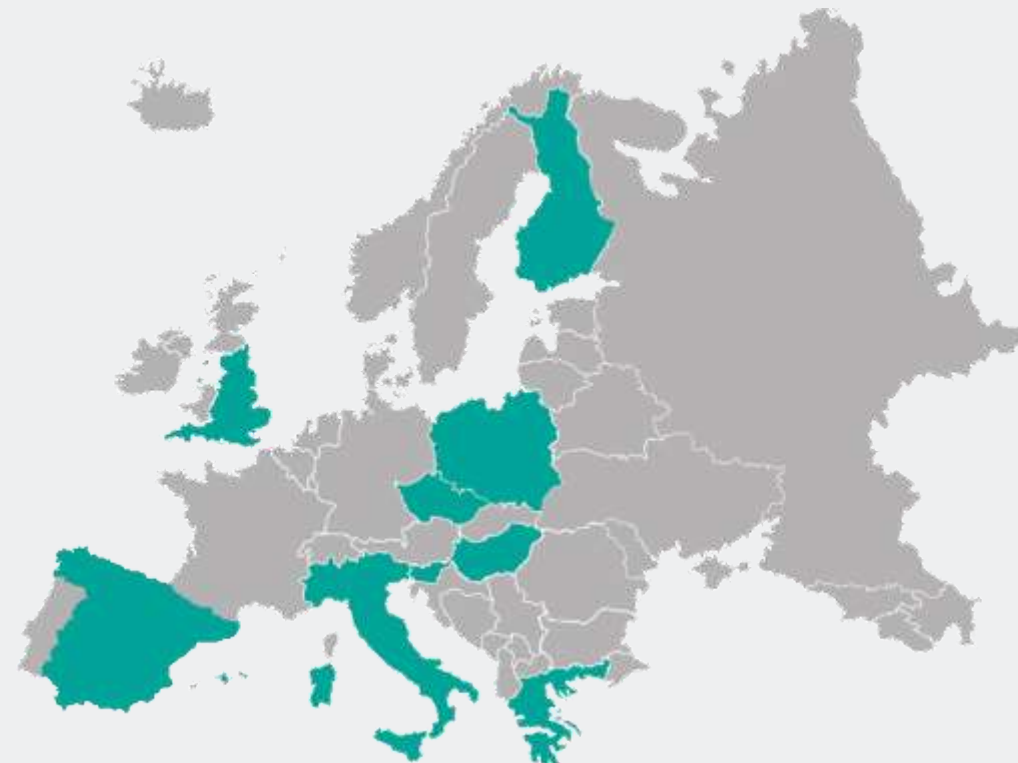
Students at risk of exclusion

+ 140 Secondary Education teachers

Teachers with different teaching experience

Teachers from STEM and non-STEM disciplines

We have implemented
STEAM activities in



Implementation (Trials)

STEAM activities with KIKS format

- Students work in groups of 3-4 members
- Generally, they solve the activity in English
- They develop a text document and a video

Development



- They show the STEAM activities to a variety of audience in different occasions:
 - Outreach activities
 - Conferences
 - Videoconferences

Dissemination



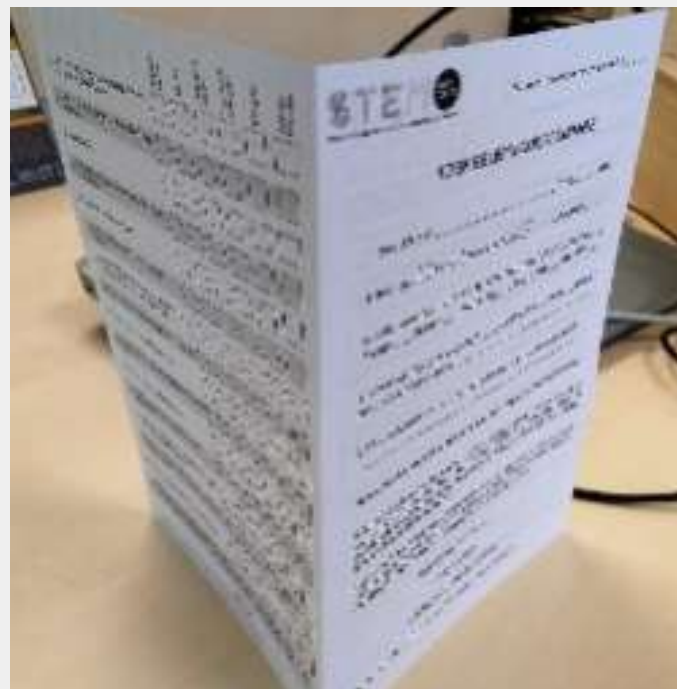
Evaluation

ANALYSIS

Mixed-methods approach

EVALUATION TOOLS

Student Attitudinal
questionnaires



Student semi-
structured
interviews

A screenshot of a 'Student Semi-Structured Interviews' form. At the top, it features the 'STEM FOR YOUTH' logo and the text 'Please provide the code number given by your teacher: _____'. Below this, the title 'Student Semi-Structured Interviews' is centered, followed by a note '(data recording some of them)'. The form contains seven numbered questions:

1. Are you satisfied with the process of being part of the STEMforYouth project? Why? Give examples |
2. How did you benefit from the project?
3. What was the most valuable and stimulating part of project?
4. Do you consider that the activities were prepared in an interesting and attractive way?
5. What activities have you done? What concepts have you learnt? Which activities did you like the most and the least? Why?
6. What recommendations would you make to improve this project and STEM learning in general?
7. Would you participate again in this project? Why?

Teacher semi-
structured
interviews

A screenshot of a 'Teacher Semi-Structured Interviews' form. It features the 'STEM FOR YOUTH' logo and the title 'Teacher Semi-Structured Interviews' with a note '(data recording some of them)'. The form includes a demographic section with fields for name, nationality, age, school name, and sex. Below this are 17 numbered questions:

1. Name: _____ 2. Nationality: _____ 3. Age: _____ years
4. School name: _____ 5. Sex: Female Male Prefer not to say
6. What subject/s and grades do you teach? _____
7. What teaching methodology do you usually follow in your lessons? Why?
8. Do you consider that students are informed well enough about their STEM career options? Why?
9. Do you consider that projects like STEMforYouth contribute to inform students about their career options? Why?
10. Do you consider that projects like STEMforYouth encourage students to choose careers related to STEM? Why?
11. Are you satisfied with the process of being part of the STEMforYouth project? Why? Give examples
12. How did you, your students and your school benefit from the project?
13. What activities have you implemented with your students? Were these activities related to the school curriculum?
14. Do you think that the proposed activities were well designed? Did you need to make any modification or adaptation of the activities to your context? Please write the improvements you made or the suggestions you have for the activities
15. What was the most valuable and stimulating part of project?
16. What recommendations would you make to improve this project and STEM education in general?
17. Do you plan to work like this in the future?

Do STEAM activities influence student's motivation for learning?

Yes, they do but with some particularities. There are some factors affecting:

- ⊕ Teachers' motivation
- ⊕ Teachers' interest





Do STEAM activities significantly influence knowledge acquisition?

They don't influence knowledge acquisition significantly more than activities in regular lessons.

- ⊕ STEAM activities help to integrate, better than other activities, knowledge from different school subjects.
- ⊕ STEAM activities help to become aware of the applicability of the concepts and procedures learned at the school.
- ⊕ Knowledge is longer time maintained



Do STEAM activities significantly influence the development of competences?

Yes, they significantly impact the development of several of these key competences.

Mathematical, scientific and technological competence

Linguistic and Oral communication

Digital competence

Learning to learn

Sense of initiative and entrepreneurship

Social and civic competences

Cultural awareness

Constraints and handicaps



Time organisation by subject

- ⊕ Activities do not fit well within the schedule of the regular curricula

RESOURCES

- ⊕ Rooms for working collaboratively are required
- ⊕ Laboratories and Computer rooms are needed
- ⊕ Materials are often disposable

Constraints and handicaps



TEACHING METHODS AND EVALUATION

- ⊕ Curricular constraints (teaching programs or textbooks)
- ⊕ Preparing students for specific exams, evaluating separate bits of knowledge

TEACHER SPECIALIZATION

- ⊕ Teachers are usually subject specific (difficult to change teaching traditions)
- ⊕ There is no continuous training

Constraints and handicaps



SCHOOL ORGANISATION AND MANAGEMENT

- ⊕ Management team support
- ⊕ Low communication and collaboration between teachers and departments
- ⊕ Teaching assistants in classroom and outside

FAMILIES

- ⊕ Learning methodologies different to the ones parents were instructed (not help and the idea of wasting time)



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Many thanks!

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