

**Research into Specific Ambits of Science and  
Mathematics Teaching**

Code: 43929  
ECTS Credits: 6

Degree	Type	Year	Semester
4313815 Research in Education	OT	0	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

### Contact

Name: Josep Maria Fortuny Aymemí  
Email: JosepMaria.Fortuny@uab.cat

### Use of Languages

Principal working language: catalan (cat)

### Teachers

Maria Mercè Edo Basté  
Josep Maria Fortuny Aymemí  
Jordi Domenech Casal  
Begoña Oliveras Prat

### External teachers

2074410

### Prerequisites

-

### Objectives and Contextualisation

El objetivo de este módulo es plantear la investigación en torno a la enseñanza de diferentes ámbitos científicos y matemáticos que aparecen en el currículo de educación infantil, primaria y secundaria, así como en el ámbito la formación del profesorado.

### Competences

- Analyse data according to its nature and present results in accordance with the research proposals.
- Collect research data coherently in accordance with the chosen method.
- Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
- Communicate the research results, knowledge acquired and the implications for practice, and adapt the register to the public and formal protocols.
- Continue the learning process, to a large extent autonomously.

- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Plan research according to practice-related problems, taking into account theoretical advances in the field of knowledge.
- Recognise and relate the basic research principles in practical work for improvement in mathematic skill.
- Recognise and relate the basic research principles in practical work for improvement in scientific competence.
- Recognise and relate the theoretical, empirical and social aspects of the specific field of research.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use ICT in the research process, information search and management, data analysis and the dissemination and communication of results.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Work in teams and with teams in the same or interdisciplinary fields.

## Learning Outcomes

1. Analyse the theoretical frameworks of reference in order to establish those that guide the research.
2. Apply basic research principles in practical work to the analysis of processes related to improving science skills.
3. Apply the basic principles of research into problem-solving to the analysis of teaching-learning situations that target the improvement of mathematical competence.
4. Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
5. Continue the learning process, to a large extent autonomously.
6. Decide on the appropriate tools for analysis according to the nature of the data.
7. Decide on the information and the subjects involved in the study.
8. Design strategies for collecting information.
9. Find and analyse theoretical references.
10. Identify problem areas related to specific aspects of science and mathematics teaching and determine methodological approaches from which to address them.
11. Identify problems related to specific areas of science and mathematics teaching.
12. Identify theoretical reference points and evaluate their suitability for interpreting problem areas in science and mathematics teaching.
13. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
14. Judge the theoretical and social importance of research into science and mathematics teaching.
15. Know the reference points in research associated with science and mathematics content domains.
16. Know the significant features of science- and mathematics-teaching research contexts and analyse them as objects of research.
17. Produce conclusions taking into reference the research objectives and questions and the theoretical references.
18. Recognise the theoretical standpoints on science and mathematics teaching and learning when planning research in this area.
19. Relate results in accordance with their origin (sources and instruments).
20. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
21. Use ICT in the research process, information search and management, data analysis and the dissemination and communication of results.
22. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
23. Work in teams and with teams in the same or interdisciplinary fields.
24. Write scientific summaries to be presented to different audiences.

## Content

- Research on teaching and learning, and on teacher training, of biological and geological systems

- Research on teaching and learning, and in teacher training, of physical-chemical systems
- Research on teaching and learning, and in teacher training, of arithmetic and algebraic thinking
- Research on teaching and learning, and on teacher training, of geometric thinking

## Methodology

The sessions will be based on the presentation of the main research theoretical framework and on the discussion of the results of research articles, as well as the analysis of data.

Our teaching approach and assessment procedures may be altered if public health authorities impose new restrictions on public gatherings for COVID-19

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Research results discussions and case analysis	0	0	1, 2, 3, 9, 16, 15, 6, 7, 8, 17, 11, 10, 12, 21, 14, 18, 24, 19, 23
Theoretical framework discussion	0	0	1, 2, 3, 9, 16, 15, 6, 7, 8, 17, 11, 10, 12, 21, 14, 18, 24, 19, 23

## Assessment

The evaluation will be based on two individual tasks (50% each one)- During the first sessions the activities, the delivery date and the evaluation criteria will be specified.

Our teaching approach and assessment procedures may be altered if public health authorities impose new restrictions on public gatherings for COVID-19

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Individual activity related with the theoretical framework	50	75	3	1, 2, 3, 9, 16, 15, 6, 7, 8, 17, 11, 10, 12, 21, 14, 13, 20, 4, 5, 18, 24, 19, 22, 23
Individual activity based on teaching materials	50	75	3	1, 2, 3, 9, 16, 15, 6, 7, 8, 17, 11, 10, 12, 21, 14, 18, 24, 19, 23

## Bibliography

Callejo, M. L.; Zapatera, A. (2016). Prospective primary teachers' noticing of students' understanding of pattern generalization. *Journal of Mathematics Teacher Education*, 1-25.

Dickson, L.; Brown, M.; Gibson, O. (1984). *Children Learning Mathematics: a Teachers' Guide to Recent Research*. London: Cassell.

Drijvers, P.; Doorman, M.; Boon, P.; Reed, H.; Gravemeijer, K. (2010). The teacher and the tool: instrumental orchestrations in the technology-rich mathematics classroom. *Educational Studies in Mathematics*, 75, 213-234.

Fernández, C.; Llinares, S. (2012). Características del desarrollo del razonamiento proporcional en la Educación Primaria y Secundaria. *Enseñanza de las Ciencias*, 30(1), 129-142.

Fernández, C.; Llinares, S.; Van Dooren, W.; De Bock, D.; Verschaffel (2011). Effect on number structure and nature of quantities on secondary school students' proportional reasoning. *Studia Psychologica*, 53 (1), 69-81

Fuentealba, C.; Sánchez-Matamoros, G.; Badillo, E.; Trigueros, M. (2017). Thematization of the derivative schema in university students: a study about the existence of nuances in constructing relations between a function's successive derivatives. *International Journal of Mathematical Education in Science and Technology (TMES)*, 48(3), 374-392. DOI: 10.1080/0020739X.2016.1248508.

Gobert, J. (2000). A typology of causal models for plate tectonics: Inferential power and barriers to understanding. *International Journal of Science Education*, 22, 9, 937-977.

Izquierdo, M. (2005). Hacia una teoría de los contenidos escolares, *Enseñanza de las Ciencias*, 23 (1), 11-122.

Morera, L.; Fortuny, J. M.; Planas, N. (2012). Momentos clave en el aprendizaje de isometrías en un entorno de clase colaborativo y tecnológico. *Enseñanza de las Ciencias*, 30(1), 143-154

Ogborn, J. (2012). Curriculum Development in Physics: Not Quite so Fast. *Scientia in educatione* 3(2), p. 3-15. (article basat en la conferència plenària del catedràtic Jon Ogborn el 03 de juliol de 2012, al The World Conference on Physics Education 2012, Istanbul, Turkey).

Radford, L. (2010). Algebraic thinking from a cultural semiotic perspective. *Research in Mathematics Education*, 12(1), 1-19.

Sanchez-Matamoros, G.; Fernández, C.; Llinares, S. (2015). Developing pre-service teachers' noticing of students' understanding of the derivative concept. *International Journal of Science and Mathematics Education*, 13, 1305- 1329. DOI: 10.1007/s10763-014-9544-y

Sauvé, L. (2010). Educación científica y educación ambiental: un cruce fecundo. *Enseñanza de las Ciencias* 28 (1), 5-18

Stylianides, G. J.; Stylianides, A. J. (2009). Facilitating the transition from empirical arguments to proof. *Journal for Research in Mathematics Education*, 40(3), 314-352.

Verhoeff, R. P. (2003). Towards systems thinking in cell biology education. *Centrum voor Didactiek van Wiskunde en Natuurwetenschappen, Universiteit Utrecht (The Netherlands)* ISBN: 90-73346-56-8. (S'indicarà la part que cal llegir)

Vermillion, P.; Rabardel, P. (1995). Cognition and artifacts: A contribution to the study of thought in relation to instrumented activity. *European Journal of Psychology of Education*, 10(1), 77-101.

Enllaços web:

- Centre de Recursos per Ensenyar i Aprendre Matemàtiques (CREAMAT). Generalitat de Catalunya. <http://phobos.xtec.cat/creamat/joomla/>

- Freudental Institute. Utrecht (Netherlands). <http://www.fisme.science.uu.nl/fisme/en/>

- The Nrich Maths Project. Cambridge (UK). <http://nrich.maths.org/frontpage>

Godino, J. D., Batanero, C. & Font, V. (2003). Fundamentos de la enseñanza y el aprendizaje de las matemáticas. Departamento de Didáctica de las Matemáticas. Universidad de Granada. (Recuperable en, <http://www.ugr.es/local/jgodino/>)

Iranzo, N. (2009). Influence of dynamic geometry software on plane geometry problem solving strategies. Unpublished Doctoral Dissertation. Bellaterra, Spain: Universitat Autònoma de Barcelona. (Recuperable en, <http://www.geogebra.org/publications/2009-06-30-Nuria-Iranzo-Dissertation.pdf>)

PROVISIONAL