

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



Maija Aksela

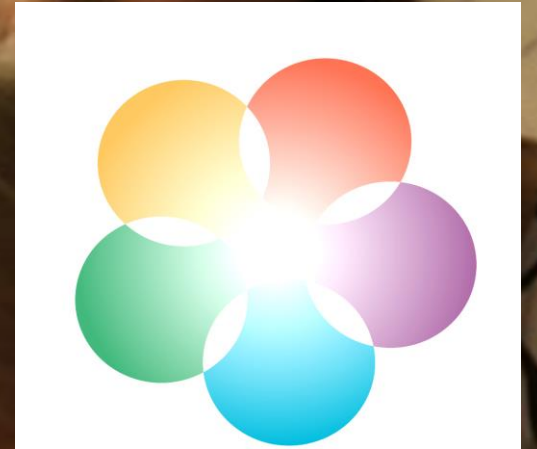
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WHAT IS LUMA?



- ❑ **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: "**LU**onnontieteet" (science) and MA "**MA**tematiikka" (math) in Finnish.

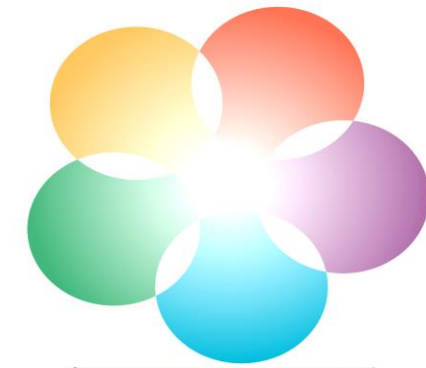


**ENJOY OF
MATH,
SCIENCE AND
TECHNOLOGY**

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!

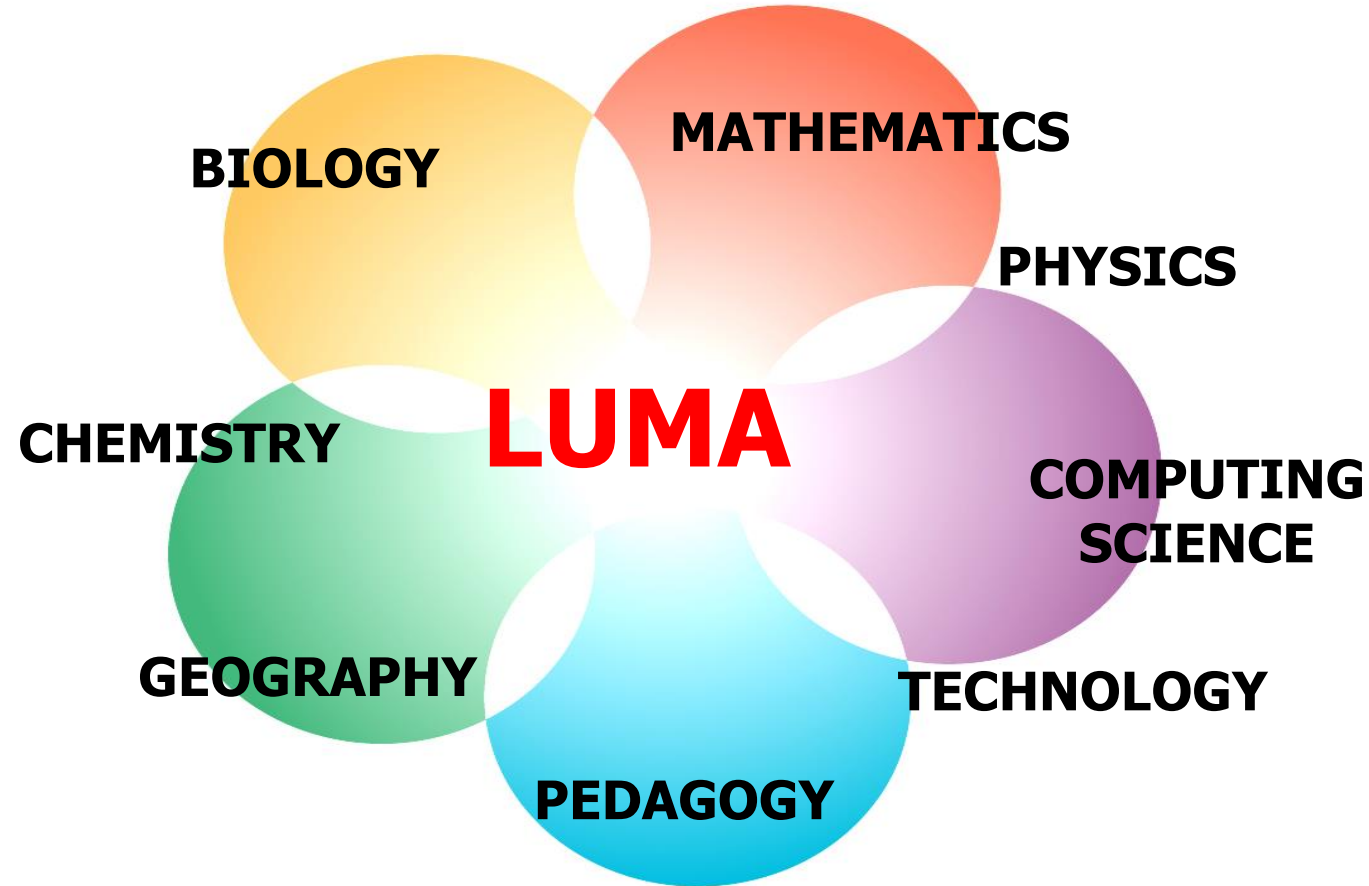
RE FINLAND

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**.**

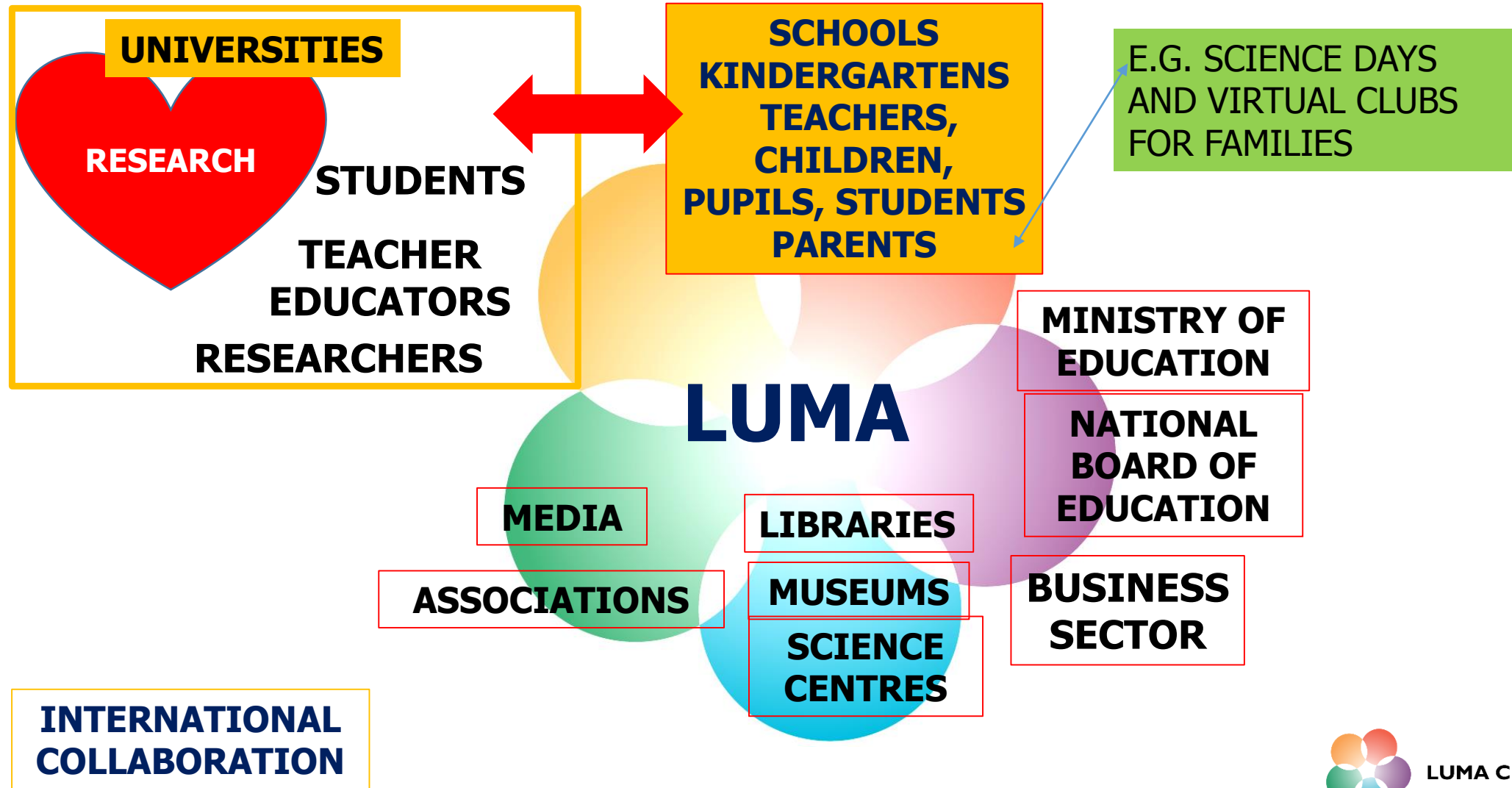


ALSO COLLABORATION WITH OTHER SCIENCES AND **ART**



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THE FINNISH LUMA MODEL: COLLABORATION IS A KEY FOR SUCCESS



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

IN-SERVICE TEACHER EDUCATION

INTEGRATING FORMAL, NON-FORMAL AND INFORMAL LEARNING

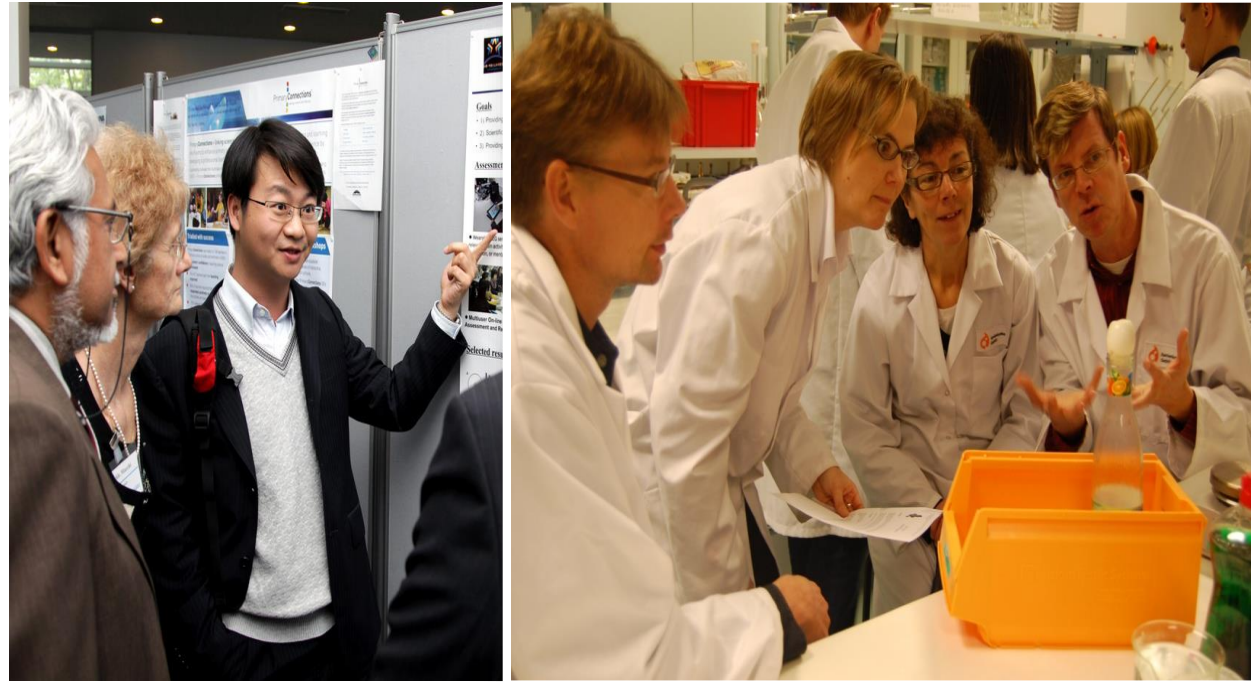


COLLABORATIVE IN-SERVICE TRAINING PROGRAMS

**National and
international
LUMA days**

No registration fee

**MOOCS
AND
WEBINARS**



- TEACHERS' NEEDS**
- THE NEWEST RESEARCH**
- INNOVATIONS**

**SUPPORTING
CURRICULUM**

**INNOVATIVE TEACHERS
ARE KEY FOR SUCCESS.**



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**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



□ THE
NEWEST
RESEARCH
USED

□ 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)



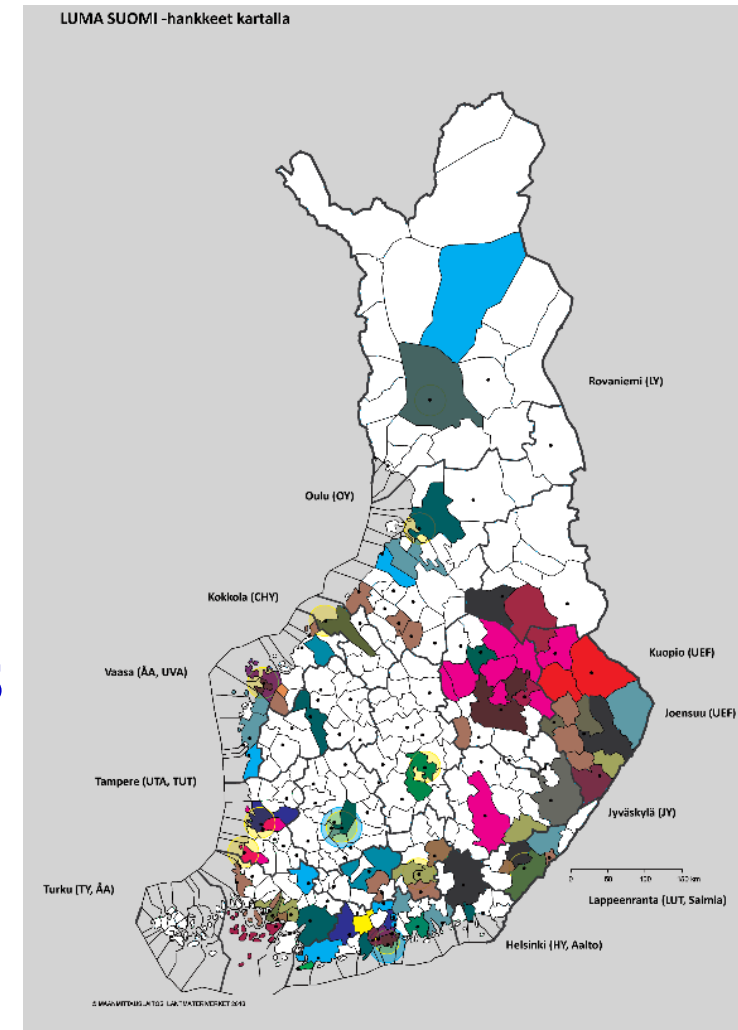
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Three sub-programs

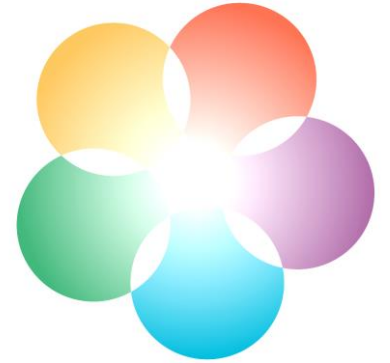
1. Inquiry-based learning, educational technology, and working life in **mathematics**, 12 projects
2. Inquiry-based learning, educational technology, and working life in **natural sciences and environmental education**, 14 projects
3. **Technology education**: programming, robotics and the information 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

EMOTIONS
AND SKILLS 

**THE JIPPO
PROGRAM FOR
3 TO 6 YEARS
OLD:**

**MATH, SCIENCE
AND
TECHNOLOGY
INTEGRATED
WITH **ART.****

the education of
the *whole child*

- 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

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

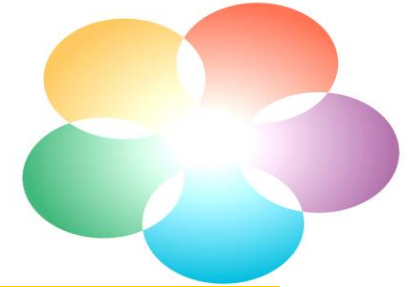




12 LUMA LABS IN FINLAND;



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)



CHEMISTRYLAB GADOLIN

- Founded v. 2008
- Collaboration between
 - University of Helsinki
 - Finnish chemistry industry
 - Pedagogical institutions
- Coordinated by Centre for chemistry education (Kemmi)
- Over 24 000 visitors and 1300 groups
- All school levels – free of charge
- Based on Finnish national curriculum

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

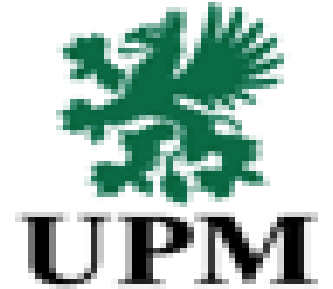
- Study visits
 - Laboratory activities
 - Molecular modeling
 - **Scientist meetings**
 - Department and campus tours
- **Science clubs (all school levels)**
- **Science camps (all school levels)**

**FUTURE TEACHERS
GUIDING GROUPS**



HELSINGIN YLIOPISTO

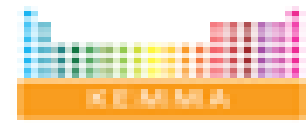
NESTE OIL



OPETUSHALLITUS
UTEIDNINGSTYRELSEN



LUMAKESKUS



kemira



Helsingin kaupunki
Opetusvirasto



**COLLABORATION
WITH
BUSINESS**



BOREALIS

A Member of
The Linde Group



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

TEACHER
TRAINING

13 TO 19 YEARS OLD

MEETING
SCIENTISTS
AND SPECIALISTS IN
INDUSTRY

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

E.g. Tolppanen, S., & Aksela, M. (2013). Important social and academic interactions in supporting gifted youth in non-formal education. *LUMA*, 1, 279-298.

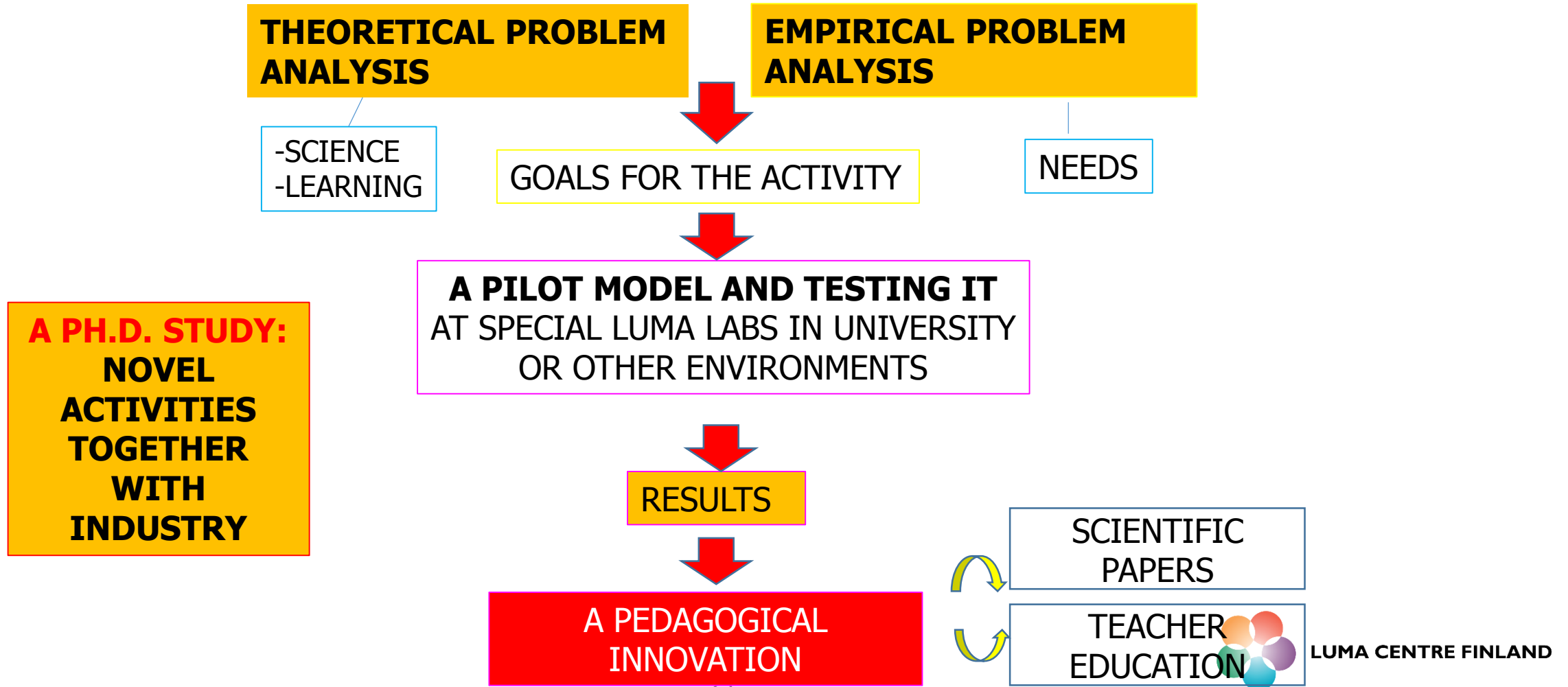


NATIONAL ACTIVITIES FOR CHILDREN

TEACHER
TRAINING

**SCIENCE CLUBS AND CAMPS
7 TO 12 YEARS OLD
E.G. 40 CAMPS IN 2016**

DESIGN-BASED RESEARCH AS A TOOL FOR PEDAGOGICAL INNOVATIONS



Example of Gadolin study

Veli-Matti Ikävalko & Maija Aksela

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



Name of the laboratory work sheet	Company	Categories
1. What's in your drinking water?	Metrohm	1. Environment and nature 2. Industry, technology and production 3. Human biology and health 4. Home economics
2. Too soft plastic	Borealis	1. Industry, technology and production 2. Home economics
3. Problems at Pulp Mill	UPM-Kymmene	1. Industry, technology and production
4. Chlorine traces in drinking water	Kemira	1. Environment and nature 2. Industry, technology and production 3. Human biology and health 4. Home economics
5. Measuring the salinity	Laskentaväline	1. Environment and nature 2. Home economics
6. Production of Biodiesel	Neste Oil	1. Environment and nature 2. Industry, technology and production 3. Home economics
7. Sugar content in soda	Bruker	1. Industry, technology and production 2. Home economics
8. Investigation of E.Coli	3M	1. Environment and nature 2. Industry, technology and production 3. Human biology and health 4. Home economics
9. Hardness of water	Aga	1. Environment and nature 2. Industry, technology and production 3. Human biology and health 4. Home economics

Sakari Tolppanen, Ph.D. thesis:

CREATING A BETTER WORLD

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

Tolppanen, S., & Aksela, M. (2013). Important social and academic interactions in supporting gifted youth in non-formal education. *LUMAT*, 1, 279-298.

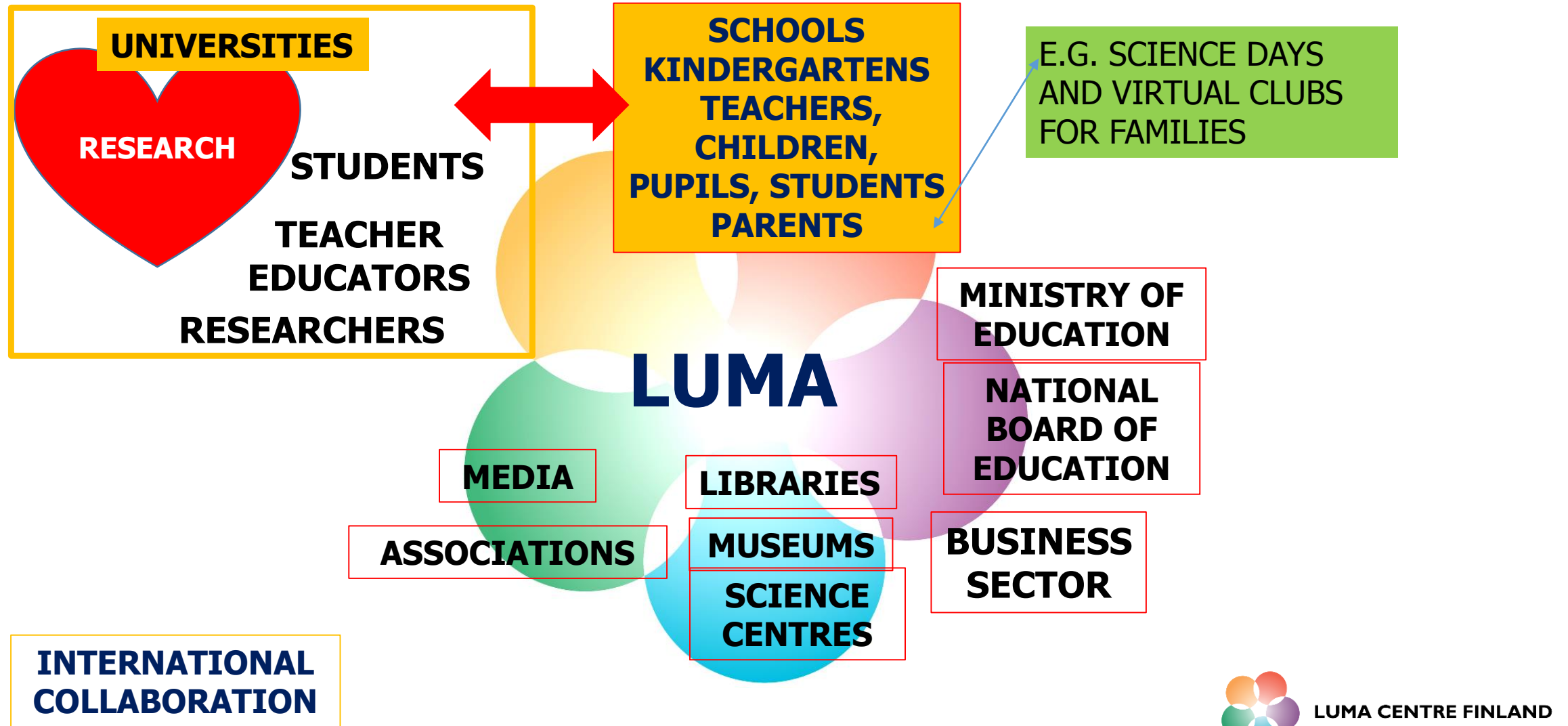
THE RESEARCH RESULTS APPLIED TO

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**

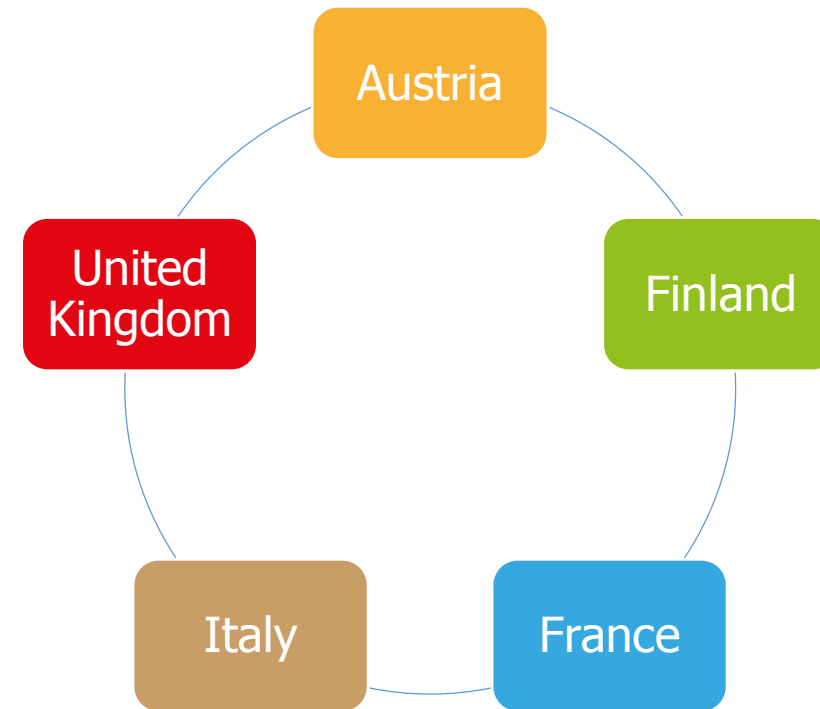
See more from [LUMA News \(in English\)](#)

THE FINNISH LUMA MODEL: COLLABORATION IS A KEY FOR SUCCESS



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

Suomi
Finland
100

- 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



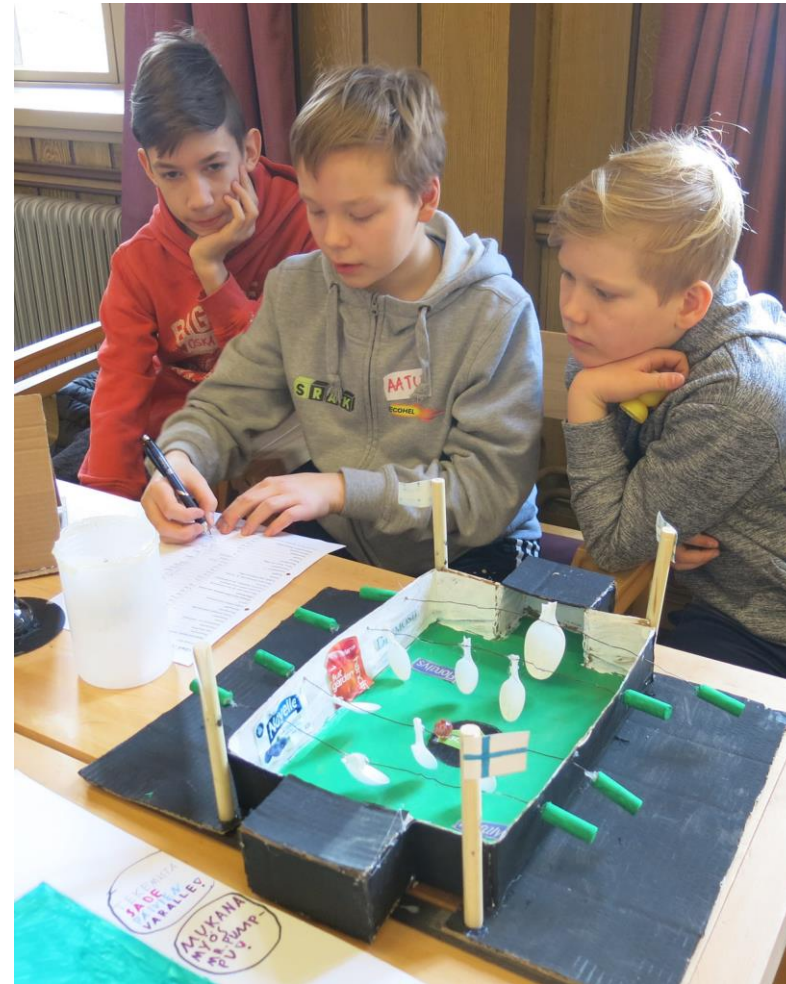
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2017-2018

*Suomi
Finland*
100

- 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!**



LUMA CENTRE FINLAND



LUMA CENTRE FINLAND

LUMA NEWS:**IN ENGLISH:**

suomeksi

på svenska

in English

**LUMA.fi**

Finnish STEM education portal

Google™ Custom Search


<http://www.luma.fi/news/>


A brief introduction to
LUMA



Get to know the
building blocks of
Finnish education



New LUMA Centre
Finland to enhance
STEM skills



June 2015 Newsletter

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LUMA news

E-LETTER ONCE A MONTH



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.

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- Turning cellulose into propane: a possible alternative?
- Change is always possible
- Engineering with DNA

[LUMAT journal on Twitter](#)

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30 Mar

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- www.facebook.com/LUMAKeskusSuomi
- twitter.com/LumaSuomi



**THANK YOU FOR
YOUR ATTENTION!**

KIDS & YOUTH

TOGETHER WE ARE MORE!

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