



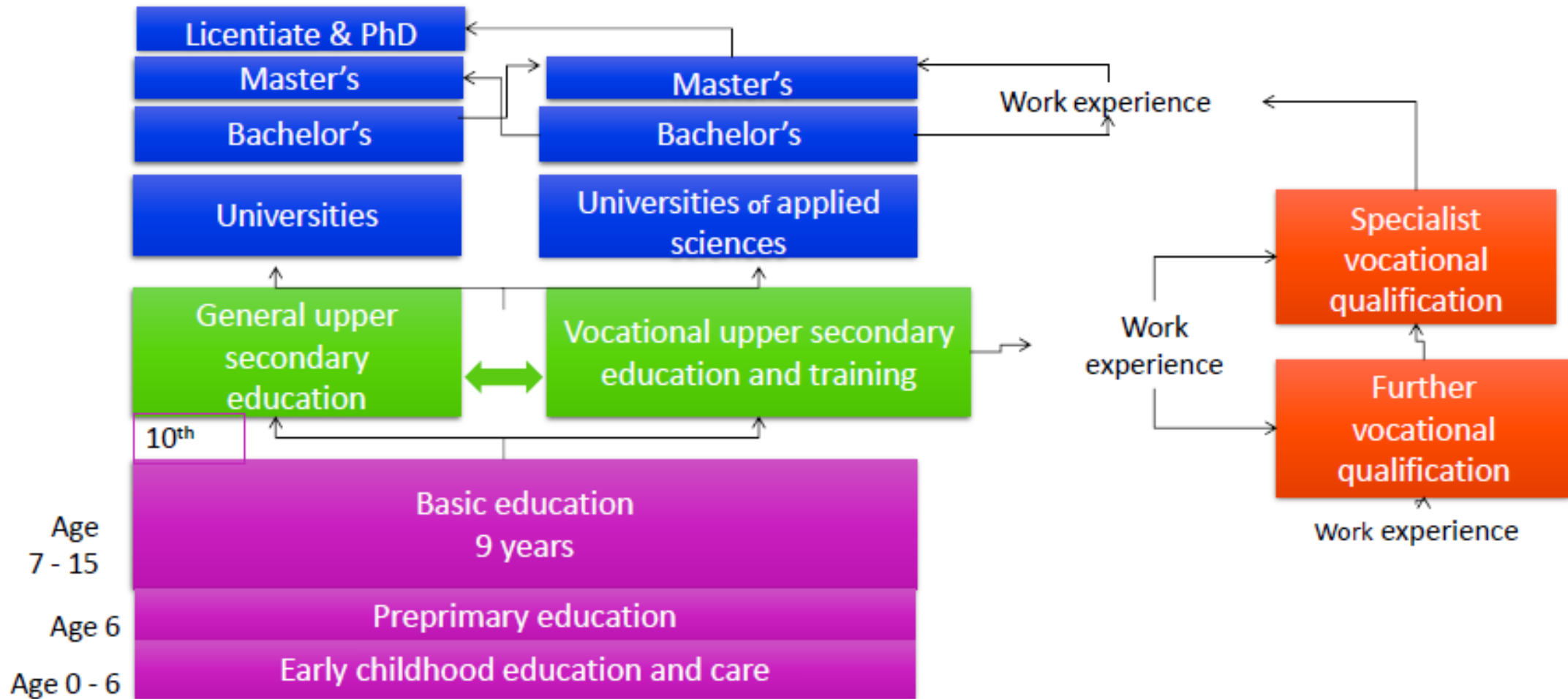
FINNISH NATIONAL  
AGENCY FOR EDUCATION

# STEM subjects in Finland

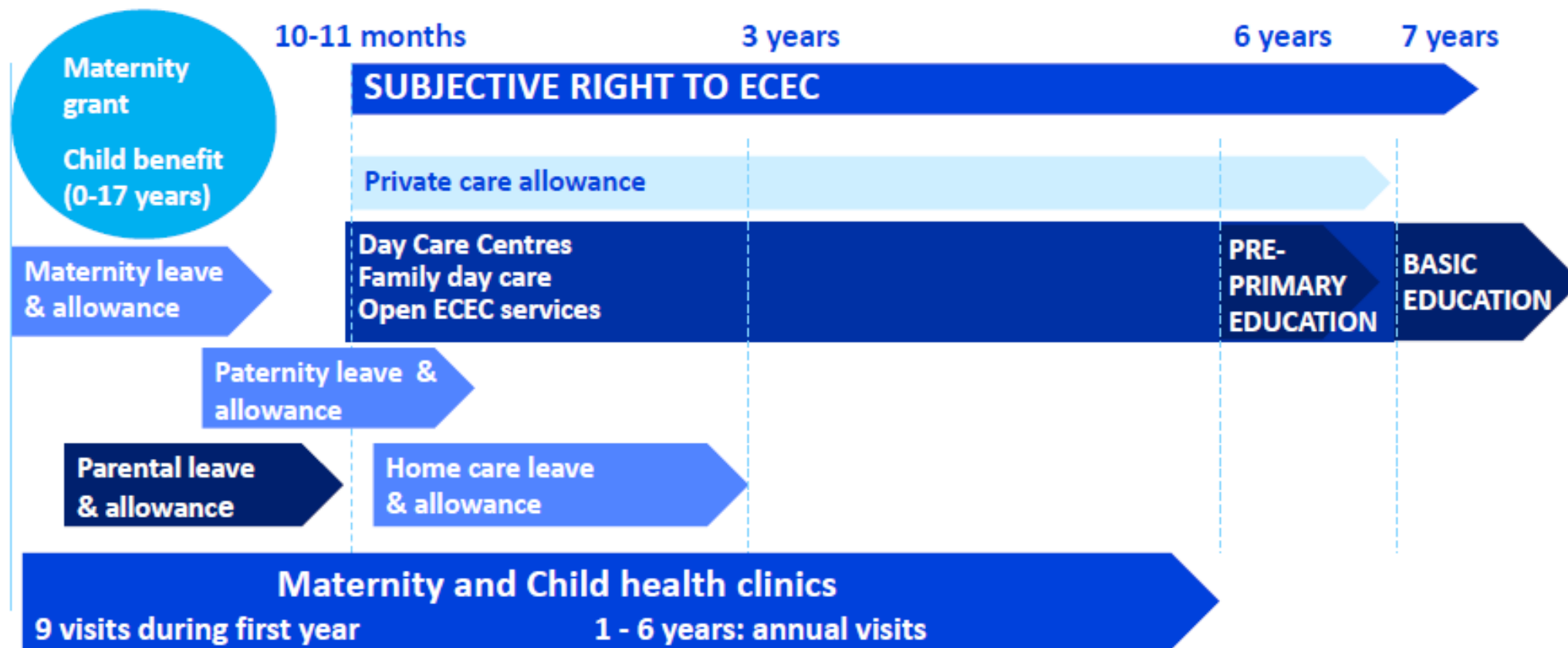
Leo Pahkin  
Counsellor of Education



# No dead-ends in the education system



# Early childhood education and care (ECEC)



# Early childhood education and care + pre-primary education

- Years 0 – 5 and 6
- Education is divided into 5 subject fields.
  - Language
  - Physical activity
  - **Exploration**
  - Artistic experiences
  - Self-expression
- Learning through play essential

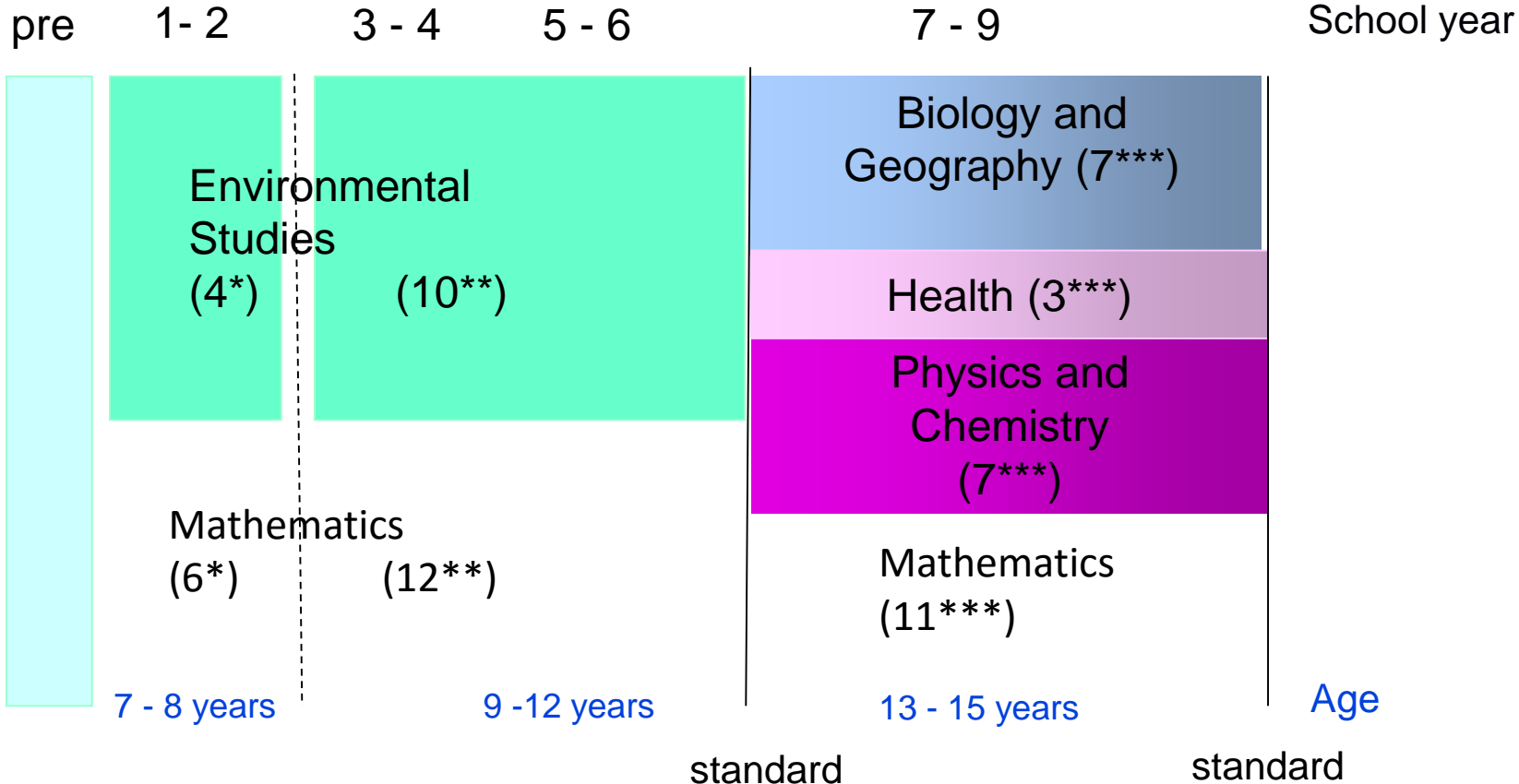
# Exploring in ECEC and Pre-Primary education

1. to explore and work in a natural and constructed environment.
2. development of mathematical thinking and strengthens positive attitudes towards mathematics.
3. environmental education and technology education.



# Basic Education: Environmental and Natural Studies and Mathematics

## *distribution of lesson hours*



\* lessons a week divided during two years  
 \*\*lessons a week divided during four years  
 \*\*\*lessons a week divided during three years

# Math in Basic Education

- Mathematical concepts and structures
- Processing information and solve problems
- A concrete and functional approach
- Information and communication technology
- Positive attitude towards mathematics and their positive self-image as learners of the subject.
- Communication, interaction and cooperation skills
- The instruction guides the pupils to understand the usefulness of mathematics in their own lives and more broadly in the society.



# Key content areas related to the objectives of environmental studies in grades 1–2

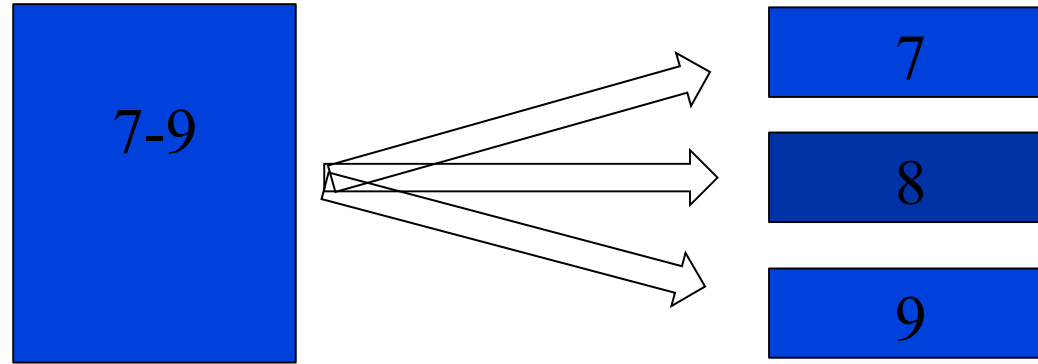
- Growth and development
- Acting at home and school
- Observing the surroundings and changes taking place in it
- Exploring and experimenting
- Reflecting on the prerequisites of life
- Practising a sustainable way of living



# Key content areas related to the objectives of environmental studies in grades 3–6

- Me as a human being
- Acting in situations and communities of daily life
- Exploring the diverse world
- Exploring the environment
- Structures, principles and cycles of nature
- Building a sustainable future

## Objectives and key content areas divided between year classes



Cyclical: objectives and key content areas "grow" from one year to the next

AND/OR

Consecutive: different objectives and key content areas are emphasized in different year classes

=> gives flexibility depending on the nature of the subject and possibilities for planning together with the pupils

# GENERAL UPPER SECONDARY EDUCATION

## **Task and Status**

- provides general education leading to the matriculation examination  
general eligibility for higher education

## **Administration**

- schools are usually owned and run by municipalities
- only a few private or state schools

# MAIN CHARACTERISTICS OF THE SYLLABI

## Non-graded System

- students don't repeat grades nor get promoted
- the syllabus for each subject consists of modules/courses (38 lessons each)
- compulsory courses and elective courses
- two kinds of elective courses:
  - specialisation courses (national targets and contents)
  - applied courses (school-specific)

## STUDYING IN NON-GRADED SCHOOL

- school year is divided into 5 or 6 periods, each offering different course options
- minimum number of 75 courses are required for the completion of upper secondary education syllabus
- no permanent groups
- independent studies are possible (a whole course or a part of it)
- to be completed in 3 years, 4 years also acceptable
- the student plans his/her own study programme with the help of a student counsellor



requires efficient student counselling



# **MATRICULATION EXAMINATION**



# MATRICULATION EXAMINATION

## One compulsory subject

- mother tongue

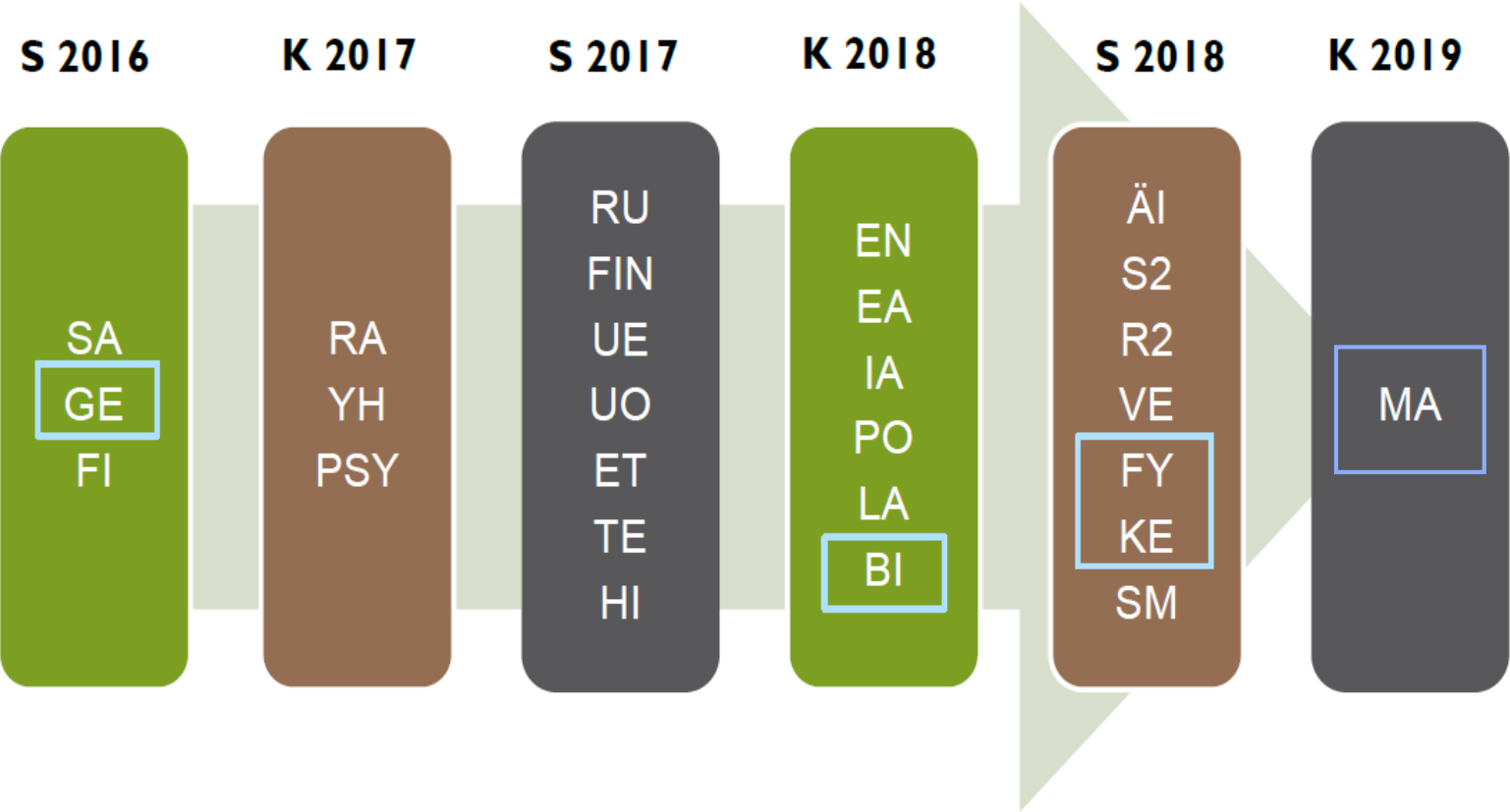
## and three out of the following subjects:

- second national language, foreign language, mathematics, general studies test (one subject)

## Optional subjects

- mathematics, general studies test (more subjects), one or more foreign languages

# Matriculation examinations to e-exams





# UPPER SECONDARY SCHOOL

## Current course programme

1 course = 38 lessons of 45 minutes  
 ≈ 1 weekly lesson in a year

| Subjects                      | Compulsory courses | Specialization courses | School-based courses: specialization or applied |
|-------------------------------|--------------------|------------------------|---|
| Biology                       | 2                  | 3                      |   |
| Geography                     | 2                  | 2                      |   |
| Physics                       | 1                  | 7                      |   |
| Chemistry                     | 1                  | 4                      |   |
| <b>Compulsory courses</b>     | <b>47-51</b>       |                        |   |
| <b>Specialization courses</b> |                    | <b>Min. 10</b>         |   |
| <b>Total minimum</b>          | <b>75</b>          |                        |   |

# UPPER SECONDARY SCHOOL

## Course programme as from 2016/2017

1 course = 38 lessons of 45 minutes  
≈ 1 weekly lesson in a year

| Subjects                      | Compulsory courses | Specialization courses | School-based courses: specialization or applied |
|-------------------------------|--------------------|------------------------|---|
| Biology                       | 2                  | 3                      |   |
| Geography                     | 1                  | 3                      |   |
| Physics                       | 1                  | 6                      |   |
| Chemistry                     | 1                  | 4                      |   |
| <b>Compulsory courses</b>     | <b>47-51</b>       |                        |   |
| <b>Specialization courses</b> |                    | <b>Min. 10</b>         |   |
| <b>Total minimum</b>          |                    | <b>75</b>              |   |

## Courses in physics and chemistry

FY1: Physics as a natural science (compulsory)

FY2: Heat

FY3: Electricity

FY4: Force and motion

FY5: Periodic motion and waves

FY6: Electromagnetism

FY7: Matter and radiation

KE1: Chemistry around us (compulsory)

KE2: World of molecules

KE3: Chemical reactions and energy

KE4: Materials and technology

KE5: Chemical reactions and equilibrium

# Courses in mathematics

## Basic syllabus (6 + 2)

- Numbers and sequences
- Expressions and equations
- Geometry
- Mathematical models
- Statistics and probability
- Commercial mathematics
- *Mathematical Analysis*
- *Statistics and probability II*

## Advanced syllabus (10 + 3)

- Numbers and sequences
- Polynomial functions and equations
- Geometry
- Vectors
- Analytical geometry
- Derivative
- Trigonometric functions
- Radial and logarithmic functions
- Integral calculus
- Probability and statistics
- *Number theory and mathematical proofs*
- *Algorithms in mathematics*
- *Advanced differential and integral calculus*

# Cross-curricular themes

- Cross-curricular themes will be taken into account in instruction in all subjects as appropriate for each particular subject, as well as in the upper secondary school's operational culture.
- There will be 6 themes:
  - active citizenship, entrepreneurship and working life
  - safety and well-being
  - sustainable way of life and global responsibility
  - knowledge of cultures and internationality
  - multiliteracy and media
  - technology and society

# Mathematics in upper secondary general education

- understand, exploit, and produce information
- the models of mathematical thinking and the basic ideas and structures of mathematics
- use both spoken and written mathematical language,
- develop students' skills in calculation, modelling of phenomena, and problem solving

- topics and phenomena of interest for the students as well as on problems related to them
- Varying working methods: Allowing the students to work independently and together with others
- Utilise images, drawings, and tools that support his or her thinking as well as supported in the ability to move from one form of representation of mathematics into another
- Creative solutions to mathematical problems
- Technical tools, for example, dynamic mathematics software, symbolic computation software, statistical software, spreadsheets, text processing, and, when possible, digital sources.

# General objectives for teaching physics/chemistry are to enable the students

- to recognise their competencies in physics/ chemistry, to set targets and apply learning strategies characteristic of physics/chemistry
- to apply physics/chemistry in different situations (nature, business life, organisations, science communities)
- to set questions on given phenomena as a basis for research and problem solving
- to plan and conduct experiments in cooperation with others



# General objectives for teaching physics/chemistry (cont.)

- to process, interpret and present the results from experiments, and to evaluate them and the whole process, to use scientific language
- to create, interpret and evaluate different models
- to use different sources of information and to evaluate them critically
- to structure the understanding of nature and its phenomena with principles and concepts characteristic to physics/chemistry
- to evaluate the importance of physics/ chemistry (individual / society)

# Specialised upper secondary schools

- 13 schools specialised in mathematics / natural sciences / environmental sciences / technology
- 40 % of students are girls
- adjusted curriculum: emphasis on science subjects (more compulsory and elective courses)
- permission from the Ministry of Education and Culture needed
- possibility for increased subsidy from the state



FINNISH NATIONAL  
AGENCY FOR EDUCATION

# Thank you!

Leo Pahkin

