

**Research Perspectives in Science and Mathematics
Education**

Code: 43928
ECTS Credits: 6

Degree	Type	Year	Semester
4313815 Research in Education	OT	0	1

Contact

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Other comments on languages

Students will be able to use their own language through oral and written practices. The visual presentations, the teaching instruments and materials, and readings will be in catalan, spanish or english

Use of Languages

Principal working language: catalan (cat)

Teachers

Jordi Deulofeu Piquet

Nuria Planas Raig

Prerequisites

No prerequisites

Objectives and Contextualisation

Research Perspectives in Science and Mathematics Education is an introductory module to the speciality. It aims to bring students closer to the basic ideas of research in Didactics of Science and of Mathematics.

Different themes will be addressed: the nature of science and of mathematics; the aims of science and mathematics teaching; theories of science and mathematics learning; historical milestones in the construction and transformation of the character of science and mathematics education as scientific disciplines.

This module is compulsory for the specialty of Science and Mathematics Education and it is optional for all other specialities, while being especially useful for students interested in Environmental Education research.

The module aims to get the student:

- . acquire a basic knowledge of the specificity of research in both Science Education and Mathematics Education;
- . learn to speak, read and write according to the criteria within the areas above mentioned;
- . identify the particular criteria of rigour in the educational investigation involving either mathematics or science.

Competences

- 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. Identify methodological approaches and evaluate their adequacy to investigate problems related to scientific education, mathematical education and possibly the intersection between the two areas.
7. Identify practical problems in science education and mathematics education.
8. Identify research trends in science education and mathematics education, and trends that are emerging at the intersection between both.
9. Identify theoretical references and assess their adequacy to interpret distinctive problems of scientific education, mathematical education and study domains in the intersection of both areas.
10. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
11. Judge the importance and theoretical and social pertinence of a research problem or problems in science education and mathematics education.
12. Know the changes in the nature of science and mathematics and their resulting impact on science education and mathematics education.
13. Recognise the theoretical standpoints on science and mathematics teaching and learning when planning research in this area.
14. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
15. Understand the main aspects of the contexts of scientific education and mathematical education and analyze them as research objects.
16. Use ICT in the research process, information search and management, data analysis and the dissemination and communication of results.
17. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
18. Work in teams and with teams in the same or interdisciplinary fields.
19. Write scientific summaries to be presented to different audiences.

Content

There are three key themes of content:

- Introduction to research in Mathematics Education and in Science Education;
- Theoretical and founding strands in the teaching and learning of mathematics and of science;
- Research trends in Mathematics Education and in Science Education.

Methodology

The training activity will be developed through the following dynamics:

- Master classes / lectures by the teacher
- Reading of articles and documentary sources
- Collective analysis and discussion of articles and documentary sources
- Classroom practices: problem solving / case studies / exercises
- Presentation / oral presentation of papers
- 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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
master classes and classroom practices	36	1.44	
Type: Supervised			
shared analysis and discussion of documents, presentation of works, tutorials	36	1.44	
Type: Autonomous			
reading papers	78	3.12	

Assessment

The score of the module will be the weighted average of the scores obtained in the evaluation activities, provided that each of them is equal to or greater than 4. The evaluation of each of the activities will be individual. Details of the evaluation activities and the delivery schedule, where applicable, will be presented during the development of the module.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Critical reading of a science education or mathematics education research paper	40%	0	0	2, 3, 15, 6, 7, 16, 10, 14, 4, 5, 13, 19, 17
Reflection on the nature of science and mathematics, competences, and problem solving	30%	0	0	1, 9, 8, 10, 14, 4, 5, 17

Bibliography

BIBLIOGRAPHY

The teachers responsible for the different activities of the module will present the bibliography corresponding to each session. Below is a list of books and journals compiling research and a list of the most important research publications in Science Education and Mathematics Education.

HANDBOOKS AND REVIEW JOURNALS IN SCIENCE EDUCATION AND MATHEMATICS EDUCATION

School Science Review: <http://www.ase.org.uk/journals/school-science-review>

Science Education Review: <http://www.scienceeducationreview.com/editorial.html>

Abell, S.K. & Lederman, N.G. (Eds.) (2010). *Handbook of research on Science Education Volume I*. New York: Routledge.

Abell, S.K. & Lederman, N.G. (Eds.) (2014). *Handbook of research on Science Education Volume II*. New York: Routledge.

Bishop, A. J., Clements, M. K., Keitel, C., Kilpatrick, J., & Laborde, C. (Eds.). (1996). *International handbook of mathematics education*. Springer Science & Business Media.

Bishop, A., Clements, M.A.K., Keitel-Kreidt, C., Kilpatrick, J., Leung, F.K.-S. (Eds.) (2003). *Second International Handbook of Mathematics Education*. Springer International.

Clements, M.A., Bishop, A., Keitel-Kreidt, C., Kilpatrick, J., Leung, F.K.-S. (Eds.) (2013). *Third International Handbook of Mathematics Education*. Springer International.

English, L. D., & Kirshner, D. (Eds.). (2015). *Handbook of international research in mathematics education*. Routledge.

Fraser, B.J. & Tobin, K.G. (Eds.) (1998). *International Handbook of Science Education*. Dordrecht, The Netherlands: Kluwer Academic.

Fraser, B.J., Tobin, K.G. & McRobbie, C.J. (Eds.) (2012). *Second International Handbook of Science Education*. Dordrecht, The Netherlands: Springer.

Gunstone, R. (2015). *Encyclopedia of science education*. Dordrecht, The Netherlands: Springer.

Grouws, D. A. (Ed.). (1992). *Handbook of Research on Mathematics Teaching and Learning*: National Council of Teachers of Mathematics. IAP.

Grouws, D. (Ed.). (2007). *Handbook of Research on Mathematics Teaching and Learning*: National Council of Teachers of Mathematics. IAP.

Gutiérrez, A., & Boero, P. (Eds.). (2006). *Handbook of research on the psychology of mathematics education: Past, present and future*. Sense Publishers.

Gutiérrez, A., Leder, G., & Boero, P. (Eds.). (2016). *Second Handbook of research on the psychology of mathematics education: Past, present and future*. Sense Publishers.

Johnson, C.C., Mohr-Schroeder, M.J., Moore, T.J., & English, L.D. (Eds.). (2020). *Handbook of Research on STEM Education (1st ed.)*. Routledge. <https://doi.org/10.4324/9780429021381>

Kelly, A.E., & Lesh, R.A. (Eds.). (2000). *Handbook of research Design in Mathematics and Science Education*. New York: Routledge.

Lerman, S. (Ed.). (2014). *Encyclopedia of Mathematics Education*. Springer.

Stevenson, R.B., Brody, M., Dillon, J., & Wals, A. (Eds.). (2013). *International Handbook of research on Environmental Education*. New York: Routledge.

SCIENCE EDUCATION RESEARCH JOURNALS

Enseñanza de las Ciencias: <http://ensciencias.uab.es>

Didáctica de las ciencias experimentales y sociales: <http://dialnet.unirioja.es/servlet/revista?codigo=418>

Revista Electrónica de Enseñanza de las Ciencias: <http://www.saum.uvigo.es/reec>

Revista EUREKA sobre enseñanza y divulgación de las ciencias: <https://revistas.uca.es/index.php/eureka>

Ciencia & Educação: <http://www2.fc.unesp.br/cienciaeducacao>

Cultural Studies of Science Education:

<http://www.springer.com/education+%26+language/science+education/journal/11422>

International Journal of Science Education: <http://www.tandf.co.uk/journals/titles/09500693.asp>

Journal of Research in Science Teaching: <http://onlinelibrary.wiley.com/journal/10.1002>

Science Education: [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1098-237X](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1098-237X)

MATHEMATICS EDUCATION RESEARCH JOURNALS

Avances de Investigación en Educación Matemática: <http://www.aiem.es/index.php/aiem>

Bolema: Boletim de Educação Matemática: www.scielo.br/bolema

Educational Studies in Mathematics: <https://link.springer.com/journal/10649>

For the Learning of Mathematics: <http://flm-journal.org>

Journal of Mathematical Behavior: <https://www.journals.elsevier.com/the-journal-of-mathematical-behavior>

Journal of Mathematics Teacher Education:

<http://www.springer.com/education+%26+language/mathematics+education/journal/10857>

Journal for Research in Mathematics Education:

<http://www.nctm.org/publications/journal-for-research-in-mathematics-education>

Mathematics Education Research Journal:

<http://www.springer.com/education+%26+language/mathematics+education/journal/13394>

Mathematical Thinking and Learning: <http://www.tandfonline.com/toc/hmtl20/current>

PNA, Pensamiento numérico avanzado: <http://revistaseug.ugr.es/index.php/pna/index>

RELIME, Revista latinoamericana de investigación en matemática educativa:

<http://www.clame.org.mx/relime/relimee.html>

Software

There is no need of a specific computer program to participate in this course