VNIVERSITAT DE VALÈNCIA

Course Guide
33620 Natural sciences for teachers

COURSE DATA

Data Subject	
Code	33620
Name	Natural sciences for teachers
Cycle	Grade
ECTS Credits	9.0
Academic year	2022 - 2023

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, which is 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 Science *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.

Assuming that the primary goal of this subject is to complement 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 it are:

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

-Acquisition of skills and scientific and technological 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 in order 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 presence and scheduled type of academic activity. The following activities are proposed as examples:

Classroom activities:

-Classes in the classroom or the laboratory: 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 teacher.

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

-Group work: carrying out scheduled 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 year and every teacher will establish the specific conditions of each in its programming.

Out-of-the-classroom activities:

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

EVALUATION

Understood as a tool for improving the teaching and learning that promotes and guides the work of students and professors themselves, through which we can see the level of acquisition of basic skills (knowledge, procedures, skills ...) mentioned in this Guide and associated with this subject.

The evaluation criteria of each teacher should be communicated to the students at the beginning of the term.

Formative and summative evaluation to assess how the progress is being made and the objectives met, and, where appropriate, possible reorientation of the teaching-learning process. Its grades will be 30-50% of each part of the evaluation. It will be performed throughout the academic year, and various techniques can be used, considering aspects such as:

-Attendance and participation of each student in regular class assignments (classroom, laboratory, tutorials ...), their attitude towards the subject and their ability to work individually and/or in groups. Attendance and participation will be considered but will not be an exclusive reason for evaluation. Students who do not attend class are entitled to a final exam in the two official calls per enrolment that the University establishes, but will not be able to aspire to qualify for honours (“Matrícula de Honor").

-Preparation of materials or assignments (individually or collectively). In some situations, these materials or assignments can be exposed and subjected to discussion in the classroom, as well as graded according to the criteria communicated previously to the group. Plagiarism or non-presentation of the assignments within the indicated deadline may be a failure in that assignment.

-Acquisition of the skills (knowledge, procedures, skills ...) listed in this Guide.

Final evaluation. A written test will be performed on the previously scheduled dates by the University. To pass the course, students must pass this test, which will be 50-70% of each part of the evaluation. If these tests include multiple-choice questions, their grades may not exceed 50% of the grades of the written tests. Students will be entitled to the two official calls per enrolment corresponding to each registration, which will be published by the University at the proper time. In the first official call, the faculty can divide the evaluation into two parts, one at mid-year and the other at the end. The dates of the exams will be established by the University at the beginning of the course.

To pass the course, the final grade should be at least 5 points out of 10. To take the average between the two parts of the evaluation, the grade of each of them should be equal to or greater than 4 points out of 10. If one of the two parts is failed, each teacher will decide whether to keep the grades obtained in other parts of the evaluation or not.

Students who fail one of the two parts should take the exam of that part in the 1st official call. Students who fail or do not take the exam of the failed part in the 1st call must take the exam for the whole subject in the 2nd official call. Students who do not attend one of the two partial exams will be graded as Non-attendance (“No Presentado”) in the Grades Certificate.

REFERENCES

Basic

- ANGUITA, F. 2002. Biografía de la Tierra. Historia de un planeta singular. Madrid. Aguilar.
- ASIMOV, I. 1971. El Universo de la Tierra plana a los quásares. Madrid. Alianza. 2004.
- BRYSON, B. 2003. Una breve historia de casi todo. Barcelona. RBA. 2004 (traducción al español de José Manuel Álvarez Flórez).
- CAMPBEL N. y REECE, J. 2006. Biología, 7ª ed. Buenos Aires. Panamericana.
- GARRIDO, J.M., PERALES, F.J y GALDÓN, M. 2008. Ciencia para educadores. Madrid. Pearson Educación.
- SOLAZ, J.J. y SANJOSÉ, V. 2012. Ciencias Naturales para maestros. Parte 1: Ciencias Físicas. Valencia. Reproexpres Ediciones.
- SOLBES, J. y DOMÍNGUEZ, C. 2013. Ciències naturals per a mestres. Valencia. Reproexpres Ediciones (http://roderic.uv.es/handle/10550/28451).

Additional

- CARSON, R. 1962. Primavera Silenciosa. Barcelona. Crítica. 2010 (traducción al español y prólogo de Joandomènec Ros).
- DAWKINS, R. 2004. El cuento del antepasado. Barcelona. Antoni Bosch. 2008 (traducción al español de Víctor V. Úbeda).
- DELIBES, M. y DELIBES DE CASTRO, M. 2005. La Tierra herida. ¿Qué mundo heredarán nuestros hijos? Barcelona. Destino.
- ESTUPINYÀ, P. 2010. El Ladrón de Cerebros. Barcelona. Debolsillo.
- GARCÍA LEAL, A. 2008. El sexo de las lagartijas. Controversias sobre la evolución de la sexualidad. Barcelona. Tusquets.
- GOULD, S.J. ed. 1993. El libro de la vida. Barcelona. Crítica (traducción al español de Oriol Canals y Luís Ignacio López).
- KOLBERT, E. 2006. La catástrofe que viene. El hombre, la naturaleza y el calentamiento global. Madrid. Planeta. 2008 (traducción al español de Emilio G. Muñiz).
- MARGALEF, R. 1980. Ecología. Barcelona, Omega.
- MARGULIS, L y SCHWART, K. 1982. Los cinco reinos. Barcelona. Labor. 1985 (traducción al español de Ana Ávila).
- MAYR, E. 1997. Así es la biología. Barcelona. Debate. 1998.
- MAYR, E. 2004. Por qué es única la biología. Consideraciones sobre la autonomía de una disciplina científica. Buenos Aires. Katz. 2006 (traducción al español de José María Lebrón).
- MOYA, A. y PERETÓ, J. 2011. Simbiosis. Seres que evolucionan juntos. Madrid. Síntesis.
- NAVARRO, V. 2006. Mariners que solquen el cel. Alzira. Bromera i Publicacions de la Universitat de València.
- SAPIÑA, F. 2005. Un futur sostenible? El canvi global vist per un químic preocupat. Alzira. Bromera i Publicacions de la Universitat de València.