Universitat Autònoma de Barcelona

2017/2018

Teaching Methods for Biology and Geology

Code: 42084
ECTS Credits: 27

Degree	Type	Year	Semester
4310486 Teaching in Secondary Schools, Vocational Training and Language Centres	OT	0	A

Contact

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Use of languages

Principal working language: catalan (cat)

Teachers

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External teachers

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Prerequisites

No requirements

Objectives and Contextualisation

GOALS

The aim of the course is to complete the knowledge of future science teachers of biology, geology, physics and chemistry graduates, engineers or graduates and bring them to the knowledge of science education and the specific teaching of each discipline.

It consists of two modules differentiated content:

- The additional training module that aims to complete the knowledge of biology, geology, physics and chemistry graduates, engineering graduates or future science teachers. It includes blocks of history of science and current events and training complements.

- The module specific teaching and teaching innovation and introduction to research aimed at training the future high school teacher that can teach the contents of the knowledge areas of biology and geology and physics and chemistry, integrating disciplinary knowledge and the teaching of science taking into account the knowledge of other areas such as epistemology, language and communication, psychology and pedagogy. Includes blocks introduction to didactics, the didactics of biology and geology and teaching innovation and introduction to research.

Content

The specific module of Biology and Geology and its teaching is divided into 2 large blocks: Physics and Chemistry didactics and Complementary Training.

BIOLOGY AND GEOLOGY DIDACTICS

The block "Biology and Geology didactics" is divided into 2 parts: "Learning and teaching Biology and Geology " (9cr) and "Teaching innovation and introduction to research in Biology and Geology didactics" (6cr).

Learning and teaching Biology and Geology (9cr)

Introduction to Science Education (3cr)

- Purpose of teaching science at ESO

- The teaching of science and development of scientific competence

- What is science? Reflections on the epistemology of science

- What science should be taught in school?

- Didactic models and preconceptions

- The learning cycle and activities

- Assessment and regulation of learning

Chemistry Didactics (3cr)

- Biology Didactics (3cr)

- Models (living thing, cell, ecosystem, genetics and evolution and key concepts in

school biology What and why.

- Selection and sequencing of content to teach.

- Learning scenarios and resources

- Previous ideas and learning difficulties related to big ideas and proposals for

overcoming them.

- Modelling, inquiry and argument

- Biology in context

Geology Didactics (3cr)

- Models and key concepts in school geology. What and what for.

- Selection and sequence of contents to teach.

- Learning scenarios and resources.

- Misconceptions and learning difficulties related to the great ideas and ways to

overcome them.

- Modelling, inquiry and argumentation in school Earth Science.

- Earth Science practical activities

- Earth Sciences relation to the other Experimental Sciences.

Teaching innovation and introduction to research in Physics and Chemistry didactics (6 cr)

Teaching innovation

- The curriculum. Learning objectives, programming and evaluation.

- Diversity of types of competence teaching units according to the approach: progressions, projects, inquiry, ABP, modelling etc.

- Contexts and knowledge transfer.

- The development of transversal skills: critical thinking, cognitive-linguistic, digital, self-regulation, etc.

Introduction to Physics and Chemistry Education Research

- Reflective practice: reflection on practice and its relationship to educational innovation

- The classroom observation: goals, models of observation and instruments

- Methodological bases for innovation and educational research

- Current trends in research in science education

COMPLEMENTARY TRAINING

The block "Complementary Training in Biology and Geology and Physics and Chemistry" is divided into 2 parts: History of Science and Fundamentals of biology, geology, phisics and chemistry

History of Science (4cr)

Through critical analysis of authors and relevant episodes, this part is intended that the student acquire a basic historical master scientific culture.

1. Thinking mythical, natural thought. Reading: Aristotle and Galen
2. The Journey of the Almagest. Views: Copernicus
3. The mathematization of nature. Views: Galileo
4. The world system. Views: Newton
5. The two cultures. Readings: Frankenstein
6. The historical view of life. Readings: Darwin
7. Newtonian crisis. Readings: Einstein
8. The new atoms. Views: Curie
9. Individual, information and society. Views: Watson
10. Chaos, order and dinosaurs. Views: Crichton

In the first part of each session we will discuss and discuss the proposed texts for the topic that we will have exposed in the previous session. In the second part we will present a new theme and propose issues so you can read the text or texts proposed for the next session.

Fundamentals of Biology, Geology, Physics and Chemistry (6cr)

Work on fundamental contents of biology, geology, physics or chemistry to supplement the initial training of future teachers of biology and geology.
Students will attend two disciplinary basis depending on their initial training.
The contents to study are:

Fundamentals of Biology (3cr)

- The Chemistry of Life: Chemical components of the cell. Bioelements and organic molecules. Enzyme biological activity. Introduction to metabolism. Relationship between metabolism and nutrition.

-The Genetically modified organisms (GMOs): transgenic plants. Handling plant genome for transgene introduction. Examples.

- The cell: The prokaryotic cell and eukaryotic. structure and function of the organelle. Organizational models. Cellular division. Virus and bacteria.

- Basis of Inheritance: Classical Genetics. Mendel's laws. sex-linked inheritance. Identification of DNA as the carrier of genetic inheritance Humana (Human Genome). Alterations of the genome.

- Human body: General organization of the human body. Anatomy and physiology of the human body devices. endocrine sensory organs, nervous system and

- Origin of life. Biological Diversity. Fixity and evolutionism. Darwinian selection. Fossil hominids to the Homo Sapiens and Evolution of Man.

- Organisms and systems. Levels of ecological organization. Basic principles of ecology.

Fundamentals of Geology

- Geology as a science. The Earth as a complex system.

- Earth materials: rocks, rock cycle.

- Geology of Catalonia. Geological history and landforms. Field work in the area of the Sant Jaume stream between the towns of Olesa de Montserrat and Vacarisses.

- History of the Earth: strata, sedimentary structures, sedimentary environments, stratigraphic record, continuity and discontinuity, geological time, dating and fossils

- History of the Earth: geological maps, map elements, maps and geological sections, geological history.

- Earth materials: minerals, rock builders and resource base.

Interdisciplinar project linked to Fundamentals of Physics:

- Sun-Earth system.

- Internal structure and Earth changes: global tectonics, earthquakes, volcanoes, tectonic deformation and structures, landscape as an interaction between internal and external processes. Geological hazards.

Fundamentals of Physics

- Measurement and analysis

- How to determine the correlation between variables.

- The Multilog-Pro team and Multilab program.

- Examples of relations between position, velocity and acceleration.

- Forces and Motion

- The concept of force and their types.

- Examples of movements with and without friction. Useful use of frictional forces.

- The dynamic equilibrium: motion at constant speed.

- Energy view of the processes

- Energy conservation.

- Mechanisms of energy transfer and its relationship withthe power quality. Probabilistic interpretation of the Second Law of Thermodynamics.

- Electromagnetism

- The electric field and magnetic. Experimental determination of the field lines.

- An experiment on electromagnetic induction.

- Wave phenomena.

Fundamentals of Chemistry

- Pure substances and dissolutions. Chemical change.

Laboratory. Density measure. Saturated dissolution: crystallization. Visualisation of chemical change.

Discussion and exercises. Pure substances and mixtures. Dissolutions. Substances separation. Physical change and chemical change.

- Stoichiometry

Laboratory. Precipitation reaction. Filtration. Performance. Mass conservation in a chemical reaction.

Discussion and exercises. Atom and molecule. Mole concept. Chemical equation: levelling. Stoichiometric calculus.

- Heat of chemical reactions

Laboratory. Exothermic reaction. Endothermic reaction.

Discussion and exercices. Reaction heat. Inner energy and enthalpy. Calorimetry and stoichiometric calculus.

- Chemical kinetics.

Laboratory. Chemical reaction speed observation. Reaction speed dependence regarding temperature and reagents.

Discussion and exercises. Fast and slow reactions. Chemical reaction speed concept. Order of reaction and constant of reaction.

- Chemical balance and acid-base reactions

Laboratory. Observations of chemical balance in different reactions.

Discussion and exercises. Chemical balance concept. Balance constant (Kc or Kps). Dependence of K regarding temperature. Balance displacement.

Laboratory. pH measure of real samples and solutions.

Discussion and exercises. Acid-base reaction concept: H+ transfer. Ionization of water (Kw) and acid or base strength (Ka and Kb). pH scale. Acid-base Indicators.

- Redox reactions and batteries

Laboratory. Redox reactions observation.

Discussion and exercises. Redox reaction: electron transference. Semireactions and global reactions. Oxidant/ reduction power of substances.

Laboratory. Battery construction and electromotive force (FEM)

Discussion and exercises. Battery electrodes: cathode and anode. Polarity. Semireactions and global reactionof a battery. Ion movement and saline bridge. Fem Calculus from tabulated data (Eº).

Interdisciplinary Project of Biology and Chemistry

This is a transversal activity of "Fundamentals of Biology" and "Fundamentals of Chemistry", it is scheduled to be done in groups.

Interdisciplinary Project of Physics and Geology

This is a transversal activity of "Fundamentals of Physics" and "Fundamentals of Geology", it is scheduled to be done in groups.

Topics of current science (2cr)

Issues in the field of science with a high degree of social impact that will helpthe future teacher to promote discussion with high school students to arrive at a reasoned opinion on them.

The topics will be among the following:

- Science, money and politics

- Gender and Science

- Neuroscience and education: towards a new paradigm of learning processes.

- Ethnificate representations of alumni: from cultural essentialism to deficit perspectives.