A short introduction to the new curricula in STEM subjects in Finland

Finnish National Agency for Education, 2017
Teijo Koljonen and Jukka Tulivuori
Finland in brief

- population 5.5 million (18 inhabitants / sq. km)
- two official languages: Finnish and Swedish
- persons with foreign background: 6.2 % of the population
- education level of the working age population:
  - 13 % basic education
  - 45 % upper secondary education
  - 42 % tertiary education
No dead-ends in the education system

- Basic education: 9 years
  - Age 7 - 15
- Preprimary education
  - Age 6
- Early childhood education and care
  - Age 0 - 6

Universities
- Bachelor’s
- Master’s
- Licentiate & PhD

Universities of applied sciences
- Bachelor’s
- Master’s

Vocational upper secondary education and training
- Work experience

General upper secondary education

Specialist vocational qualification
- Work experience

Further vocational qualification
- Work experience

Further vocational qualification
- Work experience
Two-tier national administration

Ministry of Education and Culture

• Education policy
• Preparation of legislation
• State funding

Finnish National Agency for Education

• National development agency
• National core curricula & qualification requirements
• Support for evidence-based policy-making
• Services for learners
Central steering

- Educational priorities
- Minimum time allocation
- National core curricula
- Size of state subsidies

Local decisions

- Educational priorities
- Local curricula
- Allocation of subsidies
- Class size
- Recruitment
- Teacher "evaluation"
- Quality assurance
Education developed in partnership

National authorities
Local authorities
Teachers’ union
Social partners
Parents
Pupils and students
Research institutions
Relevant stakeholders
Education providers have main responsibility for quality

Self-evaluation

Skills demonstrations
Competence-based qualifications
System & thematic evaluations

National evaluations of learning outcomes
International assessments
Evaluation of learning outcomes function as traffic lights

- National evaluation plan
- Sample-based
- Stratified

Mother tongue and mathematics every other year

Other subjects according to policy priorities
Basic education is free for pupils and families.
Rethinking competences

National Goals for Basic Education and Transversal Competences

- knowledge
- skills
- values
- attitudes
- will

Thinking and learning to learn

Cultural competence, interaction and expression

Participation and influence, building the sustainable future

Taking care of oneself and others, managing daily activities, safety

Competence for the world of work, entrepreneurship

Multiliteracy

ICT competence

Development as a human being and as a citizen

Thinking and learning to learn

Cultural competence, interaction and expression

Participation and influence, building the sustainable future

Taking care of oneself and others, managing daily activities, safety

Competence for the world of work, entrepreneurship

Multiliteracy

ICT competence

Development as a human being and as a citizen
# National minimum time allocation

## Sample of subjects

(annual weekly lessons<sup>1</sup>)

<table>
<thead>
<tr>
<th>Forms</th>
<th>1–2</th>
<th>3–6</th>
<th>7–9</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mother tongue &amp; literature</strong></td>
<td>14</td>
<td>18</td>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td>6</td>
<td>15</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td><strong>A language (1st foreign language)</strong></td>
<td>–</td>
<td>9</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td><strong>B language (2nd national language)</strong></td>
<td>–</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Forms</th>
<th>1–6</th>
<th>7–9</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environment and science</strong></td>
<td>14</td>
<td>17</td>
<td>31</td>
</tr>
<tr>
<td><strong>History &amp; civics</strong></td>
<td>5</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td><strong>Arts, crafts &amp; sports</strong></td>
<td>62</td>
<td></td>
<td>62</td>
</tr>
</tbody>
</table>

<sup>1</sup> Total annual no of lessons x 38  

Total min: 222
### Basic Education: Environmental and Natural Studies

**distribution of lesson hours**

<table>
<thead>
<tr>
<th>School year</th>
<th>Age</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>pre</td>
<td>7 - 8 years</td>
<td></td>
</tr>
<tr>
<td>1 - 2</td>
<td>9 - 12 years</td>
<td></td>
</tr>
<tr>
<td>3 - 4</td>
<td>13 - 15 years</td>
<td></td>
</tr>
<tr>
<td>5 - 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Environmental Studies** (4*)
- **Biology and Geography** (7***)
- **Health** (3***)
- **Physics and Chemistry** (7***)

* lessons a week divided during two years
** lessons a week divided during four years
*** lessons a week divided during three years
Inquiry-based learning in science

- more focus on qualitative / macroscopic level
- instruction is based on observations and investigations
- doing inquiries
  - is essential for adopting and understanding concepts
  - develops research skills
  - develops working and team work skills
  - develops creative and critical thinking
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
Key content areas related to the objectives of biology studies in grades 7–9

- Biological research
- Filed trips to nature and the surroundings
- The basic structure and function of an ecosystem
- What is life?
- The human being
- Towards a sustainable future
Key content areas related to the objectives of geography studies in grades 7–9

- The map and the regions of the world
- The current, changing world
- Basic conditions for life on Earth
- Changing landscapes and living environments
- People and cultures on Earth
- A sustainable way of living and sustainable use of natural resources
Key content areas related to the objectives of physics and chemistry studies in grades 7–9

- Scientific research
- Physics in the pupil’s daily life
- Physics in the society
- Physics shaping the worldview
- Interaction and motion
- Electricity

- Scientific research
- Chemistry in the pupil’s daily life
- Chemistry in the society
- Chemistry shaping the worldview
- Properties and structure of substances
- Properties and changes in substances
Mathematics & computational thinking

• computational thinking part of the new mathematics syllabus
• starts from primary class one (for example verbal or visual instructions/algorithms)
• develops to graphical programming and simple programming languages

→ websites for learning/teaching coding e.g. www.koodiaapinen.fi (”Code Alphabet”) is a grassroots initiative by teachers and educational researchers.
What happens immediately after compulsory education? 2001 / 2014

Students completing basic education (57,853 in 2014)

- General upper secondary: 54% / 52%
- Vocational upper secondary: 36% / 42%
- Other studies: 3% / 2%
- Did not continue immediately: 7% / 4%
General upper secondary education aims at broad-based knowledge
Main characteristics of the syllabus

Non-graded System

• 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)
• minimum number of 75 courses are required for the completion of upper secondary education syllabus
• 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
## Distribution of lesson hours in general upper secondary education

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compulsory courses</td>
<td>47–51</td>
</tr>
<tr>
<td>Minimum total of specialisation courses</td>
<td>10</td>
</tr>
<tr>
<td>Minimum total number of courses</td>
<td>75</td>
</tr>
</tbody>
</table>
## Distribution of courses

**sample of subjects**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Compulsory courses</th>
<th>Specialisation courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother tongue &amp; literature</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>A-language</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>B-language</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Other languages</td>
<td></td>
<td>8+8</td>
</tr>
<tr>
<td>Mathematics</td>
<td>6-10</td>
<td>2-3</td>
</tr>
<tr>
<td>Environment &amp; science</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Humanities &amp; social sciences</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Arts, crafts &amp; sports</td>
<td>4-6</td>
<td>7</td>
</tr>
</tbody>
</table>
### UPPER SECONDARY SCHOOL Sciences

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

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Compulsory courses</th>
<th>Specialization courses</th>
<th>School-based courses: specialization or applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geography</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Compulsory courses**  
47-51

**Specialization courses**  
Min. 10

**Total minimum**  
75
Courses in biology and geography

BI1: Life and evolution (compulsory)
BI2: Ecology and the environment (compulsory)
BI3: Cells and heredity
BI4: Human biology
BI5: Biological applications

GE1: The world in change (compulsory)
GE2: The blue planet
GE3: A common world
GE4: Geomedia – explore, participate, and get involved
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
Cross-curricular themes

Cross-curricular themes are 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 are 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
Specialised upper secondary schools

- 13 schools specialised in mathematics / natural sciences / environmental sciences / technology
- 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
Matriculation examination

- Minimum 4 tests
- Mother tongue + 3 of the following:
  - 2nd national language
  - foreign language
  - mathematics
  - general studies
    (one subject in sciences and humanities)
- One or more optional tests possible
- Biannual
Matriculation examinations to e-exams
Finnish teachers are trusted professionals.
Most teachers are required a master’s degree

Kindergarten teachers
180 ECTS (3 years)

Class teachers
300 ECTS (5 years)

Subject teachers
300 ECTS (5–6 years)

Teachers of vocational studies:
Master’s, Bachelor’s + work experience + pedagogical studies of 60 ECTS (1 year)

Principals:
teacher education + e.g. certificate in educational administration
Teacher training institutions can select heavily

Intake into teacher education 2016 (% of those who applied)

<table>
<thead>
<tr>
<th>Type of Teacher Education</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class teacher education</td>
<td>12 %</td>
</tr>
<tr>
<td>Subject teacher education</td>
<td>10% – 53%</td>
</tr>
<tr>
<td>Vocational teacher education</td>
<td>31%</td>
</tr>
</tbody>
</table>

Finnish National Agency of Education, Vipunen.fi, universities
Comparing Finnish education
Finnish education in international comparison

- Instruction time low
- Differences between schools small
- Girls outperform boys
- Moderate costs
- Socio-economic effect moderate
- Teachers feel highly valued
Thank you!

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