Designing STEM Project for the Primary School Classroom

Code: 105055
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500798 Primary Education	OT	4

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Teaching groups languages

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

Prerequisites

It is recommended to have pass the scientific and mathematical courses of the degree in Primary School Education.

In concrete:

- Mathematics for Teachers

- Learning Mathematics and the Curriculum

- Teaching and Learning about the Natural, Social and Cultural Environment

- Teaching Experimental Sciences

- Management and Innovation in the Mathematics Classroom

Objectives and Contextualisation

The approach of the subject within the curriculum of primary school teachers aims to introduce and deepen the tools for the design and evaluation of teaching and learning sequences, projects and classroom nooks in the field of mathematical and / or scientific-technological education (STEM).

Scientific and mathematical ideas (what we call school science and mathematics content) and approaches for the teaching of science, mathematics and engineering (such as modeling and scientific and mathematical argumentation, the role of language, the importance of contextualization, etc.) that have been learned in the compulsory subjects of science and mathematics in the primary education degree will be used to design and plan both the implementation and evaluation of innovative classroom activities and teaching and learning sequences within a competence-based framework.

From a view of teaching and learning of both science and mathematics as participation of scientific and mathematical practice, the aim is to plan and evaluate activities where pupils can think, do and talk science and mathematics in the classroom, that is, to

promote scientific and mathematical modelling, scientific inquiry and mathematical problem-solving, and / or argumentation in science and mathematics, with pupils reflecting on the nature of scientific and mathematical activity emcompased in these activities

From a view of learning as a progression of knowledge and competence throughout schooling, design and sequencing of learning arises at the level of conversation, meeting, teaching unit, course and school staging, using the ideas of the learning cycle and learning progression to guide the teaching action.

From the point of view of evaluation as regulation of learning, evaluation is presented as integrated into the process of teaching and learning, where the promotion of metacognition and self-regulation in students is considered essential and is promoted through the use of strategies innovative assessment such as co-avalació and self-evaluation and sharing of design assessment rubrics.

Finally, from a competence-based framework in which the teaching and learning of science and mathematics allows to "act" in the world (that is, to think, argue, decide, evaluate, etc. with and mathematicals cientific knowledge), these activities and teaching and learning sequences must be contextualized in appropriate contexts of personal, social or global relevance to students.

The objectives of the course are:

1) Deepening on inquiry, problem solving, modeling and argumentation (do, think and speak) as school scientific and mathematical practices and planning and evaluating teaching and learning activities that integrate both.practices

2) Designing and evaluating sequences of teaching and learning activities, projects, nooks, ... according to the ideas of learning cycle, learning progression and knowledge to micro and macro levels of scientific-mathematical field.

3) Propose and evaluate assesment activities from the perspective of the evaluation as regulation of learning.

4) Justify and use contexts of teaching and learning appropriate for teaching science and mathematics and relevant for students from the personal, social or global viewpoint.

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

1. The framework of STEM education (origin, interest,..) from the point of view of scientific, mathematical and school engineering practices in the primary classroom: How are the activities that integrate doing, thinking and talking science, mathematics and engineering in the classroom? What is it and how to promote inquiry, problem solving, modelling and communication and/or argumentation in students? What nature of scientific, mathematical and engineering activity do these activities reflect?

2. Evaluation as a regulation of learning: What functions does evaluation have? What does it mean to evaluate to learn? What is the difference between evaluation and regulation? What evaluation activities and strategies from the training perspective can we use? How can self-regulation of scientific-technological and mathematical learning be promoted?

3. Sequencing as knowledge progression: How are science and mathematics learned?: previous ideas and learning cycle. How can we sequence knowledge according to what we know about learning? What types of didactic activities are there?

- How to design the exploration: How do we make students' knowledge emerge? For what purpose?

- How to design the emergence of knowledge: How to make scientific-technological and mathematical knowledge emerge in the classroom? (school science models, big mathematical ideas and strategies, school engineering practices,...) How to contrast the scientific point of view with one's own? (build, use and/or evaluate the model)

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

- How to design the synthesis of knowledge: How can we structure what we have learned? (orientation bases, mind maps, outlines, key ideas, learning diary,...) Why structure what we have learned? How to design the application of the contents: How can we apply the contents learned in different contexts? (communication / argumentation).

4. The importance of teaching and learning contexts: Why contextualize? What are good teaching and learning contexts? How to use context in teaching and learning science, mathematics and engineering.

5. The structure of scientific-technological or STEM projects: How are good STEM projects in the primary classroom? Which ones can we design? How to include a gender and equity perspective? What criteria take into account when evaluating 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 main actor of the teaching-learning process are the student teachers, and it is under this premise that the methodology of the course has been planned as shown in the table below:

1. Short presentations/ teaching pills by the teaching staff on the contents and basic questions of the syllabus. It is carried out with the whole class group and allows the exhibition of the main contents through an open and active participation from the students' part. It includes activities of reflection, follow-up, construction of ideas, etc. that can be carried out individually or in a small group "in situ" and are shared in the class group.

2. Sessions of directed activities where aspects related to what was exposed in the large group sessions will be deepened, including when necessary the work in the laboratory, with ICT / CT tools, visit of Maker spaces and oral exhibition of student productions. It includes implementation of micro-teaching activities (mini-interventions of simulated teaching in the classroom) with self and co-evaluation, guided design workshops of both didactic sequences and evaluation activities as well as presentations and co-evaluations of the final productions.

3. Autonomous and / or supervised activities where students will elaborate tasks related to readings, exhibitions and / or activities proposed in class. Specifically, an activity, teaching and learning sequence / project must be adapted and / or designed including the evaluation activities of the same, as well as other classroom activities with concrete 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, 2, 4, 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

The summative evaluation of the course includes both group and individual activities. In order to pass the student will have to get over a 4 in both the individual and the group marks.

Block 1. Group work:

- A complete Teaching and Learning sequence (including justification, activities designed to the level of the student and a teaching guide). Students must include a signed document showing how the distribution of thegroup work has been done.

- Oral presentationof the Teaching and Learning Sequence designed by group (teacher will decidepresentation order if necessary)

Block 2. Individual work:

- A self-assessment of the didactical quality of their micro-teaching activity

- A co-assessment of another groupTeaching and learning sequence (TLS) justified according to an evaluation rubric designed by the ech student themselve according to pre-established evaluation criteria throughout the course.

Specifically, the percentages of the total grade for the subject are established as follows:

TEAMWORK

• 40% grade of the SA proposal (75% teacher grade and 25% peer grade): the TLS will be presented to the group and delivered in writing form right after these presentations.

• 10% mark of the final presentation of the SA (100% mark of the teacher).

INDIVIDUAL WORKS

• 30% mark of the justified co-evaluation of the TLS of another group (according to the criteria of good TLS of STEM education) (January 15th, 2025)

• 20% personal reflection on what has been learned in the subject (January 15th, 2025)

Dates of ordinary, one-off and recovery assessments:

The ordinary evaluation of the group part will take place on 18/12/2024 (delivery of the TLS in complete format plus oral presentation of the TLS to the group)

The evaluation of the individual part will be done a posteriori, as both the individual reflections and the co-evaluations will be delivered before January 15th, 2025.

The single evaluation will also take place on 15/01/2025, including the delivery and presentation of the SA carried out individually or in a group if possible, plus the delivery of the individual reflection and the co-evaluation, carried out in site, of the SA of some colleagues presented that day.

The recovery of both the ordinary and the unique assessment will take place on 05/02/2024.

In the case of recovery (when the continuous or single assessment is suspended) there will be a long individual written test (4 hours) that includes:

- questions on basic knowledge of the subject content pills (STEM education) in open format

- the grounded critique of a STEM activity based on the writing of a specific analysis rubric as wellasthe design

- the outline of a STEM learning situation for the teaching and learning of a given content (e.g. an SA to teach and learn about buoyancy for first cycle students)

Throughout the course, you can be asked for additional mandatory tasks without necessarily being considered assessment tasks.

Assignments will be delivered primarily via the virtual campus. Other delivery methods may be enabled, prior agreement with the teaching staff, informed in person in class and via the virtual campus.

Works submitted by means not agreed with the teacher will not be accepted, nor will works submitted with incorrect formats, which do not include the names of the authors or which are submitted after the deadline.

The marks of the assignments and the exams will be uploaded no later than 1 month after their delivery.

According to the UAB regulations, plagiarism or copying of any work as well as the detection of an abusive use of artificial intelligence will be penalized with a 0 as a grade for this work losing the possibility of recovering it, both if it is an individual or group work (in this case, all members of the group will have a 0).

If, during the completion of individual work in class, the teacher considers that a student is trying to copy or discovers some type of document or device not authorized by the teaching staff, the same will be graded with a 0, with no recovery option .

The proposed teaching methodology and assessment may undergo some modification depending on the restrictions on attendance imposed by the health authorities.

The out of school activities organisedwithin the subject timetable are compulsory.

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Software

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

Language list

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