VNIVERSITAT DE VALÈNCIA

Course Guide
43486 Fundamental research in didactics of experimental sciences

COURSE DATA

Data Subject	
Code	43486
Name	Fundamental research in didactics of experimental sciences
Cycle	Master's degree
ECTS Credits	7.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2157 - M.D. in Research in Subject Didactics	Faculty of Teacher Training	1	First term
3112 - Specific Didactics	Doctoral School	0	Annual

Subject-matter

Degree	Subject-matter	Character
2157 - M.D. in Research in Subject Didactics	9 - Research in didactics of experimental sciences	Optional
3112 - Specific Didactics	1 - Complementos de Formación	Optional

Coordination

Name	Department
CANTO DOMENECH, JOSE RAFAEL	90 - Methodology of experimental and social sciences
SOLBES MATARREDONA, JORDI ANTONI	90 - Methodology of experimental and social sciences

SUMMARY

The compulsory subject of Fundamental Research in the Didactics of Experimental Sciences, within Module 7: Research in the Didactics of Experimental Sciences, is intended to encourage students' individual and collective reflection around the lines of research, essential for their training as future researchers, which are being developed in the didactics of experimental sciences.

The training objectives of the module and this subject in particular should encourage students to contribute to the construction of a coherent body of knowledge about the problems set out by the teaching of the experimental sciences, putting them in a research situation and comparing their production with that obtained by the scientific community. The reality of school failure in scientific disciplines, students' negative attitude towards them, teachers' frustration, etc., show the need for rigorous research and grounded and properly controlled innovation in which future researchers must be involved.

The aim of this subject is, therefore, to contribute to this general objective, promoting the immersion of students in research in the didactics of science regarding different key aspects of the teaching/learning process, of teacher training itself and of non-formal scientific education, while training new researchers. All this will allow them to develop very diverse research on different conceptual, procedural and axiological dimensions of scientific education.

In particular, the course will deal with basic aspects of research in science education and, more specifically, with argumentation and critical thinking and enquiry in science education, considered essential by the international community in the teaching of experimental sciences.

Research that must be associated to innovation, that is, the transformation of what is carried out in classrooms. This is because the main motivation for research in this field derives from the concern of what does not work in classrooms and the corresponding interest in achieving better results. Research that must therefore seek to verify results within the framework of knowledge developed by the scientific community of researchers in the didactics of science of which we are part.

Likewise, the subject is related to the *Research in the Didactics of the Higher Experimental Sciences* elective, which will study in more depth, in a more specialised way, different lines of research in this field.

Achieving the objectives that this subject proposes will contribute to students being able to start a research project in any of the lines studied.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

No enrolment restrictions with other subjects in the curriculum have been specified.

In order to be correctly involved in the development of the subject, students must have studied the basic previous subjects of didactics as well as fundamental content of scientific disciplines, among others, in the field of biology, geology, physics, chemistry, environmental sciences, etc. In this way they can consider and address problematic situations related to scientific knowledge that can be researched for their interest to improve the teaching process.

OUTCOMES

2157 - M.D. in Research in Subject Didactics

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Elegir el marco metodológico más adecuado para intentar contestar las preguntas de investigación y dominar las técnicas metodológicas necesarias.
- Use appropriate bibliographical references that are relevant scientific background to the proposed research.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Analyse and synthesise the main current research agendas in Specific Didactics.
- Conduct quality research in the scientific field of Specific Didactics using the methodologies, techniques and procedures of this discipline.
- Integrate ethical values and responsibility associated with research tasks into one's own research.
- Create spaces for research and learning with special attention to equity, emotional and values education, equal rights and opportunities between men and women, citizenship training and respect for human rights that facilitate life in society, decision-making and the construction of a sustainable future.
- Evaluate current research problems on teaching or learning in the fields of knowledge characteristic of Specific Didactics.
- Synthesise historical, epistemological and ontological aspects associated with the emergence and evolution of research in Specific Didactics.
- Evaluate the relevance of a research project, its quality and future projection, with scientific criteria appropriate to the international standards of the studied speciality.
- Synthesise relevant research problems on learning or teaching in the disciplines belonging to Specific Didactics.
- Search and synthesise information on research results in bibliographic, material, virtual, etc. repertoires useful to support a new research project.
- Critically analyse, from the point of view of research in Specific Didactics, the performance of teaching, good practice and guidance using quality indicators.

- Understand and apply specialised research procedures in Specific Didactics.
- Identify, analyse and evaluate national or international research publications in the field of Specific Didactics.
- Decide, with objective criteria, which methodological paradigm quantitative, qualitative or mixed best fits the objectives of your own research.
- Plantear preguntas de investigación pertinentes sobre un tema de investigación actual.
- Adequately analyse and evaluate the partial and final results of one's own research and contrast, refute or modify the first hypotheses.

LEARNING OUTCOMES

The Research in the Didactics of Experimental Sciences course, through the development of its subjects, must provide students with the central core of the research training that they will obtain in this master's degree. Students must successfully acquire the necessary didactic and methodological knowledge in order to successfully address the different tasks involved in carrying out a research project. By the end of the course and always referring to research in the didactics of experimental sciences, students are expected have achieved the following results:

- Know the main current research agendas.

- Know the most important lines of research of the previous agendas, especially the lines that are being developed by the researchers of the University of Valencia.

- Know and effectively use the main sources of information, databases, books and magazines, Internet servers, etc.

- Know the main theoretical frameworks currently used in the main lines of research.

- Use the knowledge acquired in this subject and other subjects to be able to critically analyse publications of research results.

- Present the results of their studies, literature analyses, etc., in a synthetic, complete and suitable way for an audience of researchers.

- Know elements of the history of experimental sciences that can be useful to aid didactic research.

- Carry out epistemological reflections on formal sciences, school sciences and students' conceptions.

- Pose questions that can be used as a basis for didactic research designs and selecting appropriate theoretical frameworks and methodological tools to provide answers to such questions.

- In the case of the subject, all of this involves students' familiarisation with basic research lines for their training as future researchers.

DESCRIPTION OF CONTENTS

1. Introduction to Research in the Didactics of Experimental Sciences

This is an introductory unit to the area of Didactics of Experimental Sciences (DCE) in our context, its construction, lines of research, main successes and pending issues. Therefore, a brief historical overview will be made to show what has been the development of the area itself, its activity and scientific production, focusing on some of the main research topics and the main journals and meetings where these works can be found.

It will also show in which educational stages the research has been developed, what key questions have been addressed, what didactic models have been promoted, what training needs have been detected in both initial and continuing education, how Environmental Education, Health Education, the treatment of Sustainability and the ODS, etc. have been addressed, showing the conceptual, procedural and attitudinal changes that have taken place in this area. Finally, it also aims to show the lines of research being developed at the University of Valencia.

2. Research on argumentation and critical thinking and CSC in science education

This unit will present research results on the role of critical thinking in science education. Questions such as the following will be addressed: Does science education promote critical thinking? What skills and competences are taught to develop critical thinking? What difficulties prevent the promotion of critical thinking in students? Is science critical thinking? When can science be considered critical? Examples of conflicts throughout human history that have pitted science and power against each other.

Themes and activities to promote critical thinking in students: the Socio-Scientific Questions (SSQ). Critique of pseudoscience, denialism, anti-science and pseudo-scientific advertising.

Argumentation in science education. Skills or competences students should have in order to be able to argue scientifically. Detection of fallacies.

Topics and activities suitable for working on argumentative skills: Inquiring with elementary scientific experiences. Debates on SSQ.

3. Enquiry in science education

This unit presents the main contributions of research in Didactics of Experimental Sciences on scientific enquiry, an educational strategy that allows students to learn scientific contents and procedures linked to school science while promoting the development of a positive attitude towards science and critical thinking.

This section describes the characteristics of this strategy and the different models that exist. It also discusses the design of inquiry-based activities and how the effect on science teaching and learning can be evaluated. Finally, different research on enquiry carried out in different scientific fields and educational levels is presented.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	42,00	100
Study and independent work	133,00	0
TOTAL	175,00	

TEACHING METHODOLOGY

The subject is conceived as a workshop-course of guided research in which students participate collectively in the reconstruction of knowledge developed by the scientific community around research focused on the problems of teaching and learning the sciences, putting them in a research situation, comparing their production with those obtained by the scientific community, addressing the problems that the teaching of the sciences involves and, for all of this, counting on the guidance and support of the staff member responsible for each unit.

The activities (face-to-face and out-of-class) to be carried out will be diverse, for example, some that can be carried, in order to contribute to the set of general and specific skills that are intended, are as follows:

FACE-TO-FACE ACTIVITIES (25%):

- Theory-practical classes in which the content of the subject will be developed, debates will be held and activities will be carried out using different teaching resources guided by teachers: seminars, workshops, group work, etc.
- Group work aimed at highlighting the importance of cooperative learning and consolidating individual learning. The defence of these activities may be individual or collective and may be done in the classroom or in tutorials and seminars with small audiences.
- Individual or collective tutorials that will be used to coordinate students on individual and group assignments, as well as to assess both individual progress and teaching activities and methodology.

OUT-OF-CLASS ACTIVITIES (75%):

Study and independent work. The teaching model as a researcher in the classroom focuses the student's activity on posing relevant questions, searching for information, analysis, development and subsequent communication.

EVALUATION

The assessment will be continuous and comprehensive, of a guiding and formative type, and must analyse the individual and collective learning processes, taking into account all the contributions and extending them to all aspects of learning. The grade, the ultimate expression of the assessment process, must reflect the achievements accomplished as a result of individual and collective work.

The information to show learning will mainly be collected through some of the following methods:

- Periodic monitoring of students' progress. 20-30%
- Assessment of the work assigned (assignments, reports, analysis of readings, debates, etc.). 20-30%
- Assessment of individual and group participation. 20-30%
- Oral and/or written tests. 40-50%

The student assessment process may include the preparation of an individual learning acquisition level report

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Basic

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- Referencia b2: Fraser B.J., Tobin, K. & McRobbie, C.J. (2012). Second International Handbook of Science Education. Dordrecht: Springer.

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- Referencia b4: Perales, F. J. y Cañal, P. (2000). Didáctica de las ciencias experimentales. Teoría y práctica de la enseñanza de las ciencias. Alcoi: Marfil

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Additional

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- Referencia c5: Solbes, J., Ruiz, J.J. y Furió, C. (2010). Debates y argumentación en las clases de física y química. Alambique, 63, 65-76.

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