
GROWING
MIND
CULTIVATING INVENTION PEDAGOGY IN FINNISH SCHOOLS
Kai Hakkarainen
Kaiju Kangas
Pirita Seitamaa-Hakkarainen
Department of Education
University of Helsinki
strateginen TUTKIMUS
HELSINGIN YLIOPISTO
Tampereen yliopisto
Turun yliopisto
University of Turku
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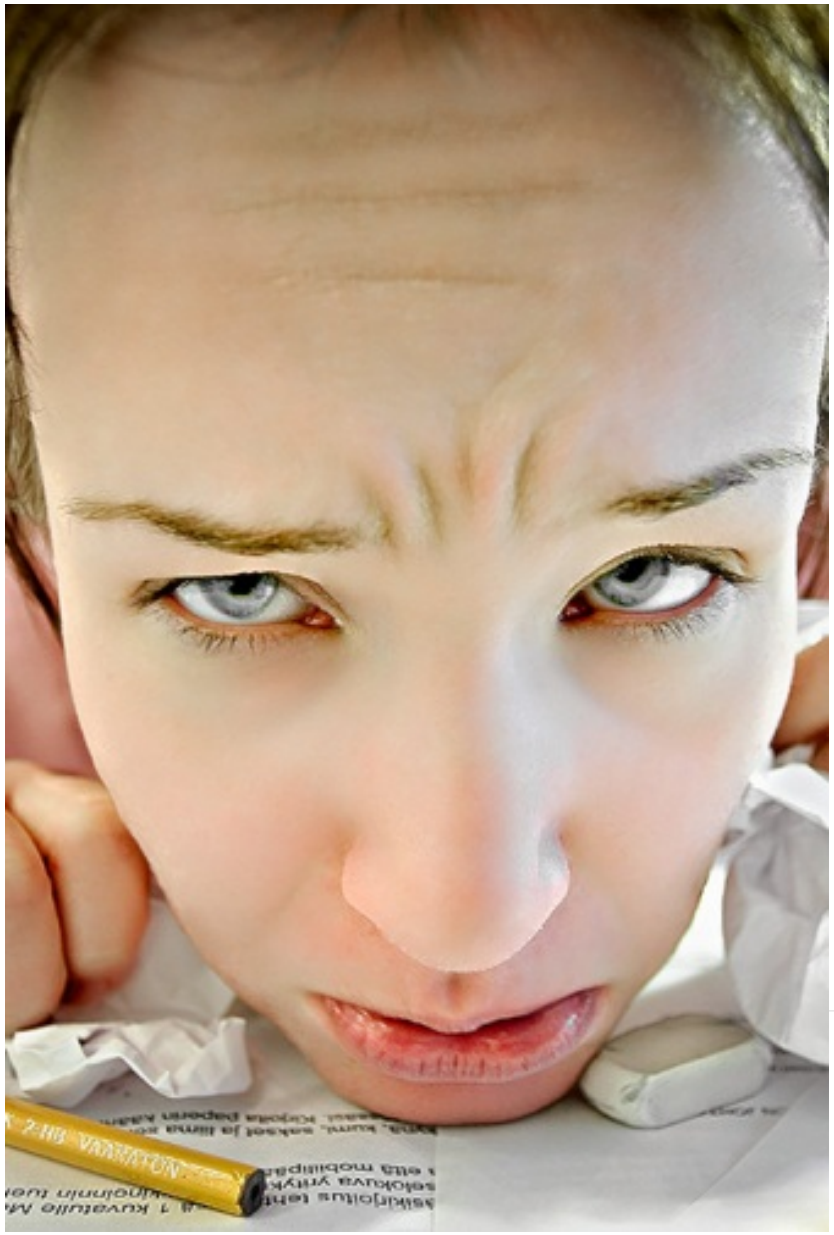
Helsinki
Helsingfors

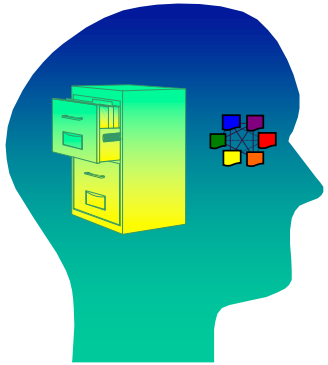


THE CHALLENGE OF INTELLECTUAL ENGAGEMENT

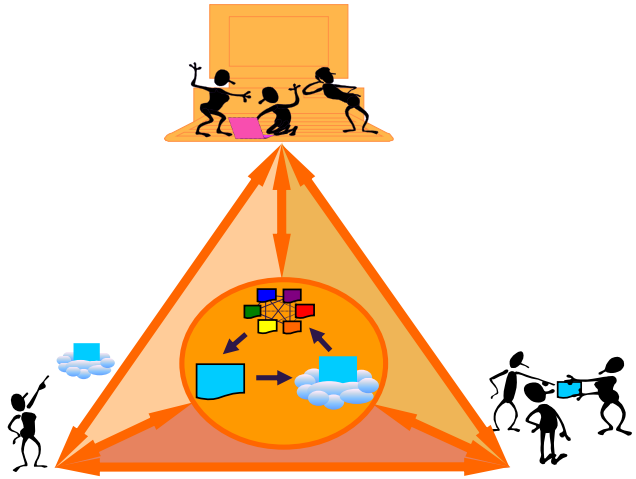
- FINNISH STUDENTS ARE PERFORMING VERY WELL IN INTERNATIONAL SCHOOL ACHIEVEMENT TESTS
- GETTING HIGH SCIENCE SCORES BUT INDICATING ONLY A LOW INTEREST IN SCIENCE
- BOYS ARE BORED/ALIENATED AND GIRLS EXPERIENCE INSUFFICIENCY/ EXHOUSTION
- ACTIVE SOCIO-DIGITAL PARTICIPATORS FEEL INCREASINGLY ALIENATED IN EXTERNALLY REGULATED, TEACHER CENTERED AND INDIVIDUALIST STUDIES

THREE METAPHORS OF LEARNING

(PAAVOLA, LIPPONEN, & HAKKARAINEN, 2004)



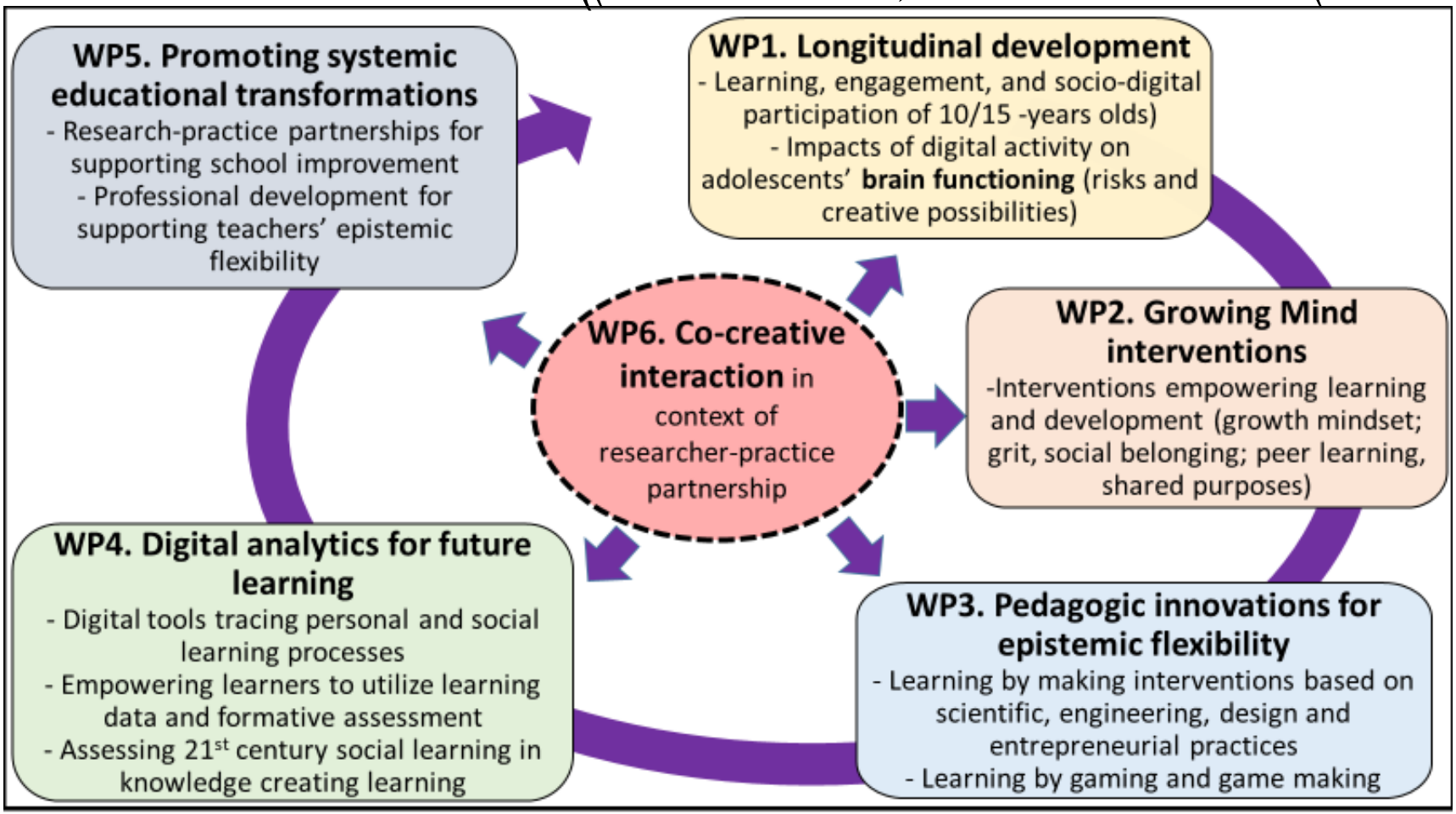
Knowledge-acquisition metaphor (cultivated skills and competencies of learning)



Knowledge-creation metaphor (Pursuing engaging objects and projects)

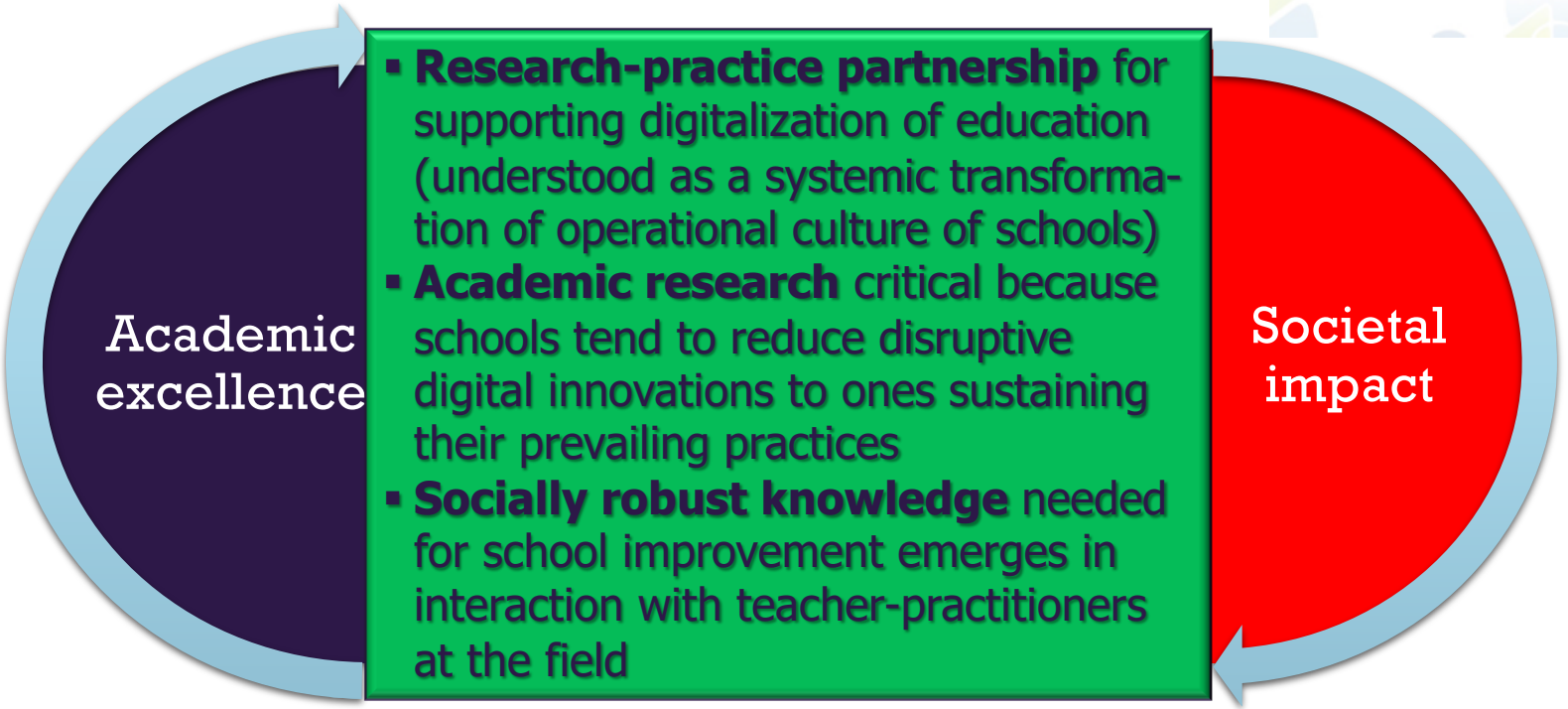
Participation metaphor (Sharing expertise in a valued community; connecting informal and formal learning; being socially recognized)

GROWING MIND: EDUCATIONAL TRANSFORMATIONS FOR PERSONAL, SOCIAL, AND INSTITUTIONAL RENEWAL AT THE DIGITAL AGE ((STRATEGIC RESEARCH, THE ACADEMY OF FINLAND (2018-2023)



Multi-disciplinary network of educational research, craft science, developmental psychology, computer science, game studies, and neuroscience

GROWING MIND: STRATEGIC RESEARCH PROJECT



From sustaining to disruptive innovations for promoting radical school transformations

Opening new innovative lines of investigation
Cutting edge theories and methods
High quality articles

Pursuing participatory pedagogic innovations;
Fostering systemic digital-pedagogic transformations of schools

Producing policy-relevant scientific knowledge
Constant interaction with policy makers
Continuous media presence

THREE PRACTICES OF USING SOCIO-DIGITAL TECHNOLOGIES

(ITO ET AL 2010)

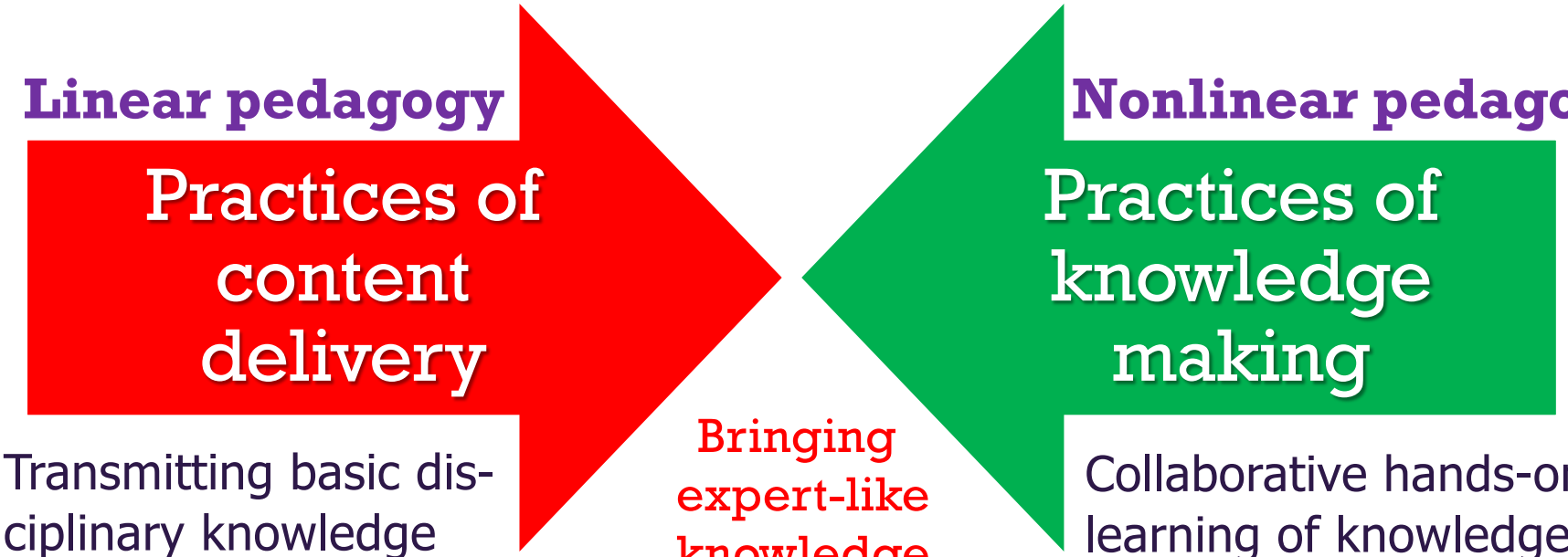
- **Creative participation gap**: disadvantaged students have limited access to and support for creative use of technology
- Constant interruptions create "grass-hopper minds"?
- Longitudinal data confirm that active digital participators increasingly alienated at school
- Young people need practices of using structured support for learning academic and creative practices of using socio-digital technology

Friendship-driven use of technology. Hanging out by keeping hyperintensive connection with extended network of friends through texting, instant messaging, and emailing mediated by mobile devices and social media.

Interest-driven use of technology. Peer supported use of socio-digital technologies for experimenting and playing while pursuing personal and joint interests, modifying and creating media, and developing socio-digital competences.

Structured efforts of creative and academic use of technology. Sustained collaborative working with open-ended and complex problems, creating and building knowledge and artifacts and, preferably, pursuing longstanding creative study projects (an emerging knowledge practice in Finnish schools)

TOWARDS KNOWLEDGE-CREATING LEARNING



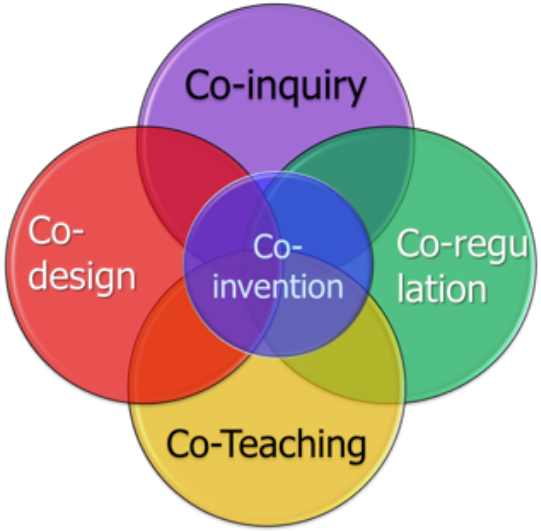
Transmitting basic disciplinary knowledge

- Focus on simplied and outdated textbook knowledge
- Becomes rapidly obsolete
- Content without methods looses its meaning (inert knowledge, rigid routines)

Collaborative hands-on learning of knowledge creation

- Operational methods of co-creating knowledge
- Scientific, engineering, design and entrepreneurial practices
- Schools partnering with wider community and university for solving vital societal problems

GENERAL DESCRIPTION OF CO-INVENTION PROJECT

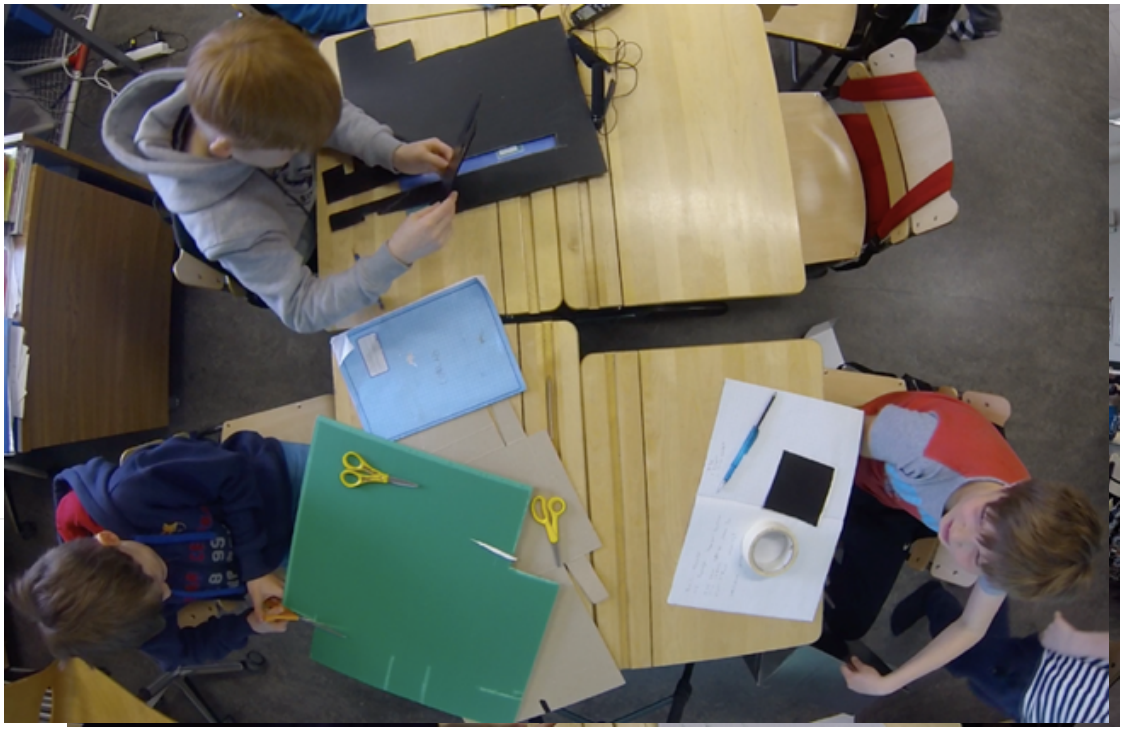


- Creating spaces (fablabs) for making and inventing at school
- Complex invention projects supported by traditional and digital fabrication technologies

Ethos:

- Everybody can be an inventor
- Best ideas are co-created
- Ideas develop by exploration
- Inventing requires sustained effort across iterations

- Bringing elements of maker culture to school in terms of challenging knowledge-creation projects
- Engaging students co-designing and co-constructing complex artifacts sparking intellectual, engineering, and aesthetic challenges
- Operational methods of creative making that provide access to experts methods, practices and networks



CRAFT EDUCATION IN FINLAND

- Craft teacher education is almost 140 years old.
  - All teacher training moved to the university level in 1970 (qualified teacher holds Master of Education –degree)
  - Craft teacher typically teaches at grades 7 to 9 (ages 13 to 15); but also as subject teacher at primary level 5 to 6.
  - They typically teach one major (craft) and one minor subjects (e.g. history / math / visual arts)
- Craft education (previously textile and technical work) is compulsory subject until the end of grade 7. It is a voluntary school subject in grades 8 and 9.
  - The craft curriculum is made for preprimary level, primary school level (grades 1–3), intermediate level (grades 4–6), and junior high school level (grades 7–9)

NATIONAL CURRICULUM FOR BASIC EDUCATION 2014

- Craft curriculum highlights the **holistic craft processes**:
  - Iterative nature of design process: ideation, testing and making as well as reflective evaluation and experimenting and prototyping
  - Digitally documenting design processes (digital e-portfolios)
- Combine traditional and digital technologies; schools approaches to maker culture
  - The emphasis is on the use of various visual and material representations for materializing students' design ideas
  - Making includes numerous activities with various materials as well as interaction with digital technology such as 3D modeling and printing, robotics and programming
- Provides frames for conducting (phenomenon-based) **integrative thematic-study projects** together with other school subjects (STEAM)

GROWING MIND CO-INVENTION PROJECTS

- Bringing elements of maker culture to schools by carrying out inspiring making projects engaging students with various ages, genders, and special educational needs (SEN):
  - The projects are anchored in phenomenon-based studies integrating several subjects
  - Examining how creative hand-on activities can be productively integrated with ”minds on” science education
- Exploring various way of constraining and structuring projects from **open ended** to **more focused projects**
- Digital fabrication (e.g. coding, microprocessors, sensors, robotics, 3D printers, laser cutters, e-textiles) in conjunction with traditional tools and technologies
- Working together with **Innokas-network** http://www.innokas.fi/en

OPEN FRAME OF GROWING MIND (CO4-LAB) INTERVENTIONS PROJECTS

Orientation	Analysis of various artifacts, their history and features
Design challenge	An open design and invention challenge (recognized everyday problems, studying earlier designs and their users)
Co-Inquiry	Exploring and testing ideas through science experiments
Ideation	Producing design ideas and analyzing design constraints
Exhibition	Presenting ideas and getting feedback from peers, teachers, and experts
Knowledge seeking	Knowledge seeking from museums, internet, joint field studies
Co-Inquiry	Testing design ideas, creating mock-ups and prototypes
Fabrication	Fabricating models and products
Exhibition	Introducing and publishing inventions and reporting knowledge creation processes

GROWING MIND PROJECT SCHOOLS

- Projects are designed in close collaboration with teacher teams and researchers. Planning co-invention projects in fall and implemented in spring (two to four months)

- **1st cycle** (2016-2017) four schools, 17 teachers (class and subject teachers), 14 classes (grade 5 to 7) + peer tutors from 8th grade

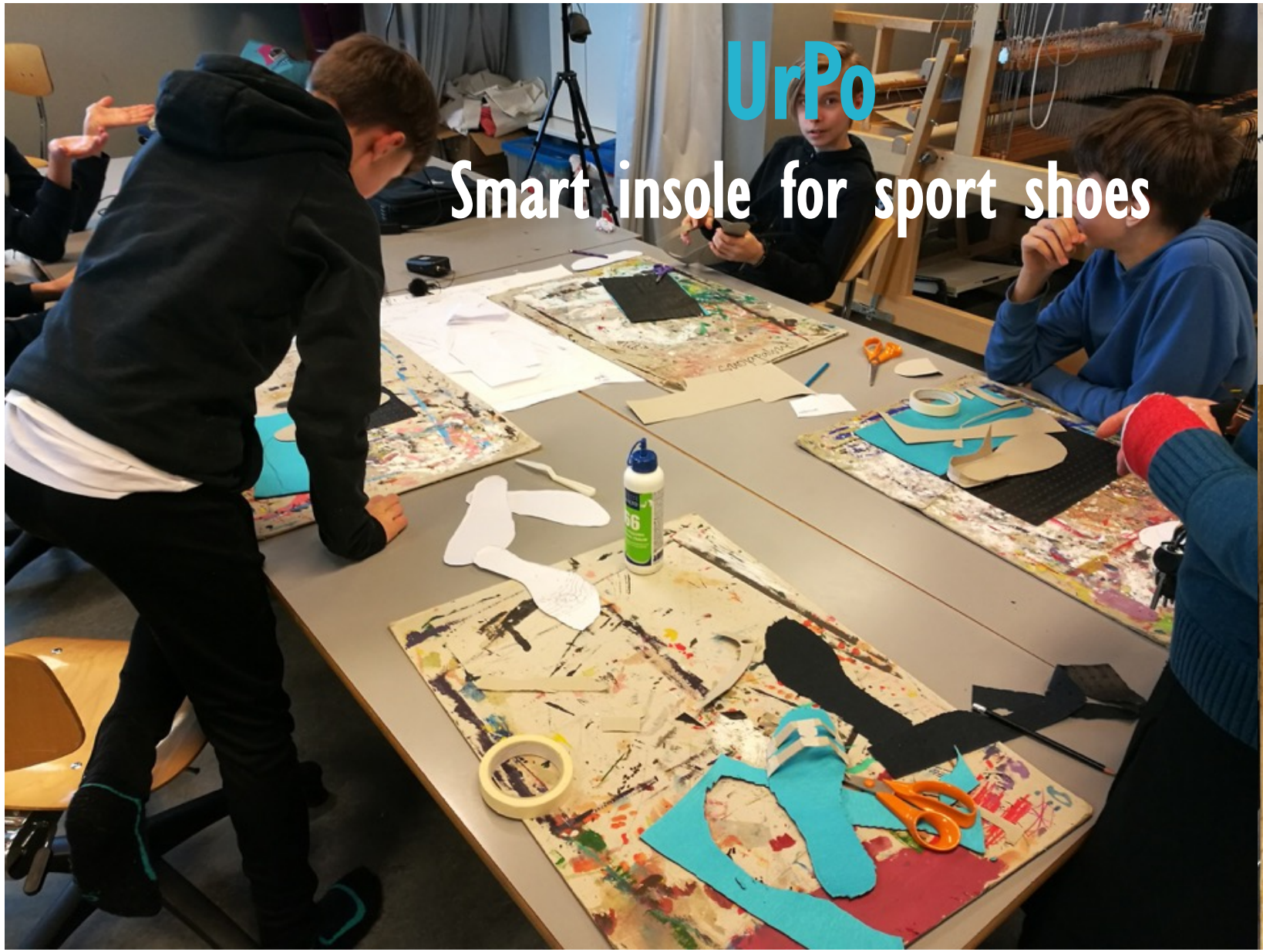
- **2nd cycle** (2017-2018): five schools, 10 teachers (mainly craft teachers); 5 classes
  - 1- 8 graders + peer tutors from 8th grade

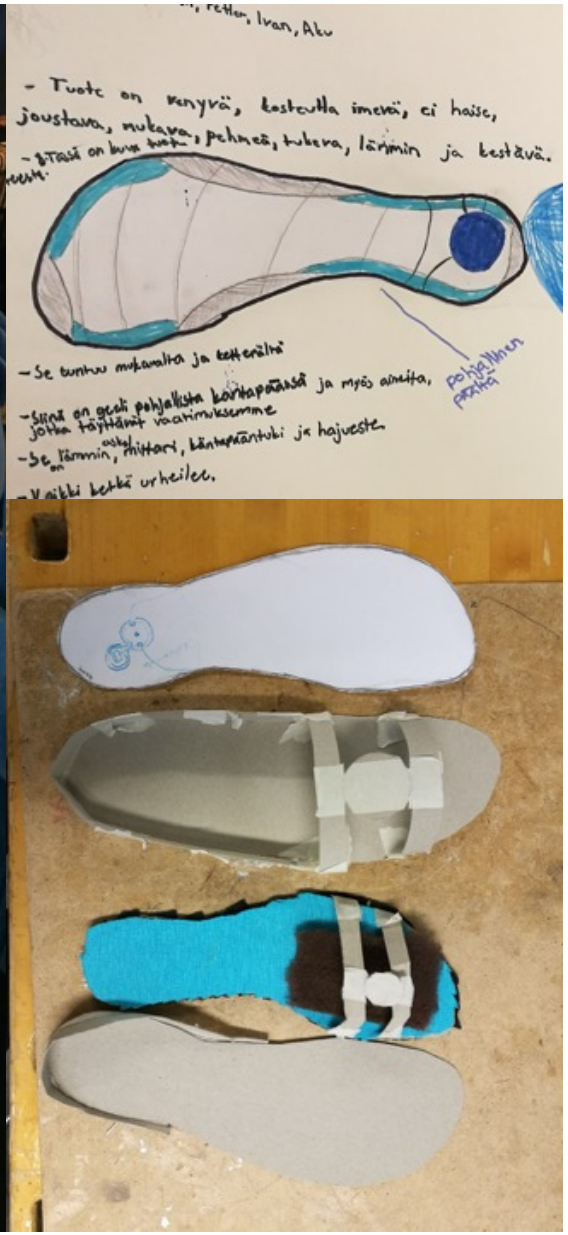
- **3rd cycle (2018-2019):** four "old schools" + **6 new schools**; 22 teachers; 20 classes (grades 0-8) + peer tutors from 8th grade
  - special education schools/ classes included;

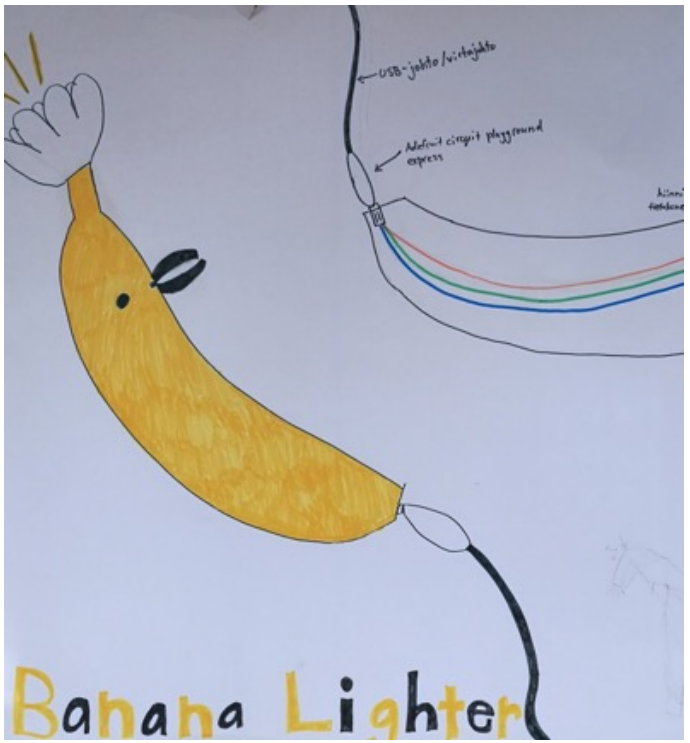
- **4th cycle (2019-2020) starting**: 6 "old schools" **+ 3 new schools & 6 preschools** + peer tutors from 8th grade
  - special education schools/ classes included

UrPo

Smart insole for sport shoes

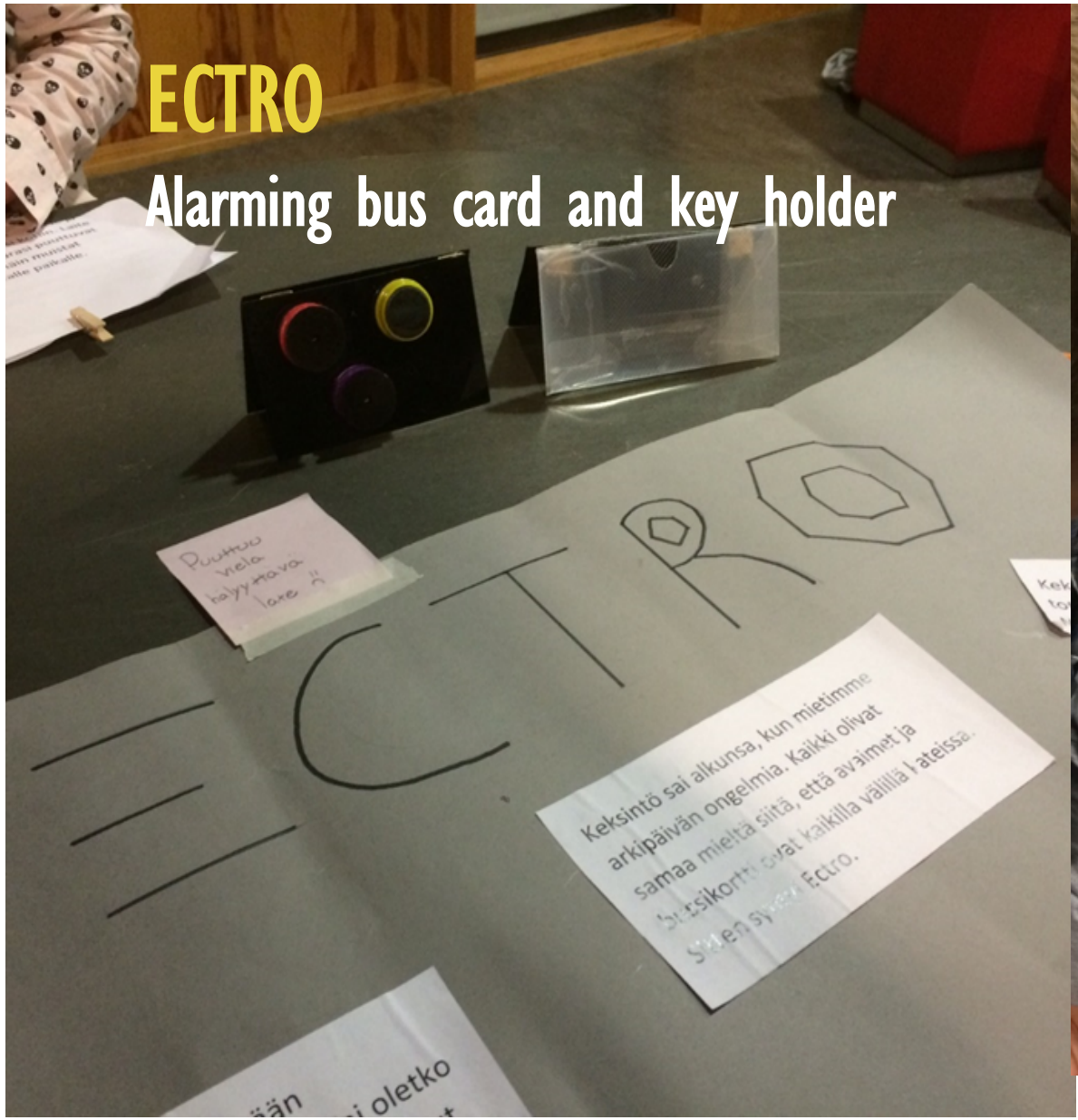


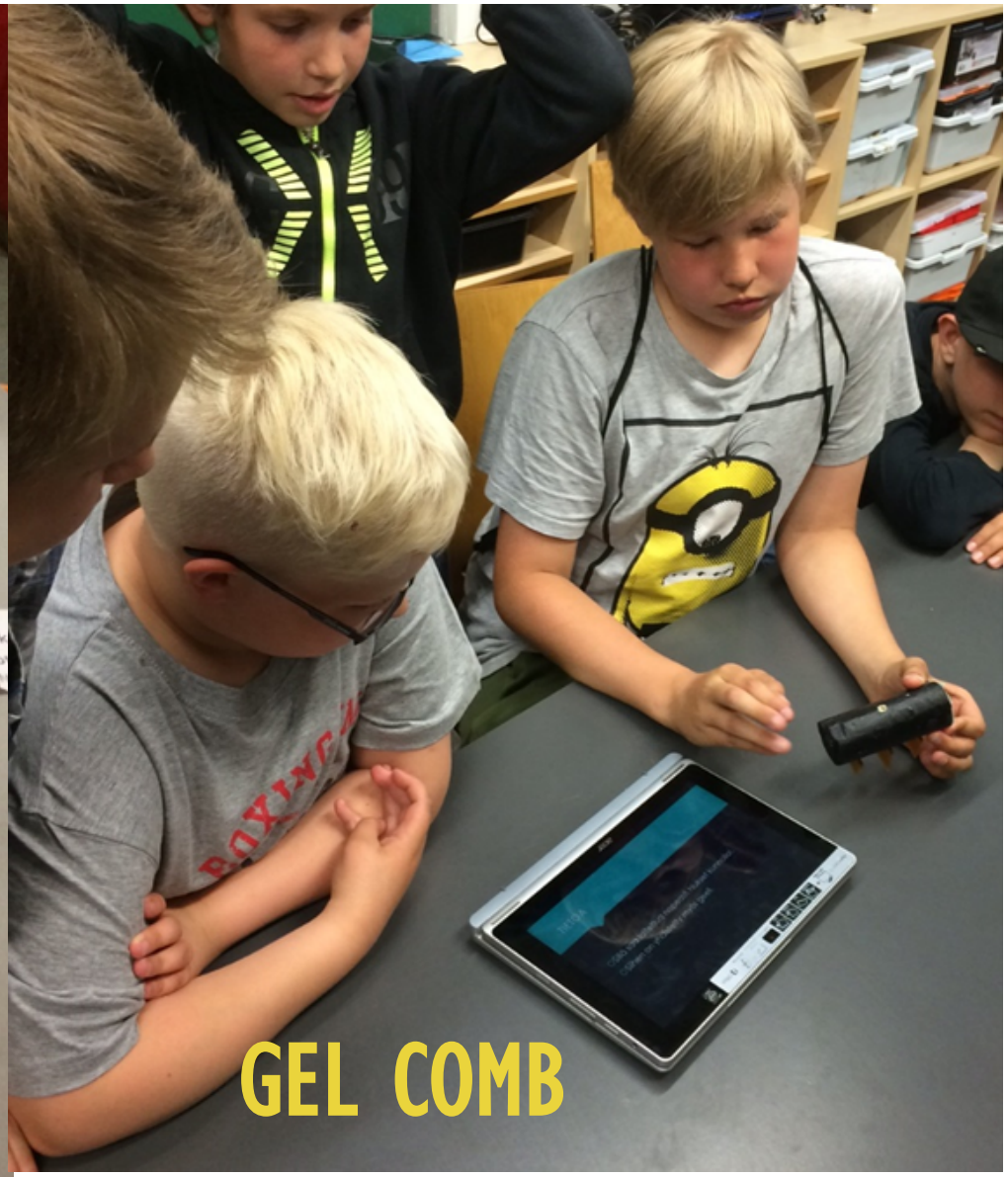




BANANA LIGHT


NEOBAG


ECTRO
Alarming bus card and key holder
Keksintö sai alkunsa, kun mietimme arkipäivän ongelmia. Kaikki olivat samaa mieltä siitä, että avaimet ja bussikortti olivat kaikilla väillä lähteissä.
Ectro.


GEL COMB


LITTLE THINKS
FOOD WASTE MINIMIZER
Kauppalista
Jääkaapin-sisältö
Asetukset
tästä voit muokata profiiliasi ja muita toimin-toja. Lisää ohjeita Asetuksissa
Jääkaapin sisältö

TWO WORLDS — OR JUST ONE

Diving Tower
My 3d printout is a diving tower that rises and lowers on its own.
If the yellow light is on you’re not allowed to jump and if the green light is on you can jump

Chessboard
This is a miniature chessboard. The light is on when the game starts and the buzzer rings, when a chess piece eats another piece. You can play chess with it.

Room
This is a room with a feet drying machine, if someone steps on top of the machine the buzzer starts to ring in the room there is also a beanbag carpet table ja tv the light goes on, if someone enters the room the room has green walls and a brown floor.

INVENTION FAIR AT THE UNIVERSITY

FACILITATING STUDENTS

- Supporting of designing
  - Give students time to brainstorm and develop ideas => how to move from idea to design
  - Emphasize the importance of different material experiments and prototyping
  - Joint presentation of ideas and peer or expert feedback are important
- Forming of student teams
  - A good group size is usually groups of 3 to 4 people
  - Requires careful preplanning from the teachers
- Fostering students' self-directedness => how to support student group responsibility for their work and planning for work as well as provide social recognition of active participation
  - Students' digital documentation of the co-invention process is central: sufficient time and effort should be invested to create the e-portfolios => what parts of the project are documented in the portfolio and how?

ESTABLISHING THE PEER TUTORING SYSTEM

2017

- Support and workshops from the university
- All Grade 8 students as tutors

2018

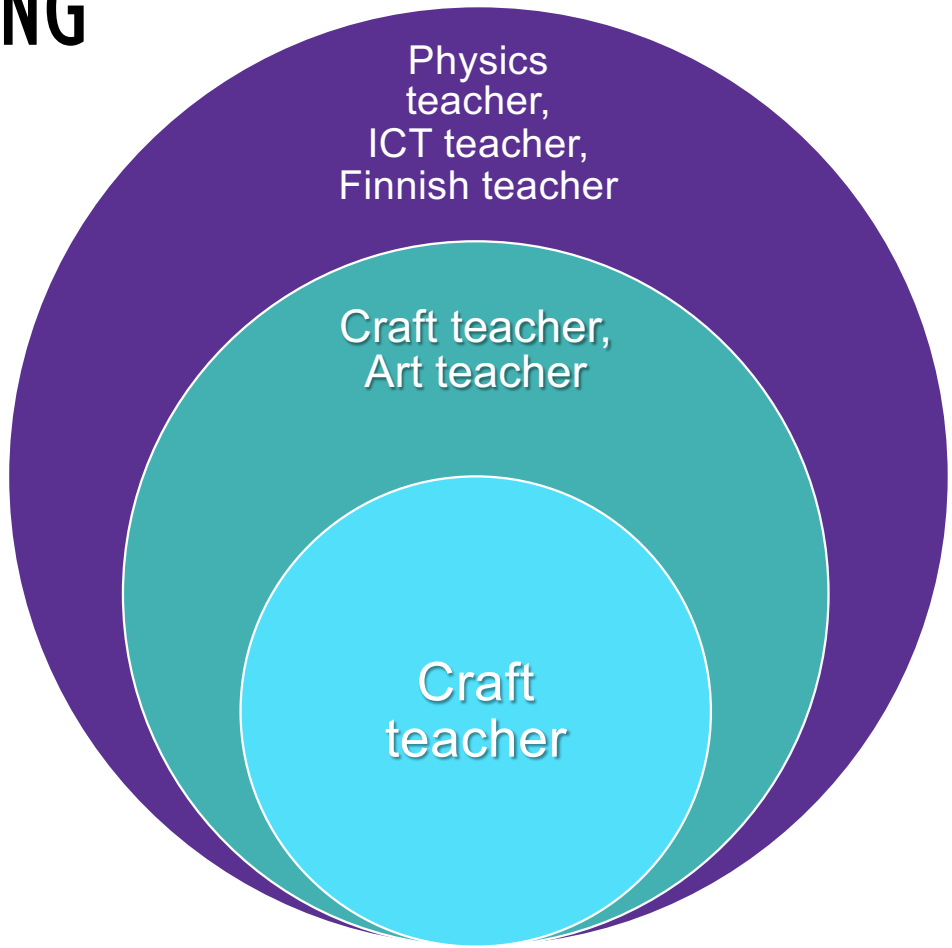
- 4 “Super-tutors”, who developed the tutoring model and trained tutors for the next year
- All tutors responsible for all teams

2019

- Tutors more involved in the co-invention process
- Each tutor responsible for one team

THREE LAYERS OF TEAM TEACHING

- Factors affecting team-teaching
  - *Co-planning practices*: ideation, organization, and evaluation
  - *Team roles*: responsibilities, inter-personal chemistry, participants' expectations
  - *Knowledge sharing*: key factor
- Research-practice partnership
  - Focus on solving practice problems of school transformation
  - Both teachers and researchers beyond their comfort zones
  - Cross-school participatory workshops on ideation and co-designing school projects
  - Building extended professional learning networks



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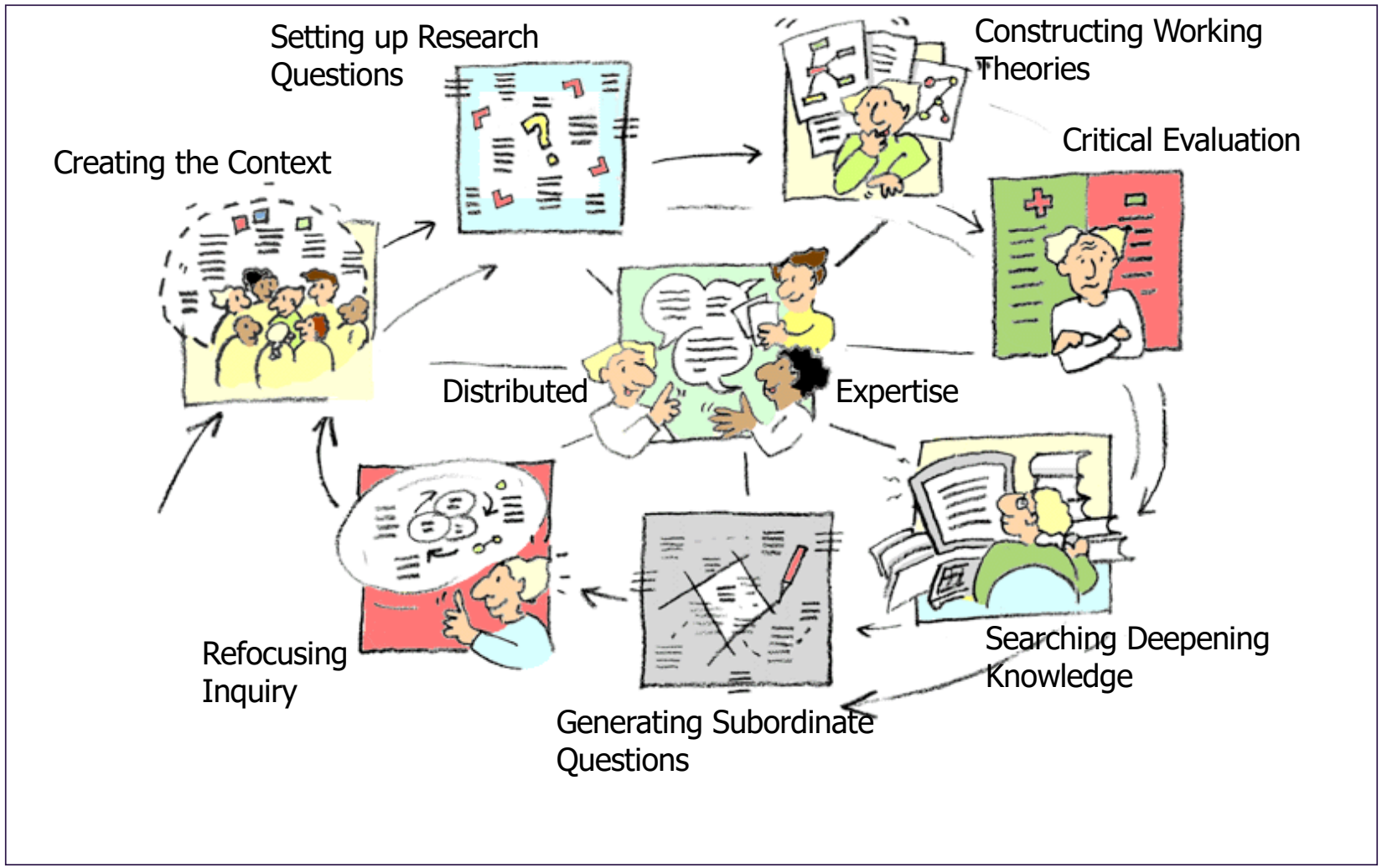
Progressive Inquiry Model
(Investigative learning, Hakkarainen, 1998)



Learning by Collaborative Designing (LCD) model

(Seitamaa-Hakkarainen, 2001)