UAB
Universitat Autònoma de Barcelona

# Designing STEM Project for the Primary School Classroom

Code: 105055
ECTS Credits: 6

**2025/2026**

| Degree | Type | Year |
|---|---|---|
| Primary Education | OT | 4 |

## Contact

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## Teachers

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## Teaching groups languages

You can view this information at the end of this document.

## Prerequisites

It is recommended that students have passed the Science and Mathematics courses from the Bachelor's Degree in Primary Education.

Specifically:

- Mathematics for Teachers
- Learning of Mathematics and Curriculum
- Teaching and Learning of Natural, Social and Cultural Environment
- Science Didactics
- Management and Innovation in the Mathematics Classroom

## Objectives and Contextualisation

The course is designed to introduce and deepen students' understanding of the tools needed to design and assess teaching and learning sequences, projects, learning corners, and field trips within the mathematical and/or scientific-technological (STEM) domains.

The course draws on scientific and mathematical concepts (what we refer to as the content of school science and mathematics) as well as pedagogical knowledge in science and mathematics education (such as the ideas of scientific and mathematical practice, the role of language, the importance of contextualization, etc.) acquired in the compulsory science and mathematics subjects of the degree. These are used to efficiently design and plan the implementation and evaluation of competency-based teaching and learning activities, projects, and/or sequences in STEM for the primary classroom.

From a perspective that views the teaching and learning of science, engineering, and mathematics as a form of school-based scientific, engineering, and mathematical practice, the course aims to plan and evaluate activities that integrate doing, thinking, and talking science, engineering, and mathematics in the classroom. That is, it promotes scientific inquiry, the construction of solutions, mathematical problem solving, modeling, and the communication and/or argumentation of science and mathematics by students, while encouraging reflection on the nature of scientific, engineering, and mathematical activity embodied in these practices.

From a view of learning as the progression of knowledge and competence throughout schooling, the design and sequencing of learning is addressed at multiple levels: conversation, lesson, didactic unit, school year, and educational stage. The course uses the concepts of learning cycles and learning progressions to guide teaching practice.

Fromthe perspective of assessment as a means to regulate learning, evaluation is conceived as an integral part of the teaching and learning process. Promoting students' metacognition and self-regulation is considered essential and is supported through the use of innovative assessment strategies such as peer assessment, self-assessment, and the co-design of evaluation rubrics.

Finally, within a competency-based framework in which science and mathematics are taught and learned to "act" in the world (that is, to reflect, argue, decide, evaluate, etc., using scientific and mathematical knowledge and thinking), teaching and learning activities and sequences must be contextualized in personally, socially, or globally relevant contexts for students.

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Course Objectives

1. To deepen understanding of inquiry, problem solving, modeling, and argumentation (doing, thinking, and talking) as scientific, engineering, and mathematical practices in school, and to plan and evaluate teaching and learning activities that incorporate them.

2. To adapt, design, and evaluate sequences of teaching and learning activities, projects, learning kits, spaces and/or corners, in line with the ideas of the learning cycle and knowledge progression at both micro and macro levels within the scientific-technological and mathematical (STEM) domain, as well as the methodologies applied (e.g., project-based learning, service learning, etc.).

3. To adapt, propose, and evaluate assessment activities from the perspective of assessment as a tool to regulate learning.

4. To justify and use appropriate teaching and learning contexts for science, engineering, and mathematics that are relevant to students from personal, social, and/or global perspectives.

## Competences

- Design and regulate learning spaces in contexts of diversity that take into account gender equality, equity and respect for human rights and observe the values of public education.
- Design, plan and evaluate education and learning processes, both individually and in collaboration with other teachers and professionals at the centre.
- Develop the functions of tutoring and guidance of pupils and their families, attending to the pupils' own needs. Understand that a teacher's functions must be perfected and adapted in a lifelong manner to scientific, pedagogical and social changes.
- Foster reading and critical analysis of the texts in different scientific fields and cultural contents in the school curriculum.
- Know and apply information and communication technologies to classrooms.

- Know the curricular areas of Primary Education, the interdisciplinary relation between them, the evaluation criteria and the body of didactic knowledge regarding the respective procedures of education and learning.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Reflect on classroom experiences in order to innovate and improve teaching work. Acquire skills and habits for autonomous and cooperative learning and promote it among pupils.
- Work in teams and with teams (in the same field or interdisciplinary).

## Learning Outcomes

1. Analyse a situation and identify its points for improvement.
2. Identify situations in which a change or improvement is needed.
3. Identifying aspects common to all the experimental sciences and examining them in depth.
4. Identifying, describing, and analysing the characteristics pertaining to management of the area of experimental sciences in the classroom, and the implementation of activities involving experimentation and the use of CLTs.
5. Knowing how to communicate and present an argument in science lessons.
6. Produce and apply resources related to the teaching and learning of experimental sciences.
7. Propose new methods or well-founded alternative solutions.
8. Propose new ways for measuring success or failure on implementing innovative proposals or ideas.
9. Relating science with its technological applications, with its social impact on the didactic situations pertaining to the school.
10. Weigh up the risks and opportunities of both one's own and other people's proposals for improvement.

## Content

- The STEM education framework (origins, interest, approaches…) from the perspective of scientific, mathematical, and engineering practices in the primary classroom:
  What are the characteristics of activities that integrate doing, thinking, and talking science, mathematics, and engineering in the classroom? What does it mean to promote inquiry, problem-solving, modelling, and communication and/or argumentation among students? What nature of scientific, mathematical, and engineering activity is reflected in these practices? What objectives should STEM activities, proposals, and initiatives pursue? What are the differences between STEM and STEAM education?

- Sequencing as knowledge progression: How are science and mathematics learned?: prior ideas and the learning cycle. How can we sequence knowledge in line with what we know about learning? What types of educational activities exist?

  - How to design exploration: How do we elicit students' existing knowledge? For what purpose?

  - How to design the emergence of knowledge: How do we bring out scientific, technological, and mathematical knowledge in the classroom? (school-level scientific models, big ideas and mathematical strategies, engineering practices, etc.) How do we contrast scientific viewpoints with personal ones? (building, using, and/or evaluating models)

  - What teaching and learning methodologies can be used: inquiry-based learning, problem-based learning, project-based learning, etc.

  - How to design knowledge synthesis: How can we structure what has been learned? (orientation guides, mind maps, diagrams, key ideas, learning journals...) Why is it important to structure what has been learned?

  - How to design the application of content: How can we apply learned content in different contexts? (communication/argumentation).

- The importance of teaching and learning contexts: Why should learning be contextualised? What are good contexts for teaching and learning? How can contexts be used in science, mathematics, and engineering education?

- Assessment of STEM or science-technology-related projects: What characterises effective STEM projects in the primary classroom? Which projects can we design? How can we include a gender and equity perspective? What criteria can be used to assess good STEM projects?

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Brief lectures and guided activities in the classroom | 45 | 1.8 | 6, 3, 4, 9, 5 |
| Type: Supervised | | | |
| Superivision of designed activities | 30 | 1.2 | 6, 3, 4, 9 |
| Type: Autonomous | | | |
| Final desing of TLS, preparation of microteaching, reflection, final presentation, co-evaluation | 75 | 3 | 6, 3, 4, 9, 5 |

The central focus of the teaching and learning process is the students, and it is under this premise that the course methodology has been planned, as shown in the table below:

1. Short lectures / capsules by the teaching staff on the core content and basic topics of the syllabus. These sessions are held with the whole class group, usually as a follow-up to a prior reading (available on the virtual campus). They allow for the presentation of key concepts through open and active student participation. The sessions include reflection activities, concept-building exercises, and monitoring tasks, which may be done individually or in small groups *in situ*, and are then shared in plenary.

2. Guided activity sessions, where aspects discussed in the large-group sessions are explored in greater depth. These may include lab work, the use of digital tools (ICT), visits to Maker spaces, and oral presentations of student work. Activities also include the implementation of *microteaching* (short simulated teaching interventions in class) with self- and peer-assessment, guided workshops for designing teaching sequences and assessment activities, as well as the final presentations and peer evaluations of student productions.

3. Autonomous and/or supervised activities, where students will carry out tasks related to the readings, lectures, and classroom activities. Specifically, students will be expected to adapt and/or design a teaching and learning activity or sequence / project, including its assessment activities, as well as other classroom-based tasks with specific characteristics.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

## Continous Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|---|---|---|---|
| Group productions: design of a TLS, activity, sequence, space, etc. of STEM education | 50% | 0 | 0 | 1, 6, 3, 4, 2, 9, 5 |
| Individual work: co-evaluation of another group designed TLS | 30% | 0 | 0 | 1, 6, 4, 10, 7, 8, 5 |
| Personal reflection about what has been learned during the course | 20% | 0 | 0 | 6, 3, 4, 9, 5 |

Continuous evaluation includes both group and individual tasks. To achieve a passing overall grade, students must obtain at least a 4 in each assessment component.

### Block 1. Group Work:

- A fully justified proposal for a Learning Situation in the scientific-technological and/or mathematical (STEM) domain (including rationale, student-level designed activities, and teacher's guide). Students must include a task allocation document indicating which activity each member led and the percentage contribution.
- Oral presentation of the group-designed Learning Situation.

### Block 2. Individual Work:

- Justified peer evaluation of one or more aspects of a Teaching-Learning Sequence or Learning Situation designed by peers (following criteria established during the course).
- Personal reflection on what has been learned throughout the course.

Weighting of Final Grade:

Group Work

- 40% for the Learning Situation proposal (adjusted if needed for individual workload): SA presentation on 17/12/2025, written submission immediately thereafter.
- 10% for the final oral presentation of the SA.

Individual Work

- 25% for justified peer evaluation of another group's SA (according to good STEM SA criteria) - due 14/01/2026.
- 25% for a personal reflection on learning, with evidence of change before/after - due 14/01/2026.

Evaluation Dates:

- Regular group evaluation: 17/12/2025 (deadline for full SA delivery and oral presentation).
- Regular individual evaluation: up to 14/01/2026 (peer evaluation and reflection).
- Single (make-up) evaluation: 14/01/2026, includes delivery/presentation of activity or SA, personal reflection and in-class peer evaluation of peers' SA (same-day presentation or access to materials).
- Resit exam: 04/02/2026 (*note*: the provided date "04/02/2025" appears outdated; likely intended for 2026). It will consist of a long individual written exam (4h) including:

1. Open-ended questions on basic readings and STEM content capsules;
2. A justified critique of a STEM activity, drafting an analytical rubric and redesign;
3. A sketch of a STEM Learning Situation for teaching a given topic (e.g., buoyancy for first-cycle primary students).

Additional complementary tasks may be requested; these are mandatory submissions but not necessarily graded.

Submissions are primarily via the virtual campus; other formats may be arranged with the instructor and communicated in class and online.

Submissions via non-agreed methods, incorrect formats, missing author names, or late will not be accepted.

Grades will be published no later than 20 working days after submission.

According to UAB regulations, plagiarism or copying-and excessive use of AI-is penalized with a 0 for the assignment with no recovery option; in group work, all members receive 0.

During supervised in-class individual work, if a student is found copying or using unauthorized materials/devices, they will receive a 0 without recovery.

Teaching methodology and evaluation may be modified according to health authority guidelines.

Field trips scheduled within course hours are mandatory.

In the case of assessment from a second enrolment onwards, the course does not include a synthesis exam.

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## Software

Different types of software useful in STEM education will be used, such as Scratch junior or equivalent (block programming)

## Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

| Name | Group | Language | Semester | Turn |
|---|---|---|---|---|
| (TE) Theory | 70 | Catalan | first semester | morning-mixed |