The Finnish Way to Engage Students and Teachers of Math, Science and Technology Education

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WHAT IS LUMA?

- **LUMA** IS A **FINNISH MODEL** TO PROMOTE MATH, SCIENCE AND TECHNOLOGY EDUCATION, SINCE YEAR 1996.
- **IT IS NOT SAME AS THE MODEL CALLED STEM.**
- **IT ALSO MEANS LIGHT (SHINE): JOY IN KIDS’ AND YOUTH’S EYES**
- **THE FLOWER LOGO MEANS “TOGETHER WE ARE MORE”** (our motto)

LUMA comes from the words: “LUonnontieteet” (science) and MA “MATematiikka” (math) in Finnish.
THE MAIN AIM OF THE LUMA MODEL:
To engage children and young people –both girls and boys- from age 3 to 19 in science, technology, engineering, and mathematics and teachers at all levels in life-long professional development.
LUMA CENTRE FINLAND

1. Central Finland LUMA Centre (University of Jyväskylä)
2. LUMA Centre Aalto (Aalto University)
3. LUMA Centre Lapland (University of Lapland)
4. LUMA Centre of Central Ostrobothnia (Kokkola University Centre Chydenius)
5. LUMA Centre of Ostrobothnia (University of Vaasa)
6. LUMA Centre of Southwestern Finland (University of Turku)
7. LUMA Centre of the University of Eastern Finland
8. LUMA Centre of the University of Helsinki – COORDINATION
9. LUMA Centre of the University of Oulu
10. LUMA Centre Päijät-Häme (Lahti University Campus)
11. LUMA Centre Saimaa (Lappeenranta University of Technology)
12. LUMA Centre Åbo Akademi (Åbo Akademi University)
13. Tampere LUMATE Centre (University of Tampere & Tampere University of Technology)

LUMA MOTTO: TOGETHER WE ARE MORE!
LUMA FOR ALL
connecting various fields of science from kindergarten to university

THE JIPPO PROGRAM FOR 3 TO 6 YEARS OLD:
MATH, SCIENCE AND TECHNOLOGY INTEGRATED WITH ART.

ALSO COLLABORATION WITH OTHER SCIENCES AND ART
THE FINNISH LUMA MODEL:
COLLABORATION IS A KEY FOR SUCCESS

SCHOOLS
KINDERGARTENS
TEACHERS,
CHILDREN,
PUPILS,
STUDENTS
PARENTS

E.G. SCIENCE DAYS
AND VIRTUAL CLUBS
FOR FAMILIES

INTERNATIONAL
COLLABORATION

UNIVERSITIES
STUDENTS
TEACHER
EDUCATORS
RESEARCHERS

LUMA

SCHOOLS
KINDERGARTENS
TEACHERS,
CHILDREN,
PUPILS,
STUDENTS
PARENTS

MINISTRY OF
EDUCATION
NATIONAL
BOARD OF
EDUCATION

BUSINESS
SECTOR

LIBRARIES
MUSEUMS
SCIENCE CENTRES

MEDIA
ASSOCIATIONS

LUMA CENTRE FINLAND
National mission 2017 - 2020

- Coordinated by University of Helsinki
- Annual funding from Ministry of Education and Culture
- Jointly agreed areas for the focus
- **Annual aims and evaluation**
  - Each LUMA Centre sets aims at February every year
  - These are evaluated and cross-evaluated (two centres) by other centres at October
## The areas of the national mission

1. Increasing the amount of **international collaboration** enhancing learning and funding possibilities in future
2. Offering **informal and formal science education** for children and youth to support recruiting students for higher education
3. Conducting **LUMA-related research** brings valuable information for developing activities furthermore and making LUMA fields more appealing
4. Promoting **pre-service and in-service teacher education**
5. Supporting studying LUMA subjects with the aid of **StarT projects** inspires children and youth for STEM areas
6. **LUMA Labs** provide and offer facilities and equipment for STEM activities
SUPPORTING TEACHERS’ LIFE-LONG LEARNING

PRE-SERVICE TEACHER EDUCATION

INTEGRATING FORMAL, NON-FORMAL AND INFORMAL LEARNING

IN-SERVICE TEACHER EDUCATION
INNOVATIVE TEACHERS ARE KEY FOR SUCCESS.

COLLABORATIVE IN-SERVICE TRAINING PROGRAMS

- National and international LUMA days
- No registration fee
- MOOCS AND WEBINARS

- TEACHERS’ NEEDS
- THE NEWEST RESEARCH
- INNOVATIONS

SUPPORTING CURRICULUM
E.G. UNIVERSITY OF HELSINKI: A NEW MODEL FOR PRE-SERVICE TEACHER EDUCATION: STUDENT TEACHERS ARE IN ACTIVE ROLE IN LUMA ACTIVITIES AND COLLABORATION WITH SCHOOLS AND COMPANIES
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DEVELOPMENT PROJECTS AND IN-SERVICE TRAINING GOING ON

- **MATHEMATICS**
  (e.g. creative problem solving; inquiry)

- **SCIENCE AND ENVIRONMENT**
  (e.g. good questions, JIPPO program)

- **TECHNOLOGY EDUCATION**
  (e.g. programming, robotics)

**LUMA SUOMI PROGRAMME**
FOR YEARS 2014-19
(RESOURCES from the Ministry of Education and Culture)
Three sub-programs

1. Inquiry-based learning, educational technology, and working life in mathematics, 12 projects

2. Inquiry-based learning, educational technology, and working life in natural sciences and environmental education, 14 projects

3. Technology education: programming, robotics and the information society, 11 projects

+ Follow-up and evaluation program

• When the programme ends, 80% of Finnish municipalities should be included!
EXAMPLE 1: MEANINGFUL MATH

- A virtual club for math
- The main aim is to show that math is interesting and everywhere.
- Videos: http://blogs.helsinki.fi/mathversum/
Example 2: Good questions
Design Research: Pedagogical Models Produced with Teachers

- Promoting students to ask questions
- Promoting “better” questions
- Using the questions in teaching
  - Questions in integrated science teaching
  - Questions in project-based learning
  - Questions in inquiry-based teaching
  - Finding out about students pre-knowledge
  - Questions as discussion promoters
  - Questions in teaching planning
THE JIPPO PROGRAM:
SCIENCE CLUBS FOR 3 TO 6 YEARS OLD

MATH, SCIENCE AND TECHNOLOGY INTEGRATED WITH ART.

- INQUIRY-BASED LEARNING: PLAYFUL LEARNING, ROLE PLAYING AND STORIES
- HANDS-ON ACTIVITIES (PROBLEMS IN MATH)
- ACTIVATING CHILDREN TO ASK AND TO BE ACTIVE LEARNERS AND RESEARCHERS
- HOME ACTIVITIES WITH FAMILIES OR GRANDPARENTS

the education of the whole child
Example 4. LUMA Centre Program: Collaboration with Business

PRE-SERVICE AND IN-SERVICE EDUCATION

- It is carried out in collaboration with the industry and schools through the course called Math and Science in Society (LUMA)
- Students, a company and a school (two teachers from the school) in each team
- A project work with Industry Companies: designing a collaboration model for the school close to it
12 LUMA LABS IN FINLAND;
FOUR ROLES OF THE LUMA LABS:

- A VISITING CENTRE FOR SCHOOLS BY SUPPORTING CURRICULUM
- A RESEARCH AND DEVELOPMENT CENTRE FOR NEW PEDAGOGICAL INNOVATIONS (e.g. thesis and publications)
- A TRAINING CENTRE FOR FUTURE TEACHERS AND TEACHERS AT VARIOUS SCHOOL LEVELS
- A COLLABORATION CENTRE WITH INDUSTRY, SCIENTISTS AND OTHER PARTNERS (E.G. MEDIA)
• Founded v. 2008
• Collaboration between
  – University of Helsinki
  – Finnish chemistry industry
  – Pedagogical institutions
• Coordinated by Centre for chemistry education (Kemma)
• Over 24,000 visitors and 1,300 groups
• All school levels – free of charge
• Based on Finnish national curriculum

CHEMISTRILAB GADOLIN

• Birthday parties
• Science fairs
• In-service training
• Pre-service training
• Material development
• Material lending
• Webinars
• Academic research

• Study visits
  – Laboratory activities
  – Molecular modeling
  – Scientist meetings
  – Department and campus tours
• Science clubs (all school levels)
• Science camps (all school levels)
FINNISH LUMA MODEL: CONNECTING FORMAL, INFORMAL AND NON-FORMAL EDUCATION, TEACHER TRAINING AND RESEARCH

INTERDISCIPLINARY APPROACHES

LEARNING COMMUNITIES

E.G. INTERNATIONAL SCIENCE CAMP

SCIENCE-TECHNOLOGY-SOCIETY ENVIRONMENT
NATIONAL AND INTERNATIONAL ACTIVITIES FOR YOUNG PEOPLE

13 TO 19 YEARS OLD

MEETING SCIENTISTS AND SPECIALISTS IN INDUSTRY

E.g. special courses, camps and happenings in the university

NATIONAL ACTIVITIES FOR CHILDREN

SCIENCE CLUBS AND CAMPS 7 TO 12 YEARS OLD
E.G. 40 CAMPS IN 2016
DESIGN-BASED RESEARCH AS A TOOL FOR PEDAGOGICAL INNOVATIONS

THEORETICAL PROBLEM ANALYSIS

- SCIENCE - LEARNING

EMPIRICAL PROBLEM ANALYSIS

GOALS FOR THE ACTIVITY

NEEDS

A PILOT MODEL AND TESTING IT AT SPECIAL LUMA LABS IN UNIVERSITY OR OTHER ENVIRONMENTS

RESULTS

A PEDAGOGICAL INNOVATION

A PH.D. STUDY: NOVEL ACTIVITIES TOGETHER WITH INDUSTRY

SCIENTIFIC PAPERS

TEACHER EDUCATION

Edelson, 2002
Example of Gadolin study
Veli-Matti Ikävalko & Maija Aksela

Developing novel relevant laboratory worksheets in collaboration with the chemical industry and teacher education

The goal is to develop the student laboratory, ChemistryLab Gadolin in the means of worksheets and study visit design
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<thead>
<tr>
<th>Name of the laboratory work sheet</th>
<th>Company</th>
<th>Categories</th>
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<tbody>
<tr>
<td>1. What’s in your drinking water?</td>
<td>Metrohm</td>
<td>1. Environment and nature</td>
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<td>2. Industry, technology and production</td>
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<td>3. Human biology and health</td>
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<td>4. Home economics</td>
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<td>2. Too soft plastic</td>
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<td>3. Problems at Pulp Mill</td>
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<td>4. Chlorine traces in drinking water</td>
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<td>9. Hardness of water</td>
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Sakari Tolppanen, Ph.D. thesis:

CREATING A BETTER WORLD

QUESTIONS, ACTIONS AND EXPECTATIONS OF INTERNATIONAL YOUTH ON SUSTAINABLE DEVELOPMENT AND ITS EDUCATION

INTERNATIONAL MOOCs and VIRTUAL CONFERENCES:

- A MOOC COURSE FOR YOUTH AROUND THE WORLD ABOUT SUSTAINABLE ENERGY
- A COURSE FOR TEACHERS (SAME TOPIC IN THE EDUCATION CONTEXT)
- TEACHER’S CLIMATE CHANGE FORUM

See more from LUMA News (in English)
THE FINNISH LUMA MODEL:
COLLABORATION IS A KEY FOR SUCCESS

- UNIVERSITIES
- STUDENTS
- TEACHERS
- EDUCATORS
- RESEARCHERS
- MEDIA
- ASSOCIATIONS
- LIBRARIES
- MUSEUMS
- SCIENCE CENTRES
- MINISTRY OF EDUCATION
- NATIONAL BOARD OF EDUCATION
- BUSINESS SECTOR
- INTERNATIONAL COLLABORATION

E.G. SCIENCE DAYS AND VIRTUAL CLUBS FOR FAMILIES
International collaboration

• The LINKS project (Learning from Innovation and Networking in STEM - science, technology, engineering and mathematics) aims at improving inquiry-based STEM teaching through the continuing professional development (CPD) of teachers and their educators, both at primary and secondary levels.
EU STEM Coalition

• The main goal of the EU STEM Coalition is to raise awareness among governments, industry and education providers, at national and European level, about the crucial role of STEM education in our society.

• May 17-18, 2017 Tallinn Estonia: The main topic of the conference is impact assessment.
Together for a good future!

**StarT**: every child and youth can be a star through Teamwork

LUMA CENTRE FINLAND

www.start.luma.fi/en/
The aims of StarT

• To bring science, mathematics, and technology closer to children and youngsters by:
  • Helping them establish **connections** in STEM-subjects to everyday life: **phenomenon-based learning**
  • Making it **exciting**: one’s own interests show
  • Involving **teamwork and collaboration**
• To **share ideas and best practices internationally**: learning from each other
• To **support teachers** in the implementation of:
  • Project-based learning
  • New curriculum in Finland
2017-2018

• Registration now open on the StarT website: **welcome from all around the world!**
• Even more available ideas and materials
• Sharing and learning through an even larger international learning community: **invite your friends along!**
ESERA2015: Collaboration is key
Published 07.09.2015

The 11th Conference of the European Science Education Research Association (ESERA) brought STEM education experts from all over the world to the Finnish capital, Helsinki, last week.

Read more
LUMA Centre Finland on the internet

• www.luma.fi/keskus

• www.facebook.com/LUMAkeskusSuomi

• twitter.com/LumaSuomi
THANK YOU FOR YOUR ATTENTION!

KIDS & YOUTH

TOGETHER WE ARE MORE!

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