

LUMAT Science Research Forum, LUMA Centre Finland  
<http://www.luma.fi/en>

15<sup>th</sup> LUMAT Research Symposium

# Promoting STE(A)M learning through non-formal education

The invited talks will be recorded and shared later on.

## Organizing committee

**Dr Johannes Perna**; Editor-in-Chief of the LUMAT journal,  
LUMAT-B publication of the symposium

**Assistant Maikki Roiha**; registration and online symposium,  
contact person

**Specialist Oona Kiviluoto**; webpage, marketing & communications

Chair: **Professor Maija Aksela**  
University of Helsinki, Finland  
[maija.aksela@helsinki.fi](mailto:maija.aksela@helsinki.fi)



# Program: Slot 1, Time: 13–14.10 at Finnish time



Time	Topic	Speaker(s)
13.00–13.10	<b>Opening words</b>	Maija Aksela <i>University of Helsinki, Finland</i>
13.10–13.30	<b>Threads and Strings: Interweaving Bhutanese traditional music, textiles and STEM</b>	Som Gurung, Tshering Dorji, Johan Westman, Tashi Wangmo and Thinley Phuntsho <i>Paro college of education (HEDPC and STEM), Bhutan</i>
13.30–13.50	<b>A Case Study of Integrating Non-formal Learning for Developing Teaching Resources for Sustainability During a Science Teacher Education Course</b>	Safwatun Nida <i>Universitas Negeri Malang, Indonesia</i>
13.50–14.10	<b>Development of a Regional STEM Education Ecosystem in the Lower Mekong Basin: A Case Study of the Faculty of Science, Nakhon Phanom University, Thailand</b>	Cherdchai Phosri, Patchalai Anuchaiwong, Nutchanon Painetr, Phrarit Kumsri, Wissarut Srivarom and Wuttichai Gunnula <i>Faculty of Science, Nakhon Phanom University, Thailand</i>
14.10–14.25	Break	

# Program: Slot 2, 14.25–15.25 at Finnish time



Time	Topic	Speaker(s)
14.25–14.45	<b>Engaging learners in non-formal Science Technology Engineering and Mathematics education: ESKOM EXPO for Young Scientists</b>	Nalini Dookie and Angela James <i>University of KwaZulu-Natal, South Africa</i>
14.45–15.05	<b>Integrative Educational Projects and Teacher Practice: An Analytic Study</b>	Suraya Ayyad, Eman Zaitoun, Samar Nazzal, and Asma Zaitoun <i>Innovation for Creativity Development Association (ICDA), Jordan</i>
15.05–15.25	<b>Engaging Science Learners at Disadvantaged schools in South Africa in the Use of Culturally-Anchored Virtual Reality Simulations for Inquiry-based Learning</b>	Umesh Ramnarain, Mafor Penn and Noluthando Mdlalose <i>University of Johannesburg, South Africa</i>
15.25–15.40	Break	

# Program: Slot 3, Time: 15.40–16.30 at Finnish time

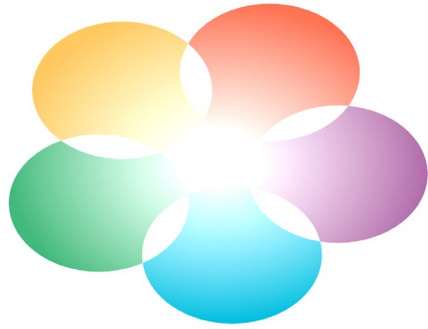


Time	Topic	Speaker(s)
15.40–16.00	Computational Drug Design in Problem-Based Learning: A Pedagogical Experience in Pre-Service Chemistry Teachers	<b>Jorge Rodríguez-Becerra</b> <i>Universidad Tecnológica Metropolitana, Escuela de Postgrado, Santiago, Chile</i> <b>José Hernández-Ramos</b> <i>Centro de Investigación Avanzada en Educación, Instituto de Educación, Universidad de Chile, Periodista José, Santiago, Chile</i> <b>Lizethly Cáceres-Jensen and Sofía Druker Ibáñez</b> <i>Universidad Metropolitana de Ciencias de la Educación, Departamento de Química; Physical &amp; Analytical Chemistry Laboratory (PachemLab), Facultad de Ciencias Básicas, Santiago, Chile</i>
16.00–16.20	Co-designing Science Clubs for Non-formal STE(A)M Learning Environments through Design-based Research	<b>Maija Aksela and Outi Haatainen</b> <i>LUMALab Gadolin, University of Helsinki, Finland</i>
16.20–16.30	Closing words	<b>Maija Aksela</b> <i>University of Helsinki, Finland</i>



# 15th LUMAT Research Symposium

Opening words: Maija Aksela



**15th LUMAT Research Symposium**  
**Promoting STE(A)M learning through non-formal  
education**  
**Warm a welcome!**

**Maija Aksela**

Dr, Professor of science education, University of Helsinki

**LUMA Science Ambassador**

1st director of national LUMA (STEM) Centre Finland (11 universities, 13 centres) 2013-2025

[maija.aksela@helsinki.fi](mailto:maija.aksela@helsinki.fi)

LUMA: Joy of Science for all!



”LUMA flower”

## The philosophy behind the LUMA logo

- ❑ Together we are more! (motto)
- ❑ Light in the middle is the light in students’ - makers of future -eyes when they are engaged on science.

**LUMA** is the brand for Finnish science education. It is abbreviated from “luonnontieteet, the Finnish word for natural sciences, and “matematiikka”, the Finnish word for mathematics. **A means all subjects/all sciences (STEAM approach/pedagogy).**

LUMA CENTRE COLLABORATION  
SINCE THE YEAR 2003



# LUMA: Promoting formal, non-formal and informal learning at all levels

**Table I.** Differences between Formal, Non-formal and Informal Learning

Formal	Non-formal	Informal
Usually at school	At institution out of school	Everywhere
May be repressive	Usually supportive	Supportive
Structured	Structured	Unstructured
Usually prearranged	Usually prearranged	Spontaneous
Motivation is typically more extrinsic	Motivation may be extrinsic but it is typically more intrinsic	Motivation is mainly intrinsic
Compulsory	Usually voluntary	Voluntary
Teacher-led	May be guide or teacher-led	Usually learner-led
Learning is evaluated	Learning is usually not evaluated	Learning is not evaluated
Sequential	Typically non-sequential	Non-sequential

\*Eshach, H. (2007). Bridging In-school and Out-of-school Learning: Formal, Non-Formal, and Informal Education. *Journal of Science Education and Technology*, 16(2), p. 174. <https://doi.org/10.1007/s10956-006-9027-1>

**Pedagogical solutions in our online book: LUMA Finland - Together we are more (2020). Aksela, M., Lundell, J., Ikävalko, T., (Eds.) (2020) (over 100 writers; best solutions; free of charge)**



# LUMA CENTRE FINLAND

- ❑ for promoting high quality math, science and technology education (since year **2013**)
- ❑ **A NETWORK OF 11 UNIVERSITIES AND 13 LUMA CENTRES:** Collaboration between schools, universities and society nationally and internationally
- ❑ **First LUMA Centre at University of Helsinki in year 2003**

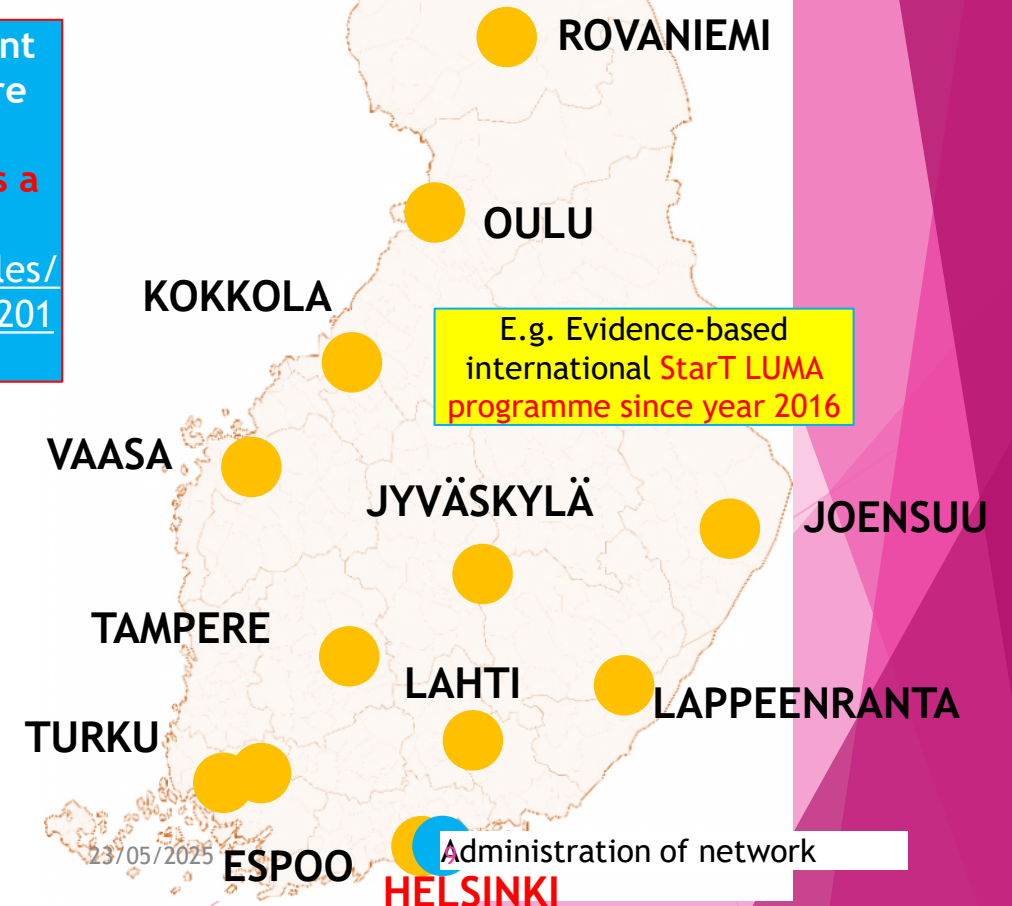
- ❑ NATIONAL TASK FROM MINISTRY OF EDUCATION
- ❑ NATIONAL BOARD (A MEMBER OF EACH UNIVERSITY)
- ❑ NATIONAL LUMA ADVISORY BOARD (OVER **40** ORGANISATIONS)
- ❑ LUMAT SCIENCE RESEARCH FORUM: E.G. **INTERNATIONAL LUMAT SYMPOSIUM AND JOURNAL LUMAT**

Research and development policy of the LUMA Centre Finland:

**Design-based research as a framework**

[https://www.luma.fi/en/files/2019/03/LUMA\\_RD\\_policy\\_2018-06.pdf](https://www.luma.fi/en/files/2019/03/LUMA_RD_policy_2018-06.pdf)

- ❑ **Online book:** LUMA Finland - Together we are more (2020). Aksela, M., Lundell, J., Ikävalko, T., (Eds.) (2020) (**over 100 writers; best solutions; free of charge**)
- ❑ **LUMA-opas:** Oivaltamisen ja onnistumisen iloa yhdessä. LUMA-opas, Pesonen, Uusi-Kilponen, Kiviluoto & Aksela (toim.), Helsingin yliopisto, Helsinki (**an online book contents over 40 novel solutions from the LUMA Centres; free of charge; in Finnish**)



Finnish National STEM Strategy and Action Plan: Experts in natural sciences, technology and mathematics in support of society's welfare and growth

Finnish National STEM Strategy and Action Plan Teacher Education Vision (LUMA part of the vision)

17 LUMALabs at the centres:  
The oldest one **LUMALab Gadolin Hub** since 2018



Together we are more! (motto)

# LUMA: EDUCATIONAL DESIGN-BASED RESEARCH AS A FRAMEWORK: NOVEL SOLUTIONS

-SCIENCE  
-LEARNING

THEORETICAL PROBLEM  
ANALYSIS

EMPIRICAL PROBLEM  
ANALYSIS

NATIONAL  
CURRICULUM

GOALS FOR THE ACTIVITY

NEEDS

A PILOT MODEL AND TESTING IT  
(**AN ITERATIVE DESIGN CYCLE &  
COLLECTING DATA**) e.g. AT SPECIAL LUMA LABS  
IN UNIVERSITIES AND/OR **SCHOOLS AND KINDERGARTENS**

E.G. OUR TALK TODAY  
ABOUT A SCIENCE  
CLUB STUDY

SCIENTIFIC  
PAPERS

RESULTS: pedagogical  
solutions, new theory and co-  
design process

TEACHER  
EDUCATION

E.G. MOOCS

Aksela, M. (2019). Towards student-centred solutions and pedagogical innovations in science education through **co-design approach within design-based research**. *LUMAT: International Journal on Math, Science and Technology Education*, 7(3), 113-139. <https://doi.org/10.31129/lumat.7.3.421>

## Learning through sharing

# LUMA: StarT LUMA programme since 2016



100.000 students (3 to 19 y.o.) and their teachers



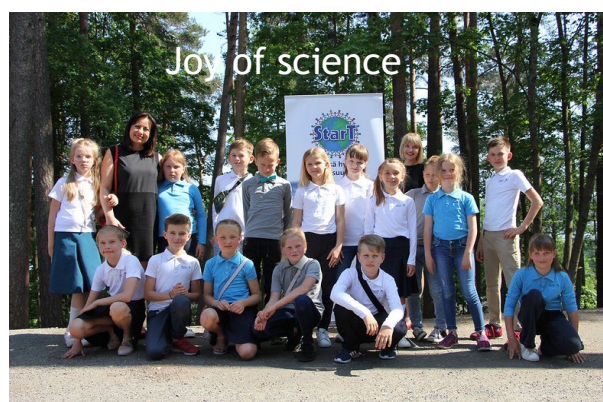
3000 shared projects and practices



2500 learning communities



Over 70 countries;  
**MOU agreements**



### Research papers and theses, e.g.

Markula, A. E., & Aksela, M. (2022). The key characteristics of project-based learning: how teachers implement projects in K-12 science education. *Disciplinary and interdisciplinary science education research*, 4, Artikkel 4:2. <https://doi.org/10.1186/s43031-021-00042-x>

**A material bank** (awarded solutions around the world; 3 minutes videos etc): <https://start.luma.fi/en/materials/>

### Virtual StarT LUMA science club for kids in English:

<https://start.luma.fi/en/start-programme/start-goedu-virtual-science-club/>

# LUMAT Science Research Forum organized by LUMA Centre Finland (11 universities, 13 centres)

- organizes yearly events: e.g. research seminars and a **research symposium**, focusing primarily on the research of math, science, and technology education. Our events are open to scholars all over the world!
- Publish international LUMAT journal (**see abstracts and virtual posters of this symposium there**):  
<https://journals.helsinki.fi/lumat>

## Organizing committee:

Thank You all!

- Professor Maija Aksela; Chair, program & invited speeches, Director of LUMAT Science Research Forum
- Dr Johannes Perna; Editor-in-Chief of the LUMAT journal, LUMAT-B publication of the symposium
- Assistant Maikki Roiha; registration and online symposium, contact person
- Specialist Oona Kiviluoto; webpage, marketing & communications





# “Together we are more”



Our e-book from [www.luma.fi/en](http://www.luma.fi/en)



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On YouTube:  
[@LUMAKeskusSuomi](https://www.youtube.com/LUMAKeskusSuomi)

Our e-letter in English:  
<http://www.luma.fi/en>



**TOWARDS SUSTAINABLE FUTURE TOGETHER**

**MAKERS OF  
FUTURE**

**HAVE A FRUITLESS  
SYMPOSIUM!**

**TOGETHER WE ARE MORE!**

**MAIJA.AKSELA@  
HELSINKI.FI**



# 15th LUMAT Research Symposium

## Threads and Strings: Interweaving Bhutanese traditional music, textiles and STEM

**Som Gurung, Tshering Dorji, Johan Westman, Tashi Wangmo and Thinley Phuntsho**

*Paro college of education (HEDPC and STEM), Bhutan*

**See abstract and a virtual poster here:**

<https://journals.helsinki.fi/lumatb>



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## A Case Study of Integrating Non-formal Learning for Developing Teaching Resources for Sustainability During a Science Teacher Education Course

**Safwatun Nida**

*Universitas Negeri Malang, Indonesia*

**See abstract and a virtual poster here:**

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# 15th LUMAT Research Symposium

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**Development of a Regional STEM Education Ecosystem in the Lower Mekong Basin: A Case Study of the Faculty of Science, Nakhon Phanom University, Thailand**

**Cherdchai Phosri, Patchalai Anuchaiwong, Nutchanut Painetr, Phrarit Kumsri, Wissarut Srivarom and Wuttichai Gunnula**

*Faculty of Science, Nakhon Phanom University, Thailand*

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**On a break until 14.25 2.25 pm. (UTC+3)**

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Engaging learners in non-formal Science Technology Engineering and Mathematics education:  
ESKOM EXPO for Young Scientists

**Nalini Dookie and Angela James**  
*University of KwaZulu-Natal, South Africa*

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## Integrative Educational Projects and Teacher Practice: An Analytic Study

**Suraya Ayyad, Eman Zaitoun, Samar Nazzal, and Asma Zaitoun**  
*Innovation for Creativity Development Association (ICDA), Jordan*

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**Engaging Science Learners at Disadvantaged schools in South Africa in the Use of Culturally-Anchored Virtual Reality Simulations for Inquiry-based Learning**

**Umesh Ramnarain, Mafor Penn and Noluthando Mdlalose**  
*University of Johannesburg, South Africa*



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# Promoting STE(A)M learning through non-formal education

On a **break** until 15.40

3.40 pm. (UTC+3)



# 15th LUMAT Research Symposium

## Computational Drug Design in Problem-Based Learning: A Pedagogical Experience in Pre-Service Chemistry Teachers

**Jorge Rodríguez-Becerra**

*Universidad Tecnológica Metropolitana, Chile*

**José Hernández-Ramos**

*Universidad de Chile, Chile*

**Lizethly Cáceres-Jensen, and Sofía Druker Ibáñez**

*Universidad Metropolitana de Ciencias de la Educación, Chile*

**See abstract and a virtual poster here:**

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Co-designing Science Clubs for Non-formal STE(A)M Learning Environments through Design-based Research

**Maija Aksela and Outi Haatainen**

*LUMALab Gadolin, University of Helsinki, Finland*

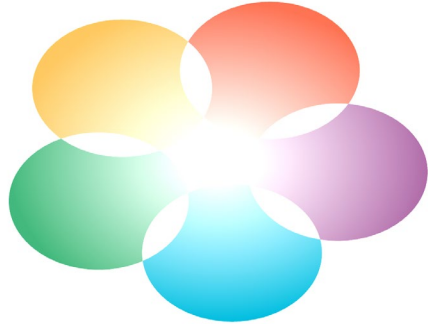
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Closing words: Maija Aksela



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**Thank You all!**

**Maija Aksela**

Dr, Professor of science education, University of Helsinki

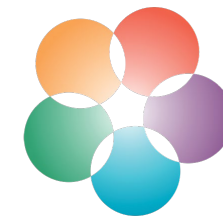
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