



Board of Teacher Education  
Biology

## Syllabus

### Scientific Literacy for Teaching 3

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| <b>Course Code:</b>                | BIGLN5  |
| <b>Course Title:</b>               | Scientific Literacy for Teaching 3<br><i>Naturkunskap med ett didaktiskt perspektiv 3</i> |
| <b>Credits:</b>                    | 30  |
| <b>Degree Level:</b>               | Undergraduate level   |
| <b>Progressive Specialisation:</b> | First cycle, has only upper-secondary level entry requirements (G1N)                      |

#### Major Field of Study:

#### Course Approval

The syllabus was approved by the Board of Teacher Education 2017-03-02, and is valid from the Autumn semester 2017 at Karlstad University.

#### Prerequisites

BIGLN1 completed and at least 7.5 ECTS credits completed for BIGLN2

#### Learning Outcomes

The aim of the course is that students develop appropriate literacy in the central natural science areas of physics, chemistry and energy technology from the perspective of scientific literacy for teaching. Based on subject knowledge students are expected to develop skills to enhance the understanding of the need to take a science perspective on issues of societal relevance. The aim of the practical placement is that students are introduced to school practice and develop their professional knowledge by reflecting on the relationship between theory and practice.

#### Module 1: Basic Physics Concepts, 4.5 ECTS cr

Upon completion of the module, students should be able to:

1. construct and assess the validity of a mathematical model of a mechanical system,
2. develop and conduct laboratory work and experiments which are adapted to education and can be used to stimulate student interest in physics,
3. give an account of the development of physics and relate this to how students' conceptual understanding has developed in the subarea mechanics,
4. discuss the curricula and grading and assessing guidelines based on subject pedagogical theories,
5. give an account of the concept of energy, forms of energy, and work,
6. independently plan and conduct investigations to find answers to their own questions in the field,

#### Module 2: Introductory Chemistry II 7.5 ECTS cr

Upon completion of the module, students should be able to:

1. explain the principles of the periodic table,
2. use different models to explain chemical bonding,
3. explain important concepts in introductory chemistry,

4. state the geometry of molecules and the intermolecular forces linked to molecular properties,
5. act and work safely in the laboratory,
6. plan, conduct and report a chemical laboratory task according to instruction and within a given time limit,
7. relate the school curriculum for natural science to the subject's scientific character, theories and teaching methods for chemistry in education and its practice,
8. give an account of how students' everyday conception can affect their learning of chemistry,
9. apply current regulations and curricula to perform risk analyses for laboratory sessions in school and give an account of what to do in case of an accident.

#### Module 3: The Universe, 7.5 ECTS cr

Upon completion of the module, students should be able to:

1. give an account of the formation and structure of the solar system,
2. give an account of the birth, evolution and final stage of stars,
3. give an account of the theories of black holes,
4. give an account of the structure of galaxies and the large-scale structure and evolution of the universe.

#### Module 4a Practical Placement 1, 7.5 ECTS cr (When the course is taken as the first subject)

Upon completion of the module, students should be able to:

1. act in accordance with the core values specified in the Swedish education act and national curricula
2. explain the meaning of the legislation pertaining to teacher confidentiality and obligation to notify irregularities,
3. reflect on how the equality and equity perspectives can be integrated in pedagogical activities,
4. communicate professionally with students and staff, one-on-one and in groups, using a language in speech and writing that is functional and adequate to the situation,
5. under some supervision, plan, lead and conduct teaching to a certain degree based on school curricula and knowledge of subject and subject-specific pedagogy,
6. describe special education and students welfare efforts on the basis of local examples
7. describe and reflect on their own teaching and how it is based on curricula and knowledge of subject and subject-specific pedagogy,
8. give an account of their own professional development and identify their needs of further development.

#### Module 4b, Practical Placement 2, 7.5 ECTS cr (When the course is taken as the second subject)

Upon completion of the module, students should be able to:

1. act in accordance with the core values specified in the education act and curricula
2. give an account of legislation concerning school obligations to prevent and take measures against bullying and abuse and analyse local school policy on discrimination,
3. integrate, under some supervision, a norm critical perspective in the pedagogical activities with a focus on equality and equity,
4. communicate professionally with students and staff, one-on one and in groups, using a language in speech and writing that is functional and adequate to the situation,
5. under some supervision, plan, lead and conduct teaching sequences on the basis of national curricula and subject knowledge and subject-specific pedagogy,
6. plan and conduct teaching with consideration of students' different circumstances and under supervision reflect on special education needs,
7. analyse their own teaching and present arguments for showing how its is related to curricula and knowledge of subject and subject pedagogy,
8. under supervision assess students' knowledge progress and social situation at school and discuss how this can be communicated with students, guardians and staff,
9. with some guidance, use digital tools in pedagogical activities, and
10. discuss their own professional development and identify their need of further development.

#### Module 5: Environmental physics, 3 ECTS cr

Upon completion of the module, students should be able to:

1. give an account of the earth's radiation balance in the solar energy flow,
2. describe and analyse phenomena in nature, technical systems and society, especially energy flows, energy conversion, and energy exchange, using physical concepts, and
3. give an account of the connection between energy for sustainable development and aspects of energy extraction and between human beings, energy, society and the environment.

## **Content**

The course comprises five modules:

### **Module 1: Basic Physics Concepts, 4.5 ECTS cr**

Students are introduced to basic physical concepts through laboratory sessions and group study. They plan and conduct physical experiments.

The module includes:

- studying basic physical concepts used to explain phenomena and solving problems encountered in daily life, in the laboratory and in groups.
- Identifying pupils' everyday perceptions related to power, heat and temperature, energy transfer and problematising the teaching tradition in these areas.
- planning and conducting physical experiments and learning how laboratory components can be used to develop pupils' physics literacy with a view to creating curiosity and interest.
- planning and conducting investigations to seek answers to their own formulated questions in the areas.

### **Module 2: Introductory Chemistry, 7.5 ECTS cr**

The module describes the development and application of different theoretical and explanatory models of the atom and molecule.

- the Periodical system and its background, periods, groups and electron configuration, the Pauli principle, the Hund's rule, the Aufbau principle, trends in the periodic system.
- chemical bonding, Lewis structures (including resonance structures and formal charge, ionic bonding, covalent bonding, hybridisation, electron division, LCAO-MO.
- empirical formula, formula unit, dipol moment, crystalline structure
- Lewis structures, determining geometry based on electron groups, bonding electron groups, free radicals, determining type of intermolecular forces between molecules on the basis of molecular geometry and any dipol moment. Van der Waal's forces, solubility.
- safety lecture and safety test. How to work in a chemical laboratory and the most common equipment used.
- studying instructions and performing risk analysis before a laboratory activity and conducting laboratory work and reporting the result according to instruction and within a given time limit.
- discussing teaching methodological issues such as student problems in understanding chemical concepts. On the basis of steering documents and curricula the relation between chemistry as a science discipline and the school subject natural science is problematised.
- rules and regulations in education for laboratory activities are treated and risk analyses performed.

### **Module 3 The Universe, 7.5 ECTS cr**

The course includes lectures, films, interactive computer use of astronomy software and observations of stars through the telescope.

- the formation and structure of the solar system with a focus on the circumstances of our solar system.
- the formation, evolution and final stage of stars
- what a black hole is and the black holes assumed to exist.
- the structure of galaxies
- the large-scale structure and evolution of the universe as well as speculations on the creation and future destiny of the universe.

### **Module 4a. Practical Placement 1, 7.5 ECTS cr**

Students have the opportunity to

- meet different groups of staff, for example, teaching teams, student welfare personnel and school management, and participate in everyday activities,

- apply central regulations and guidelines and local pedagogical planning with consideration of equality and equity perspectives,
- apply subject-specific teaching theories and transform relevant subject knowledge into teaching and reflect on the relation between theory and practice,
- discuss and reflect on the profession and professional development,
- describe special education and student welfare efforts in school,
- acquire knowledge of legislation pertaining to confidentiality and obligation to notify irregularities,
- develop skills in communicating with different staff categories and pupils.

#### Module 4b. Practical Placement 2, 7.5 ECTS cr

Students engage in the following activities:

- using IT in school
- interpreting and implementing national curricula and local pedagogical planning
- applying pedagogical and subject-specific teaching theories and transforming subject knowledge into teaching material with consideration of pupils' different knowledge and interests
- considering the special education perspective
- practising their communicative skills in cooperation with different staff groups and pupils in school
- applying central regulations and guidelines and local pedagogical planning with consideration of equality and equity perspectives,
- comparing laws and local guidelines regarding discrimination and harassment
- assessing pupils' knowledge development and social situation at school and discussing how to communicate such matters.

#### Module 5 Environmental Physics, 3 ECTS cr

- basic concepts in the area of energy with a focus on earth's radiation balance in the solar energy flow
- using applications such as solar cells, heat pumps, heat exchanger, bio fuel and water and wind power in the laboratory
- energy for sustainable development and aspects of energy extraction and the relation between human beings, energy and the environment.

#### **Reading List**

See separate document.

#### **Examination**

Assessment is based on:

##### Module 1 Basic Physics Concepts

Learning outcomes 1 and 5: written exam or individual hand-in assignments (to be announced at course start)

Learning outcomes 2 and 6: individually in laboratory sessions and oral and written reports.

Learning outcomes 3 and 4: orally and individually in seminars

##### Module 2 Introductory Chemistry II

Learning outcomes 1-4: written exam and subsequent seminar

Learning outcome 5: safety test

Learning outcome 6: laboratory tasks and report of lab results according to instructions

Learning outcome 7-9: orally and individually at seminars, or a written hand-in assignment (to be announced at course start)

##### Module 3 The Universe

All learning outcomes: written exam

##### Module 4a Practical Placement

Learning outcomes 1, 4 and 5 are assessed on the basis of completed and documented practical placement.

Learning outcomes 2, 3, 6, 7 and 8 are assessed on the basis of written assignments at the university.

#### Module 4b

Learning outcomes 1, 3, 4, 5, 6, 8, and 9 are assessed on the basis of completed and documented practical placement.

Learning outcomes 2, 7 and 10 are assessed on the basis of written assignments at the university.

Attendance is required for the introduction to and the school placement component. The occasional day of absence can be completed on agreement with the module convener. Students who fail to attend more than five days will have to retake the whole module. The number of retake opportunities is limited to two for the practical placement component.

#### Module 5 Environmental Physics

Learning outcomes 1-3: orally and individually at seminars, or hand-in assignments (to be announced at course start).

#### **Grades**

One of the grades Distinction (VG), Pass (G) or Fail (U) is awarded in the examination of the course.

#### **Quality Assurance**

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

#### **Course Certificate**

A course certificate will be provided upon request.

#### **Additional information**

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.

Teacher education: Upper secondary school level

The course includes mandatory components that can only be performed and assessed at Karlstad University.

Students are required to procure and pay for approved protective equipment.