UAB
Universitat Autònoma de Barcelona

Design and Evaluation of Teaching and Learning of Sciences and Mathematics in Context

Code: 45013
ECTS Credits: 6

2025/2026

Degree	Type	Year
Research in Education	OP	1

Contact

Name: Begoña Oliveras Prat

Email: begona.oliveras@uab.cat

Teachers

Francisco Javier Lucas Rojas Sateler

Genaro de Gamboa Rojas

Carme Grimalt Alvaro

Teaching groups languages

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

Prerequisites

None

Objectives and Contextualisation

Considering the learning of the previous modules, the study of the design of different projects and didactic proposals will be deepened to work on the contextualized integration of science and mathematics teaching. Emphasis will also be placed on how to evaluate these proposals by adopting an applied qualitative research approach.

At the end of the module, students are expected to be able to:

• Understand the role of contexts in projects and didactic proposals for the integration of science and mathematics teaching.
• Identify key elements of communication and mathematical and scientific reasoning to develop projects and solve problems in context.
• Apply evaluation criteria and processes to projects and didactic proposals to promote contextualized teaching

of science and mathematics.
• Design competency-based educational proposals with a focus on the improvement of projects and didactic proposals for the contextualized teaching of science and mathematics.

Learning Outcomes

1. CA64 (Competence) Study the relevant aspects of the contexts of science and mathematics education, and analyse them as research objectives in order to formulate questions and goals based on them.
2. CA65 (Competence) Adopt innovative approaches to assessment in order to make proposals for improvement and innovation projects on the teaching of science and mathematics in context.
3. KA63 (Knowledge) Describe the different theoretical frameworks of reference that guide research and innovation in science and mathematics education based on socially and environmentally relevant contexts.
4. KA64 (Knowledge) Identify lines of research on the teaching of science and mathematics in context from the relevant professional sources.
5. KA65 (Knowledge) Identify problem areas in innovation on science and mathematics education in context and assess which methodological approaches might help to resolve them.
6. SA50 (Skill) Create relevant research and innovation designs in relation to science and mathematics education in context.
7. SA51 (Skill) Plan research while taking into account the potential and limitations of digital tools for teaching science and mathematics in context.
8. SA52 (Skill) Report the conclusions of research on innovations, the knowledge generated and the ultimate supporting reasons to specialised and non-specialised audiences in a clear and unambiguous manner.

Content

This module will address in a transversal way some of the main processes related to science and mathematics education such as practical work, school projects, technologies for learning, communication in the classroom, problem solving and assessment.

Some of the central topics will be:

• Contextualisation and interdisciplinarity in the teaching of science and mathematics.
• Scientific inquiry based on modelling in relevant contexts.
• Mathematical communication focuses on promoting mathematical reasoning around specific contents of the curriculum.
• Formative and qualifying assessment throughout the learning process of science and mathematics.
• Use of digital tools in the design of contextualized projects in science and mathematics.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom practices	18	0.72	
Lectures	18	0.72	

Type: Supervised		
Analysis and group discussion of papers	16	0.64
Tutorials	10	0.4
Type: Autonomous		
Production of papers / group work	60	2.4
Reading papers	28	1.12

The training activity will be developed based on the following dynamics:

• Lectures by the teaching staff
• Readings of articles and documentary collections
• Classroom practices: problem solving/cases/exercises
• Oral presentations
• Tutorials

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
Evaluation of an interdisciplinary project (including the design of a competency-based assessment question) Group work presentation	45%	0	0	CA64, CA65, KA63, SA51, SA52
Individual reflection document based on the improvement proposals received from the evaluation of a project (also supporting some of the reflections with theoretical references analyzed throughout the module)	45%	0	0	KA63, KA64, KA65, SA50
Participation in class and in a Moodle forum (minimum 80% attendance) Individual	10%	0	0	CA65, KA63, SA52

To access the assessment, it will be necessary to attend 80% of the sessions of the module. The participation and involvement of students in the proposed activities and the development of the work dynamics will be valued.

Three evaluation activities are proposed:

- Task A: Evaluation of an interdisciplinary project (including the design of a competency assessment question or activity) - Presentation of the work in groups. Delivery date: May 21, 2026
- Task B: Individual reflection document based on the proposals for improvement received from the evaluation of a project (basing some of the reflections on theoretical references analysed throughout the module). Delivery date: June 4, 2026
- Task C: Participation in the forum on the Virtual Campus (participation is expected to be continuous throughout the module). Forum closing date: June 4, 2026

Reassessment: To recover the continuous assessment activities, it will be necessary to submit a report justifying the changes incorporated into the activities based on the contributions of the teaching staff. The maximum mark that can be obtained in the recovery task is five (5.0). The deadline for submission for the Virtual Campus will be June 4, 2026.

Single assessment: A single document will be delivered with the three continuous assessment activities of the module:

- Task A: Evaluation of an interdisciplinary project (including the design of a competency assessment question or activity).
- Task B: Individual reflection document on the proposals for improvement of the evaluated project (Task A), basing some of the reflections on theoretical references analysed throughout the module).
- Task C: Participation in the forum on the Virtual Campus (a single document must be submitted that responds to all the reflections proposed in the forum).

The activities will be delivered anddefended orally on May 21, 2026, from 5:30 p.m. to 8:00 p.m. The recovery of the single assessment will consist of the delivery of a report justifying the changes incorporated into the activities based on the contributions of the teaching staff during the oral defence. The deadline for submitting the recovery will be made through the Virtual Campus and will be June 4, 2026.

Copy or plagiarism.

According to UAB regulations, plagiarism or copying of any work, or the use of AI without proper disclosure, will be penalized with a grade of 0, with no possibility of resubmission. This applies to both individual and group work (in the latter case, all group members will receive a 0).

Use of Artificial Intelligence (AI) Technologies

For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for assignments where the instructor has explicitly allowed it. Students must clearly indicate which parts were generated using AI, specify the tools used, and include a critical reflection on how these tools influenced the process and final outcome of the activity. Lack of transparency in the use of AI in any graded activity will be considered academic dishonesty and will result in a total penalty (zero) for the assignment.

Bibliography

Caro, A., & Planas, N. (2021). Estudio exploratorio con futuras maestras sobre lenguas matemáticas para enseñar la relación entre área y volumen. *Avances de Investigación en Educación Matemática, 19*, 117-131. https://doi.org/10.35763/aiem.v0i19.361

Carrillo, J., Climent, N., Gorgorió, N., Prat, M. y Rojas, F. (2008). Análisis de secuencias de aprendizaje matemático desde la perspectiva de la gestión de la participación. *Enseñanza de las Ciencias, 26*(1), 67-76.

Couso, D. (2014). De la moda de "aprender indagando" a la indagación para modelizar: una reflexión crítica. XXVI Encuentro de Didáctica de las Ciencias Experimentales. http://uhu.es/26edce/actas/docs/conferencias/pdf/26ENCUENTRO_DCE-ConferenciaPlenariaInaugural.pdf

Couso, D., Domènech Casal, J., Simarro Rodríguez, C., López Simó, V., & Grimalt-Álvaro, C. (2022). Perspectives, Metodologies i Tecnologies en el desplegament de l'educació STEM. *Ciències: Revista Del Professorat de Ciències de Primària i Secundària, 44*, 56-71. https://doi.org/10.5565/rev/ciencies.470

Gómez Zaccarelli, F., Cándido Vendrasco, N. y Arriagada Jofré, V. (2024). Discusiones y argumentación en la enseñanza de las ciencias: prácticas y desafíos docentes. *Enseñanza de las Ciencias, 42*(2), 25-43. https://doi.org/10.5565/rev/ensciencias.5958

Grimalt-Álvaro, C., López-Simó, V. & Tena, È. (2024) .How Do Secondary-School Teachers Design STEM Teaching-Learning Sequences? A Mixed Methods Study for Identifying Design Profiles. *Int J of Sci and Math Educ* (2024). https://doi.org/10.1007/s10763-024-10457-3

Hernández-Sabaté, A., Joanpere, M., Gorgorió, N., & Albarracín, L. (2015). Mathematics learning opportunities when playing a tower defense game. *International Journal of Serious Games, 2*(4), 57-71.

Klein, P.D; Kirkpatrick, L.C. (2010). Multimodal Literacies in Science: Currency, Coherence and Focus. *Research in Science Education, 40*, 87-92.

Lin, F-L., y Rowland, T. (2016). Pre-Service and In-Service Mathematics Teachers' Knowledge and Professional Development. En, A. Gutierrez, G. C. Leder, y P. Boero, *The Second Handbook of Research on the Psychology of Mathematics Education* (pp. 483-520). Rotterdam, The Netherlands: Sense Publishers.

Millar, R. (2009). *Analysing practical activities to assess and improve effectiveness: The Practical Activity Analysis Inventory (PAAI)*. Centre for Innovation and Research in Science Education, Department of Educational Studies, University of York, Heslington, York.

Morell, M., & Planas, N. (2024). Calidad de la enseñanza de la divisibilidad en un aula trilingüe de secundaria. *Números-Revista de Didáctica de las Matemáticas*, 117.

NCTM (2015). *De los Principios a la Acción. Para Garantizar el éxito matemático para todos*. NCTM.

Niss, M. & Højgaard, T. (2011). *Competencies and Mathematical Learning Ideas and inspiration for the development of mathematics teaching and learning in Denmark. KOM project*. IMFUFA, Roskilde University, Denmark.

Oliveras, B.; Márquez, C.; Sanmartí, N. (2013). «The Use of Newspaper Articles as a Tool To DevelopCritical Thinking in Science Classes».International Journal of Science Education, 35 (6), 885-905

Pérez Torres, M., Couso, D., & Márquez, C. (2021). ¿Cómo diseñar un buen proyecto STEM? Identificación de tensiones en la co-construcción de una rúbrica para su mejora. *Revista Eureka Sobre Enseñanza y Divulgación de Las Ciencias, 18*(1), 1-21. https://doi.org/10.25267/Rev_Eureka_ensen_divulg_cienc.2021.v18.i1.1301

Pimm, D. (201). *Speaking mathematically: Communication in the mathematics classroom*. Routledge Revivals.

Planas, N., & Pimm, D. (2024). Mathematics education research on language and on communication including some distinctions: Where are we now?. *ZDM Mathematics Education 56*, 127-139. https://doi.org/10.1007/s11858-023-01497-0

Planas, N., Alfonso, J.M., Arnal-Bailera, A., & Martín-Molina, V. (2024). Mathematical naming and explaining in teaching talk: Noticing work with two groups of mathematics teachers. *ZDM Mathematics Education*. https://doi.org/10.1007/s11858-024-01576-w

Planas, N., García-Honrado, I., & Arnal-Bailera, A. (2018). El discurso matemático del profesor: ¿Cómo se produce en clase y cómo se puede investigar? *Enseñanza de las Ciencias, 36*(1), 45-60. https://doi.org/10.5565/rev/ensciencias.2240

Ponte, J. P., & Chapman, O. (2006). Mathematics teachers' knowledge and practices. In A. Gutierrez & P. Boero (Eds.), *Handbook of reaserch on the psychology of mathematics education: Past, present and future* (pp. 461-494). Roterdham: Sense.

Roca, M.; Márquez, C.; Sanmartí, N. (2013). Las preguntas de los alumnos: Una propuesta de análisis. *Enseñanza de las Ciencias, 31*, 1, 95-114.

Sala, G. & Font, V. (2019). Papel de la modelización en una experiencia de enseñanza de las matemáticas basada en indagación. *Avances de Investigación en Educación Matemática, num. 16*, 73-85. DOI: https://doi.org/10.35763/aiem.v0i16.283

Sala, G., Barquero, B., Barajas, M., & Font, V. (2016). Què amaguen aquestes ruïnes? Disseny d'una unitat didàctica interdisciplinary per una plataforma virtual. Revista del Congrés Internacional de Docència Universitària i Innovació (CIDUI), núm. 3.

Sanmartí Puig, N., & Márquez Bargalló, C. (2017). Aprendizaje de las ciencias basado en proyectos: del contexto a la acción. *Ápice. Revista De Educación Científica, 1*(1), 3-16. https://doi.org/10.17979/arec.2017.1.1.2020

Sanmartí, N. (2016). Trabajo por proyectos: ¿filosofía o metodología? *Cuadernos de Pedagogía*, 472.

Sanmartí, N. (2020). *Avaluar és aprendre. Xarxa Competències bàsiques*. Generalitat de Catalumya. Departament d'Educació.

Sanmartí, N., & Márquez, C. (2017). Aprendizaje de las ciencias basado en proyectos: del contexto a la acción. *Ápice. Revista de educación científica, 1*(1), 3-16.

Scott, P., Ametller, J. (2006). Teaching science in a meaning fulway: striking a balance between opening up and closing down classroom talk. *School Science Review, 88*(324), 77-83.

Smith, M. y Stein, M. K. (2016). *5 prácticas para orquestar discusiones en matemáticas*. NCTM.

Tena, È., & Couso, D. (2023). ¿Cómo sé que mi secuencia didáctica es de calidad? Propuesta de un marco de evaluación desde la perspectiva de Investigación Basada en Diseño. *Revista Eureka Sobre Enseñanza y Divulgación de Las Ciencias, 20*(2). https://doi.org/10.25267/Rev_Eureka_ensen_divulg_cienc.2023.v20.i2.2801

Thomas, J. W. (2000). *A review of research on project-based learning*. The Autodesk Foundation, California.

Software

No specific software is required.

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
(TEm) Theory (master)	1	Catalan	second semester	afternoon