COURSE DATA

Data Subject	
Code	33620
Name	Natural sciences for teachers
Cycle	Grade
ECTS Credits	9.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1304 - Degree in Preschool Education	Faculty of Teacher Training	2	Annual
1305 - Degree in Primary School Education	Faculty of Teacher Training	2	Annual
1324 - Degree in Preschool Education (Ontinyent)	Faculty of Teacher Training	2	Annual

Subject-matter

Degree	Subject-matter	Character
1304 - Degree in Preschool Education	15 - Natural sciences for teachers	Obligatory
1305 - Degree in Primary School Education	6 - Natural sciences for teachers	Obligatory
1324 - Degree in Preschool Education (Ontinyent)	15 - NATURAL SCIENCES FOR TEACHERS	Obligatory

Coordination

Name	Department
ESTEVE MARTINEZ, ANNA RAQUEL	90 - Methodology of experimental and social sciences
PINA DESFILIS, MARIA TATIANA	90 - Methodology of experimental and social sciences

SUMMARY

Natural Sciences for Teachers is a compulsory annual subject taught in the second year of the Degree in Primary School Education and the Degree in Preschool Education. It comprises a total of 9 ECTS credits.

It has a theoretical and practical nature and its purpose is that students complete their basic training in this scientific discipline and improve their training as educators.

This subject is related to the compulsory subjects of S*cience Teaching: matter, energy and machines* and *Science Teaching: environment, biodiversity and health*, which are taught in the 3rd and 4th years of the Degree in Primary School Education, and *Teaching Natural Sciences at Nursery School*, which is taught in the 4th year of the Degree in Preschool Education. However, while the subject of Natural Sciences for Teachers aims to consolidate basic science content for students who enrol in it, the other subjects are more oriented toward addressing the problems of teaching and learning natural sciences.

It is essential that teachers possess scientific culture foundations, especially the basic skills needed to practice; understand and appreciate scientific thinking, which builds knowledge from considering problems, issuing grounded hypotheses, and testing them; know and understand the role of science and technology in human progress; and gain interest in science so that, through their professional work, can awaken their students' interest, and thus improve their science teaching.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

While there is no requirement for this subject other than those to access the studies of Degree in Primary School Education and the Degree in Preschool Education, students are expected to have the skills in science that provide the primary to lower secondary education, because, besides consolidating them at a superior level, they will provide the basis for addressing new ones described in the relevant section of this teaching guide. Students taking this course in English should be able to understand and express themselves in this language both orally and in writing.

OUTCOMES

1305 - Degree in Primary School Education

- Express oneself orally and in writing correctly and appropriately in the official languages of the autonomous region.
- Use information and communication technologies effectively as usual working tools.
- Analyse critically the most relevant issues in today's society that affect family and school education: social and educational impact of audiovisual languages and of screens; changes in gender and inter-gender relations; multicultural and intercultural issues; discrimination and social inclusion, and sustainable development; Also, carry out educational actions aimed at preparing active and democratic citizens, committed to equality, especially between men and women.

- Promote cooperative work and individual work and effort.
- Assume that teaching must be perfected and adapted to scientific, pedagogical and social changes throughout life.
- Know the processes of interaction and communication in the classroom.
- Recognise the identity of each educational stage and their cognitive, psychomotor, communicative, social and affective characteristics.
- Design, plan and evaluate teaching and learning classroom activities in multicultural and co-educational contexts.
- Know how to work as a team with other professionals within and outside the school to attend to each student, to plan the learning sequences and to organise work in the classroom and in the play space.
- Know and apply basic educational research methodologies and techniques and be able to design innovation projects identifying evaluation indicators.
- Understand that systematic observation is a basic tool that can be used to reflect on practice and reality, and to contribute to innovation and improvement in education.
- Identify and plan the resolution of educational situations that affect students with different abilities and different learning rates, and acquire resources to favour their integration.
- Understand the basic principles and fundamental theories of the natural sciences: physics, chemistry, biology and geology.
- Know how to raise and resolve issues of everyday life related to science and from a scientific point of view.
- Value science as a basic element of Europe's cultural heritage, its contribution to improving the quality of life, and its ability to provide the best explanations of the material world.
- Recognise the mutual influence of science, society and technological development, reflect on scientific aspects of social interest and assume responsibility for one's own learning and for individual and collective actions that may result from this learning.
- Have a solid cultural, scientific and technological background, especially the basic knowledge needed to practise professionally as a teacher. Know the evolution and the historical process of construction of some basic scientific concepts, with special reference to the contexts and obstacles that had to be overcome to introduce them.
- Encourage a critical and independent attitude towards knowledge, promoting scientific thought for its evaluation; encourage the reading of scientific and non-scientific texts dealing with issues of personal and social interest, and promote strategies to interpret and evaluate them to make informed personal decisions based on them.
- Acquire the ability to understand how scientific knowledge is constructed, what its nature is, and to keep a critical engagement with scientific ways of knowing and understanding.
- Promote intellectual independence and critical engagement with evidence through scientific understanding; assess the reliability of information, as well as the sources that provide it, on issues of scientific and social relevance.

- Collect and apply relevant data for a hypothesis, and represent these data in formats that include tables and graphs. Analyse data qualitatively and quantitatively.

1324 - Degree in Preschool Education (Ontinyent)

- Express oneself orally and in writing correctly and appropriately in the official languages of the autonomous region.
- Use information and communication technologies effectively as usual working tools.
- Analyse critically the most relevant issues in today's society that affect family and school education: social and educational impact of audiovisual languages and of screens; changes in gender and inter-gender relations; multiculturalism and interculturalism; discrimination and social inclusion and sustainable development. Also, carry out educational actions aimed at preparing active and democratic citizens, committed to equality, especially between men and women.
- Promote cooperative work and individual work and effort.
- Assume that teaching must be perfected and adapted to scientific, pedagogical and social changes throughout life.
- Know the processes of interaction and communication in the classroom.
- Recognise the identity of each educational stage and their cognitive, psychomotor, communicative, social and affective characteristics.
- Design, plan and evaluate teaching and learning classroom activities in multicultural and co-educational contexts.
- Know how to work as a team with other professionals within and outside the school to attend to each student, to plan the learning sequences and to organise work in the classroom and in the play space.
- Know and apply basic educational research methodologies and techniques and be able to design innovation projects identifying evaluation indicators.
- Understand that systematic observation is a basic tool that can be used to reflect on practice and reality, and to contribute to innovation and improvement in education.
- Identify and plan the resolution of educational situations that affect students with different abilities and different learning rates, and acquire resources to favour their integration.
- Understand the basic principles and fundamental theories of the natural sciences: physics, chemistry, biology and geology.
- Know how to raise and resolve issues of everyday life related to science and from a scientific point of view.
- Value science as a basic element of Europe's cultural heritage, its contribution to improving the quality of life, and its ability to provide the best explanations of the material world.
- Recognise the mutual influence of science, society and technological development, reflect on scientific aspects of social interest and assume responsibility for one's own learning and for individual and collective actions that may result from this learning.

- Have a solid cultural, scientific and technological background, especially the basic knowledge needed to practise professionally as a teacher. Know the evolution and the historical process of construction of some basic scientific concepts, with special reference to the contexts and obstacles that had to be overcome to introduce them.
- Encourage a critical and independent approach to knowledge, promoting scientific thinking for its evaluation; encourage the reading of scientific and non-scientific texts dealing with issues of personal and social interest, and promote strategies to interpret and evaluate them to make informed personal decisions based on them.
- Acquire the ability to understand how scientific knowledge is constructed, what its nature is, and to keep a critical engagement with scientific ways of knowing and understanding.
- Collect and apply relevant data for a hypothesis, and represent these data in formats that include tables and graphs. Analyse data qualitatively and quantitatively.

LEARNING OUTCOMES

Assuming that the primary goal of this subject is to complement the scientific and technological education of students of the Degree in Primary School Education and the Degree in Preschool Education, the three types of general objectives that research in science education indicates to achieve are:

- Acquisition of scientific and technological knowledge (facts, concepts and theories) to enable people to perform in a technological world (conceptual objectives).

- Acquisition of scientific and technological skills and strategies (familiarize themselves with procedures and the use of instruments) to help better reason and understand problematic situations of everyday life (procedural objectives).

- Application of scientific knowledge and methods to real situations and assessing the relevance and complexity of the STS interactions to promote citizen participation in decision-making (axiological objectives).

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO THE DISCIPLINE

Why is it necessary to promote scientific culture in school? What role should the teacher play? What are the characteristics of scientific activity? How to overcome the myths concerning science and technology?

Guidelines: As a preliminary lesson, the goal is to address these questions to fix the framework where the subject is going to be developed. Such questions are essential for the coherent treatment of the contents and to gain the students interest in science and science teaching. It is important to stress that the point of view of teachers (preschool and primary education) toward science and technology is fundamental for their performance at these educational levels.

2. THE EARTH IN THE UNIVERSE

Astronomical observation: practical implications and its role in the ideas about the Universe. The geocentric system. The questioning of the geocentric system and the rise of the heliocentric model. Universal gravitation. The current view of the Universe. Assessment of scientific and technological advances.

Guidelines: This is intended to approach astronomy, its implications and its importance since the beginning of human history to students. Therefore, it is proposed to make astronomical observations and discuss the basic ideas that arise about our Universe since the first observations. Without going into detailed content from the point of view of concepts, it will be necessary to talk about the idea of movement and the Newtonian concept of force to understand the structure of the Solar System and the Universe and, in particular, to talk about the gravitational force and its universal character, which breaks the Heaven-Earth barrier and constitutes the first major scientific revolution. It should be also necessary to break stereotypes and describe the distribution of the planets in the Solar System in the correct size and distance scale.

3. ENERGY AND ITS TRANSFER

Work and energy. Sources and forms of energy. Heat and temperature. Change, transfer, conservation, and degradation of energy. Alternative energies and energy model.

Guidelines: This is intended to show students the changing character of nature and, therefore, the need to introduce concepts such as energy, work and heat, types of energy, and energy transfer. It is possible to talk here about sound, light and electricity as others form of energy transfer. Students should be able to recognize the differences between heat and temperature and heat and work as forms of energy transfer, and thus of interrelationship of physical systems that are never isolated. It is important to analyse the problems related to the production and use of different energy sources and the need for a new energy model. It is important not to forget the relationship between Science, Technology, Society and Environment (STSE), which should be present throughout the subject. This session offers a practical activity in the laboratory to verify experimentally the transformation of energy conservation and degradation.

4. MATTER AND ITS CHANGES

Study of gases. Properties and kinetic model. States of matter and their changes. Macroscopic study of substances and chemical changes. Substances and mixtures. Microscopic study: Atom and chemical bond. Technological applications of materials and their implications.

Guidelines: This is to show the contribution of the study of gases to understand the structure of matter and, in particular, to build the kinetic model to explain gas properties. This will enable the extrapolation of the kinetic model for gases to other states of matter. As in the other topics, the procedural objectives should be addressed, for example, determining if a material is a mixture or a substance, dividing a mixture of substances, etc. This topic allows performing small stimulating experiences. It is also intended that students have a comprehensive understanding of what we are made of and what the basic

properties of matter are. To do this, a microscopic and macroscopic description of the behaviour of materials will be performed, through experiences that will help its understanding. It is therefore especially important that these experiences are made with as many kinds of matter as possible. This session offers a practical activity in the laboratory to separate the substances in a mixture.

5. THE EARTH, A CHANGING PLANET

Planet formation. Structure, composition and dynamics of terrestrial layers: atmosphere, hydrosphere and geosphere. Global tectonics: geological, paleontological, and biological evidence.

Guidelines: A practical activity in the laboratory is proposed to learn about the composition of the planet's soils, as an example of the interaction of the different terrestrial dynamics.

6. BIODIVERSITY

Origin and evolutionary history of living beings: genetic, biogeographical, paleontological, and physiological evidence. The cell as the unit of life: main functions of the cell. Cell types. Living beings: characterization and classification. Ecosystems: structure, dynamics, and types. Extinction of species and habitats.

Guidelines: A practical laboratory approach to the use of the microscope and binocular loupe is proposed, to show the composition of the different cell types and organisms to a microscopic level. It is also proposed to describe human evolution as an example of the evolutionary development of a multicellular organism.

7. HUMAN BODY AND HEALTH

The human body: structures, systems, and physiology of the functions of nutrition, relationship and reproduction. Health and health promotion: actions to prevent diseases. Learning the basics of health promotion related to hygiene, sexuality, accidents, addictions, environmental health, and emotional health

Guidelines: This could be limited to addressing basic ideas, aimed at understanding the functionality of health promotion. This can be addressed through practical workshops on specific topics such as hygiene of the senses, healthy diets, management of emotions, etc.

8. SUSTAINABILITY

Problems and challenges that affect humanity. Role of science and technology in the measures to be taken to contribute to the planet sustainability.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theoretical and practical classes	90,00	100
Study and independent work	135,00	0
TOTAL	**225,00**	

TEACHING METHODOLOGY

Regarding the teaching practice, the methodological strategies to be used in the classroom can be conducted through activities attending to the criteria of assistance and type of academic activity programmed. The following activities are proposed as examples:

Classroom activities:

- Classroom or laboratory classes: classroom sessions of theoretical and practical content designed to work with the basic information of the contents of the subject, either through activities that require the individual or group participation of students or through a presentation by the professor.

- Tutorials aimed at students or groups of students through which the professor will guide and supervise the tasks assigned to them and attend to their needs. These may be supplemented with the use of the virtual classroom.

- Group work: carrying out programmed tasks in groups to promote specific social skills to the profession of teacher, as well as motivate students towards collective tasks of research, such as searching for information, analysing, synthesising and presenting results.

- Activities that require going out of the classroom environment because they require special times or spaces (museums, field trips, etc.). They must be scheduled in periods allocated in the academic calendar and every professor will establish the specific conditions of each in its programming.

Out-of-the-classroom activities:

- Personal study, readings, and scheduled tasks to complement the students' training carried out in the classroom activities. Each professor will provide instructions to students to organize the subject workload throughout the year bearing in mind their dedication to other courses scheduled in the academic calendar.

EVALUATION

The assessment and grading criteria of each professor must be communicated to students in writing at the beginning of each academic year.

In general terms, assessment should be understood as the best instrument for improving learning, useful for promoting and guiding the joint work of students and teaching staff, as well as for estimating and communicating the individual level of acquisition of the basic competences (knowledge, procedures and skills) associated with the subject, already described in this guide.

Assessments will be carried out during class periods, and will take place on different aspects of the course:

- The attendance and participation of each student in the meetings and tasks of the subject (classroom or laboratory classes, tutorials, activities inside and outside the classroom, etc.), their attitude and the quality of their contributions both individually and as part of a working group. These may be reflected in the final grade as established in the evaluation and grading criteria of each professor, although this will not be a reason for exclusion from the evaluation. Students who do not meet the attendance and participation requirements established by each professor will keep their entitlement to a final exam in each of the two official calls established by the University for each course, although they may not be able, in any case, to qualify for honours ("Matrícula de Honor").

- The preparation of individual and group materials and assignments, which must meet the criteria and deadlines previously established and communicated to students; they may be subject to public exhibition and discussion before the group's students and will be evaluated according to their clarity, correctness, coherence, intelligence, the strength of their argumentation and the interest they can generate. In individual or group assignments whose assessment contributes to the final individual grade, special attention will be paid to the evidence that can guarantee the authorship and the degree of participation in them of each student. Cases of plagiarism, following Article 15 of the Assessment and Grading Regulations (ACGUV 108/2017), will result in a grade of zero, regardless of the disciplinary procedure that may be initiated and the sanction it entails.

- The performance of tests and exams to assess the individual acquisition of the basic competences (knowledge, procedures and skills) associated with the subject, already described in this guide.

The official mid-term and final exams will be held on the dates established in the academic calendar. In order to pass the course, it is necessary to pass these official exams, which will account for at least 50-70% of the final grade of the course, as established in the evaluation and grading criteria of each professor. The mid-term and final written exams will not include closed-ended questions, but open-ended questions, either of elaborated answers or of resolution of problems or practical situations and will be evaluated and graded both for their correctness and the quality of the written expression. Students will be entitled to two calls per academic year unless they have passed the first one. Each official exam, whether partial or final, will be considered passed when at least 5 points out of a total of 10 are obtained.

When the grade for the first term is equal to or higher than 5 points, students may choose, at the first call, either to take an exam only on the contents of the second term or on the contents of the whole subject, waiving the assessment of the subject by partial exams if they choose the second option. The final exam of the second call will always include the whole subject.

The other aspects of the subject's assessment, such as regular attendance and active participation, or the preparation of materials and assignments, may contribute, only when the official exams have been passed, a maximum of 30-50% to the final grade, depending on what has been established in the evaluation and grading criteria of each professor.

REFERENCES

Basic

- Anguita, F. (2002). Biografía de la Tierra. Historia de un planeta singular. Aguilar.
- Asimov, I. (2007). El Universo de la Tierra plana a los quásares. (Trad. Miguel Paredes Larrucea). Alianza Editorial.
- Bryson, B. (2016). Una breve historia de casi todo (Trad. José Manuel Álvarez Flórez). RBA Bolsillo.
- Campbell, N. y Reece, J. (2007). Biología, 7ª ed. Panamericana.
- Garrido, J. M., Perales, F. J. y Galdón, M. (2008). Ciencia para educadores. Pearson Educación.
- Mérida Serrano, R., Torres-Porras, J. y Alcántara Manzanares, J. (2017). Didáctica de las Ciencias Experimentales en Educación Infantil. Síntesis.
- Solaz, J. J. y Sanjosé, V. (2012). Ciencias Naturales para maestros. Parte 1: Ciencias Físicas. Reproexpres Ediciones.
- Solbes, J. y Domínguez, C. (2013). Ciències naturals per a mestres. Reproexpres Ediciones. http://roderic.uv.es/handle/10550/28451
- Vílchez, J. M. (2014). Didáctica de las Ciencias para Educación Primaria I. Ciencias del espacio y de la Tierra. Pirámide.
- Vílchez, J. M. (2014). Didáctica de las Ciencias para Educación Primaria II. Ciencias de la vida. Pirámide.

Additional

- Attenborough, D. (2021). Una vida en nuestro planeta. Mi testimonio y una visión para el futuro (Trad. Tomás Fernández Aúz). Crítica.
- Bryson, B. (2020). El cuerpo humano. Guía para ocupantes (Trad. Francisco J. Ramos Mena). RBA.
- Chown, M. (2019). Gravedad. Una historia de la fuerza que lo explica todo (Trad. Pablo Álvarez Ellacuria). Blackie Books.
- Carson, R. (2023). Primavera Silenciosa (Trad. Joandomènec Ros). Crítica. (Trabajo original publicado en 1962).
- Coyne, J. A. (2010). Por qué la teoría de la evolución es verdadera (Trad. Joan Lluís Riera). Crítica.
- Dartnell, L. (2019). Orígenes. Cómo la historia de la Tierra determina la historia de la humanidad (Trad. Joandomènec Ros). Debate.
- Delibes, M. y Delibes de Castro, M. (2005). La Tierra herida. ¿Qué mundo heredarán nuestros hijos? Destino.
- Escrivà, A. (2018). Aún no es tarde. Claves para entender y frenar el cambio climático (Trad. Soledat Rubio Candel). Sin Fronteras.

- García Leal, A. (2008). El sexo de las lagartijas. Controversias sobre la evolución de la sexualidad. Tusquets.
- Gould, S. J. ed. 1999. El libro de la vida (Trad. Oriol Canals y Luís Ignacio López). Crítica.
- Halliday, T. (2022). Otros mundos. Viaje por los ecosistemas extintos de la Tierra (Trad. Joaquín Chamorro Mielke). Debate.
- Knoll, A. W. (2021). Breve historia de la Tierra. Cuatro mil millones de años en ocho capítulos (Trad. Marc Figueras). Pasado & Presente.
- Mayr, E. (2016). Así es la biología (Trad. Juan Manuel Ibeas Delgado). Debate.
- Navarro, V. (2006). Mariners que solquen el cel. Bromera i Publicacions de la Universitat de València.
- Sapiña, F. (2005). Un futur sostenible? El canvi global vist per un químic preocupat. Bromera i Publicacions de la Universitat de València.