



Board of Teacher Education  
Physics

## Syllabus

### Science and Technology for Primary Teachers in Grades 4-6

<b>Course Code:</b>	LPGG19
<b>Course Title:</b>	Science and Technology for Primary Teachers in Grades 4-6 <i>Science and Technology for Primary Teachers in Grades 4-6</i>
<b>Credits:</b>	30
<b>Degree Level:</b>	Undergraduate level
<b>Progressive Specialisation:</b>	First cycle, has at least 60 credits in first-cycle course/s as entry requirements (G2F)

#### Major Field of Study:

#### Course Approval

The syllabus was approved by the Board of Teacher Education 2015-08-26, and is valid from the Spring semester 2016 at Karlstad University.

#### Prerequisites

Completed courses LPGG01, LPGG02 and LPGG05

#### Learning Outcomes

The aim of the course is to promote a joyful and reflecting approach to science and technology. Students are expected to develop the skills, knowledge and insights into biology, physics, chemistry, technology and the subject-specific teaching methodologies required for teaching, developing and evaluating these subjects in upper primary school.

Upon completion of Module 1 Technology for Primary Education (7.5 ECTS cr) students should be able to:

- 1) describe the distinguishing features of technology as a human activity and knowledge domain and how technological development and application have changed over time,
- 2) identify examples of everyday technology and construct their own designs,
- 3) describe some common materials and make appropriate choices of materials based on their properties,
- 4) describe the phases of technical development: identifying needs, investigating, proposing solutions, designing and testing,
- 5) give an account of the consequences of technological choices for humans, society, and the environment and the measures required to to achieve a sustainable society,
- 6) describe technical systems in society, some parts of the system and their interaction,
- 7) discuss learners' understanding of science and technology on the basis of teaching methodological theories and plan and conduct investigations and designs based on regulations and curricula and give an account of how this can contribute to learners' learning,

8) discuss issues of diversity and gender and their importance to the understanding of and attitude to science and technology.

Upon completion of Module 2 Chemistry for Primary Education (7.5 ECTS cr) students should be able to:

- 1) explain and identify chemical phenomena through laboratory sessions,
- 2) make risk assessment and carry out experiments safely according to current legislation,
- 3) describe the structure of matter and some basic chemical reactions such as photosynthesis and oxidation,
- 4) describe the content of food in relation to the importance of nutrition and metabolism,
- 5) evaluate the use and impact of some common chemicals on health and the environment,
- 6) give an account of some natural cycles and human participation in them,
- 7) describe the properties and compounds of air and the properties of water in relation to the structure of the water molecule,
- 8) discuss learners' understanding of science and technology on the basis of teaching methodological theories and plan and conduct investigations and laboratory experiments and give an account of how these can contribute to learners' learning,
- 9) give an account of different fossil fuels and their differences in structure and properties and the importance of the different sources to energy consumption.

Upon completion of Module 3 Physics for Primary Education (7.5 ECTS cr) students should be able to:

- 1) explain and identify everyday physical phenomena and use the concepts force, pressure, density and velocity to describe electric and magnetic phenomena,
- 2) give an account of the origin and evolution of the universe, the celestial bodies of the solar system and their movements in relation to one another and how these affect day, night, months, year, and seasons,
- 3) describe different aspects of light and sound in relation to the eye and ear and perform simple experiments in optics and acoustics,
- 4) give an account of the concept energy, the properties of substances and matter and describe the differences between energy and matter,
- 5) describe differences and similarities in various electromagnetic waves such as light, radio waves and radioactive radiation,
- 6) describe simple weather phenomena and make weather observations with the help of measurements over time,
- 7) discuss energy sources and electricity production in society, describe sustainable energy systems and conduct experiments illustrating energy issues,
- 8) describe and assess students' achievements in science and technology in relation to national curricula.

Upon completion of Module 4 Biology for Primary Education (7.5 ECTS cr) students should be able to:

- 1) explain and identify biological phenomena through laboratory experiments and models and describe how investigation-based teaching methods can be used in biology,
- 2) give an account of the characteristics of living organisms and describe difference and similarities between plant and animal cells,
- 3) give an account of basic genetic concepts and processes,
- 4) give an account of human anatomy and physiology and factors affecting health,
- 5) explain the biology of sexuality and reflect on human relationship issues,
- 6) give an account of the importance of photosynthesis and oxidation to life on earth, the cycle of matter and energy flows,
- 7) describe some ecosystems and discuss how ecosystems are affected by human activity and the measures required to achieve a sustainable society,
- 8) give an account of how organisms are classified and describe the origin of life and its evolution, and classify the groups fungus, plants and animals.

## **Content**

Throughout the course, issues of diversity, gender, subject-specific teaching methodology and sustainable development are treated. The course comprises four modules, each of 7.5 ECTS cr:  
1. Technology for Primary Education 2. Chemistry for Primary Education 3. Physics for Primary Education 4. Biology for Primary Education

### **1. Technology for Primary Education**

The module deals with the distinguishing features of technology as a human activity and knowledge domain through, for instance, the study of the relation between technological development and scientific progress.

The technology perspective centres on everyday objects consisting of mobile parts and on how these are assembled with the help of different mechanisms for transferring and amplifying forces. How common solid and stable constructions, such as buildings, bridges, and cranes, are structured is discussed. Technical solutions that utilise different technological principles, such as electricity components, to achieve sound, light and motion are constructed. The different phases of technological development are used to investigate common materials and their properties, as well as documentation in the form of sketches and drawings and basic manufacturing processes.

From the technology perspective, the consequences of different technical choices and different ways of economising with resources in the household are studied. Different technical systems, some components of the systems, how these interact and have changed over time are treated

The ways in which cultural conceptions of technology affect women and men's career choices and the use of technology are discussed.

From an aesthetic perspective, the ways in which various art forms can constitute tools for a varied and broadening understanding of science and technology are tested.

### **2. Chemistry for Primary Education**

From the chemistry perspective, ancient descriptions of the structure of matter and the shift of chemistry from magic and mysticism to modern science are explained. The concept of matter and its different stages and transitional phases are treated from a particle perspective. The photosynthesis, oxidation and other basic chemical reactions are explained. Substances and materials are categorised in various ways on the basis of their properties. Experiments are planned, conducted and evaluated.

The content of food and the importance of nutrition for health are treated. Historical and contemporary methods to prolong the sustainability of food and common chemicals in the household and surroundings as well as their use and impact on health and the environment are treated. The labelling and handling of common chemicals are also described.

The cycle of matter through the refining of raw products, how these are handled as waste and returned to nature are studied. The importance of fossil fuels to energy consumption and their effects on the climate are problematised. Interpretation and examination of information related to chemistry, for instance, in factual texts and articles are included.

From an aesthetic perspective, the ways in which different world views are processed and expressed in art are discussed.

### **3. Physics for Primary Education**

Different areas of Physics are treated:

The astronomy unit describes the origin and evolution of the universe, celestial bodies in the solar system and their relational movements, and the causes of day, night, months, year and season are

explained.

The mechanics unit deals with the concepts force and motion and how these are experienced and can be described in everyday situations. Pressure in solid substances, liquids and gases, density and Archimedes' principle are described. The concept energy is treated and the meaning of the energy principle as well as energy conversion between different forms of energy are discussed. The energy flow between objects of different temperature is demonstrated and methods to influence the flow are described.

The acoustics unit centres on the cause of sound and its expansion and how it is perceived by the ear. In the optics unit, the spreading of light from common sources and how this can explain light areas and the shapes and sizes of shadows, and how light is perceived by the eye are dealt with.

The unit on electricity introduces the concepts electricity and magnetism. The electric circuit, how it can be used in everyday electrical equipment and the properties and use of the magnet are studied.

Common weather phenomena and their causes are discussed and weather observations are made with the help of measures over time. Our energy supply and dependence on electricity are treated and sustainable energy systems are discussed.

Grading and assessment in science and technology in school are discussed.

From aesthetic and teaching perspectives, different types of narration for exploring and visualising the subject areas are tested.

#### 4. Biology for Primary Education

Basic concepts and processes related to cell biology and genetics are treated.

The evolution of life and the adaptation of organisms to different living environments are explained and the categorisation of flora, fauna and other organisms is described. The life of animals, plants and other organisms and some common species in the near surroundings are identified and the conditions required for their living environment are described. Determination keys are used to determine the classification of organisms.

The role of ecosystems, for instance, decomposition, pollination and the purification of water and air is explained. The photosynthesis, oxidation and ecological connection are treated along with the importance of such knowledge for agriculture and fishing, for example.

The ecosystem of the surroundings and some of its species are studied as well as the connection between them and with organisms and the inanimate environment. Human dependence and effect on nature are discussed and what this entails in terms of sustainable development demands. Nature as a resource for recreation and experiences and our responsibility for it are treated.

Basic knowledge of conducting systematic studies with the scientific method and knowledge of measuring techniques and documentation processes are included. Experiments are planned, conducted and evaluated.

Aesthetic learning processes are explored in conjunction with the other module subjects.

#### **Reading List**

See separate document.

#### **Examination**

Assessment is based on the following mandatory components:

Module 1

Learning outcomes 1 and 6: written exam

Learning outcome 2: technical designs  
Learning outcomes 3-5: written and oral group presentation  
Learning outcome 7: written and oral group presentation  
Learning outcome 8: seminar performance

#### Module 2

Learning outcomes 1 and 8: laboratory assignment  
Learning outcomes 2 and 5: written and oral group presentation  
Learning outcomes 3, 4, 6, 7 and 9: written exam  
Learning outcome 8: seminar performance

#### Module 3

Learning outcomes 1, 4 and 5: written exam  
Learning outcome 2: aesthetic group performance  
Learning outcomes 3 and 6: laboratory assignments  
Learning outcome 7: seminar performance and laboratory assignment

#### Module 4

Learning outcomes 1-5: written exam  
Learning outcome 6: excursions and written exam  
Learning outcome 7: designs and models and oral presentation  
Learning outcome 8: written report

All submissions for assessment must clearly indicate individual contributions.

#### **Grades**

One of the grades Fail (U), Pass (G), or Distinction (VG) 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 primary school level