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Enhancing student situational engagement via a professional development program in chemistry teacher education: A case study from Finland

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Objectives

There are two objectives:

1) to uncover how professional development program influences teacher's personal academic growth and

2) to observe how it impacts in chemistry education (*project based learning*).

Based on my ongoing doctoral studies (theses are just be finalized)

Abstract

This study is part of a larger collaboration project between Finland and U.S. that included a professional development program, where was active collaboration between researchers and secondary school science teachers.

Professional development program emphasized scientific practices and project-based learning (PBL). Important for professional development program is individual and collaborative reflection on beliefs and experiences of a teacher. The professional development program had benefits for both the teacher's professional development and the student situational engagement.

The aim of this study is to get support for teacher’s own evaluation of the professional growth and how it impacted the students’ situational experiences. This study combines data received both from teacher and the students. With multiple research methods, we can have a deeper sense on how international collaboration project supports not only the teacher’s academic growth but also the situational engagement of students. The notable change in student situational engagement was also supported by the results. The 21st century skills and evolving science curriculums call for a research-based implementation of a new kind of science education.

Theoretical and philosophical aspects

Teacher identity vs. practical theory

- Self-reflection process
- Based on personal and professional experiences
- Forms in your relations and networks, in different contexts
- Includes personal feelings
- Change all the time – through experiences

References (for example):

Stenberg & others (2014). "*Beginning student teachers' teacher identities based on their practical theories*"

Teacher as a Researcher vs. Career plan

- **Personal development:**
  - PhD-studies – Further education
  - Philosophical approach, Worldview
  - Learning theories, research theories
- **Specialization** (what makes you special):
  - Health and safety in Chemistry
  - 3D Modeling
  - Spectroscopy (IR, NMR)
- Team creation and development, **Networks** (Community of Practices)
- **Writing and creating** (own) learning materials – e-Book-writer

1. Personal interpretative framework
   - Professional self-understanding
   - Subjective educational theory
2. Positioning theory (= You are in different position)

The **subjective** educational theory – how to recognize and acknowledge it

- The personal system of **knowledge and beliefs** on teaching and teacher education and how to enact recognize and acknowledge these.
- It contains **teacher educators' technical know-how**, the basis on which they ground their decisions for actions in particular situations

The new way to think about teachers´personal development

- It **is not enough when it is about**
  - Training via training courses (usually and mainly short courses)
  - Participating different conferences as listener (of course making notes)
  - Reading new articles about teaching, subject matter or something else (without making abstracts or own reflection by blogging)
- It **is about**
  - **Doing new things** (trying to evaluate and test good practices learned from colleagues) and reflecting the experiences
  - Partizipating conferences **having a lecture or presentation** of our own (dealing with your own research or good practices)
  - **Being active part** of interesting projects and development programs (long term projects, including also training and one-/two-day seminars)
  - **Sharing** your experiences and outcomes (materials)

Rogers: Diffusion of innovations

2014 in Braga:

Viikki Teacher Training School,
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Curate – Customize – Create – Collaborate

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HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Adoption and diffusion of innovations

Networking and its support
- Interaction with other teachers
- Sharing of materials

Local special conditions
- conditions
- school as community

External factors
- funding options
- curricula
- continuing education

Teacher´s personal characteristics
- prior skills
- competence
- will to develop oneself

Characteristics of innovation
- need and usefulness
- clarity, quality
- feasibility, usability
- **experimentation opportunities** (”shareware”)
- visibility (results)

Anchoring and resistance
- conflicts (value, power)
- resistance to change
- practical issues

Source: Myllyviita and Uusikartano (2003), Adapted from Fullan & Rogers

Teachers Professional Development

(Loughran, 2002; Lavonen, et al., 2006; Borg, 2011; Avalos, 2011; van den Bergh, Ros, & Beijaard, 2015)

Professional Development (PD) should

- be teacher-led,
- be continuous (long term),
- be situated in or connected to the classroom context,
- be collaborative, and
- include reflective practices

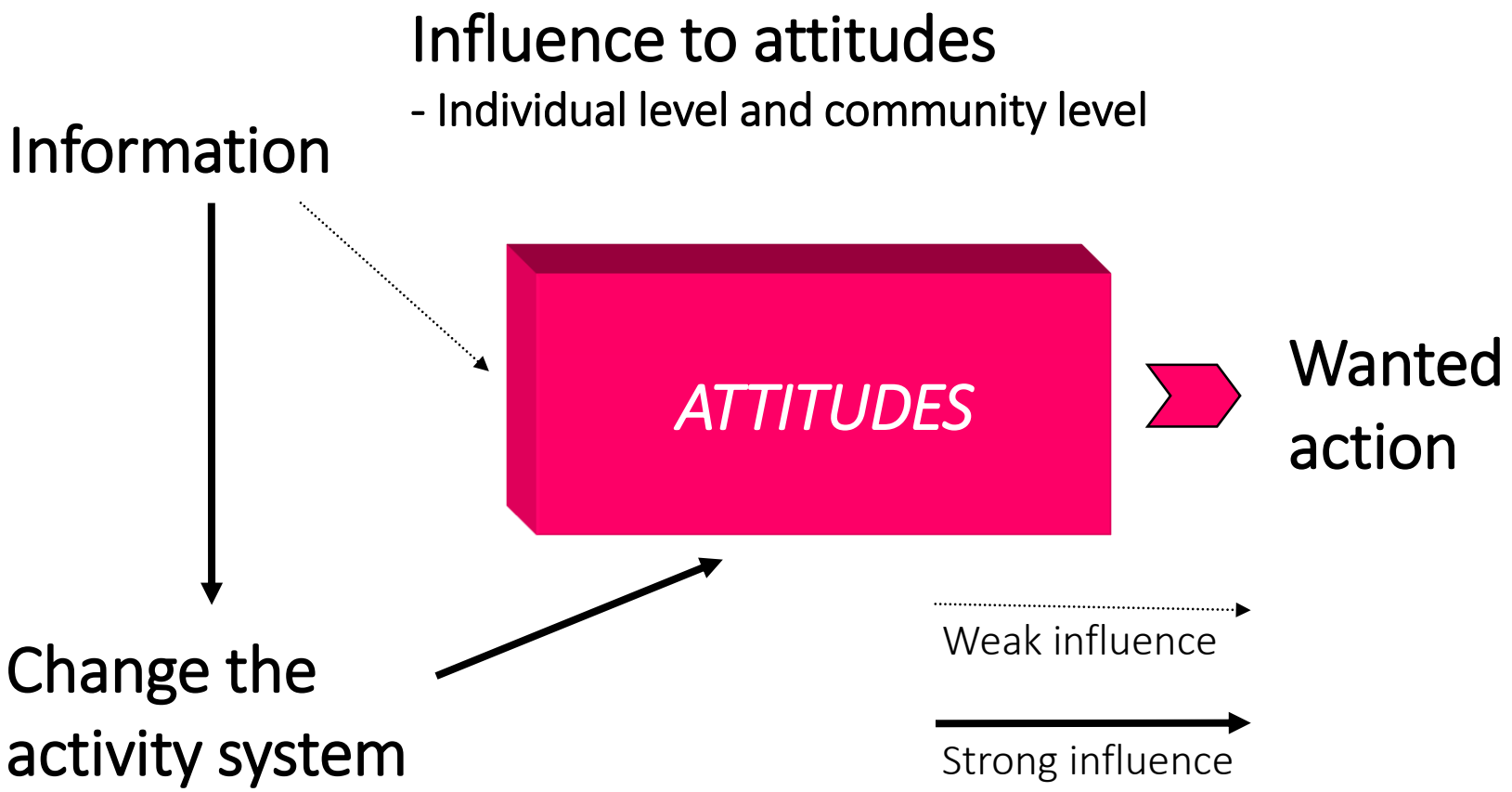
Many short-term PD projects fail to foster teachers' deep understanding of instructional practices and their influence on students' learning and engagement: teachers do not have enough time to reflect on and discuss their experiences of different instructional practices in different contexts

Introducing the PIRE-project

Lavonen, J., Linnansaari, J., Juuti, K., Salmela-Aro, K., Krajcik, J., Schneider, B. "The influence of an international professional development project for the design of engaging secondary science teaching in Finland"

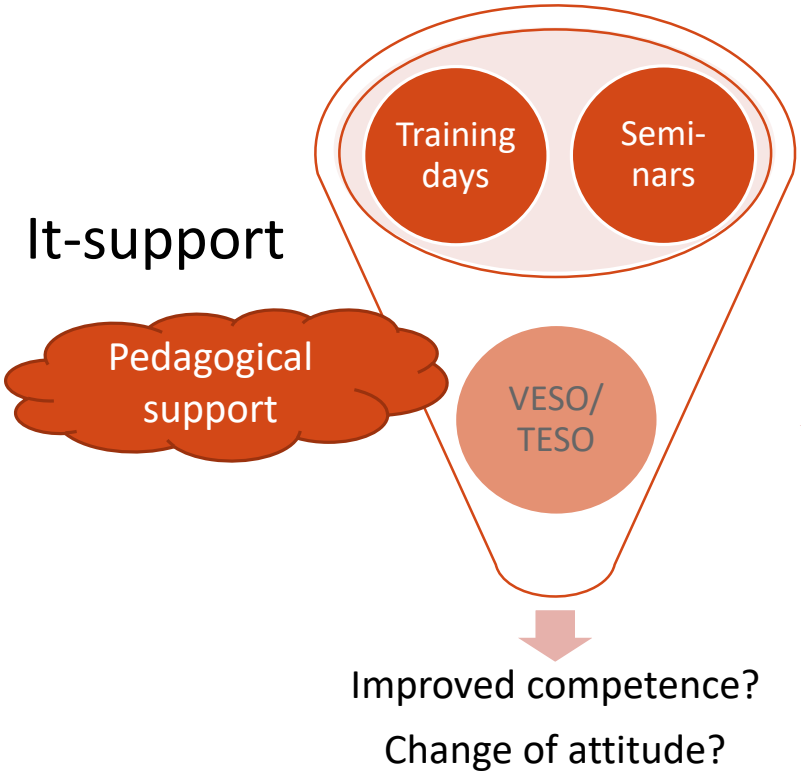
Change in action - How to change teacher´s practise?

Activity theory approach

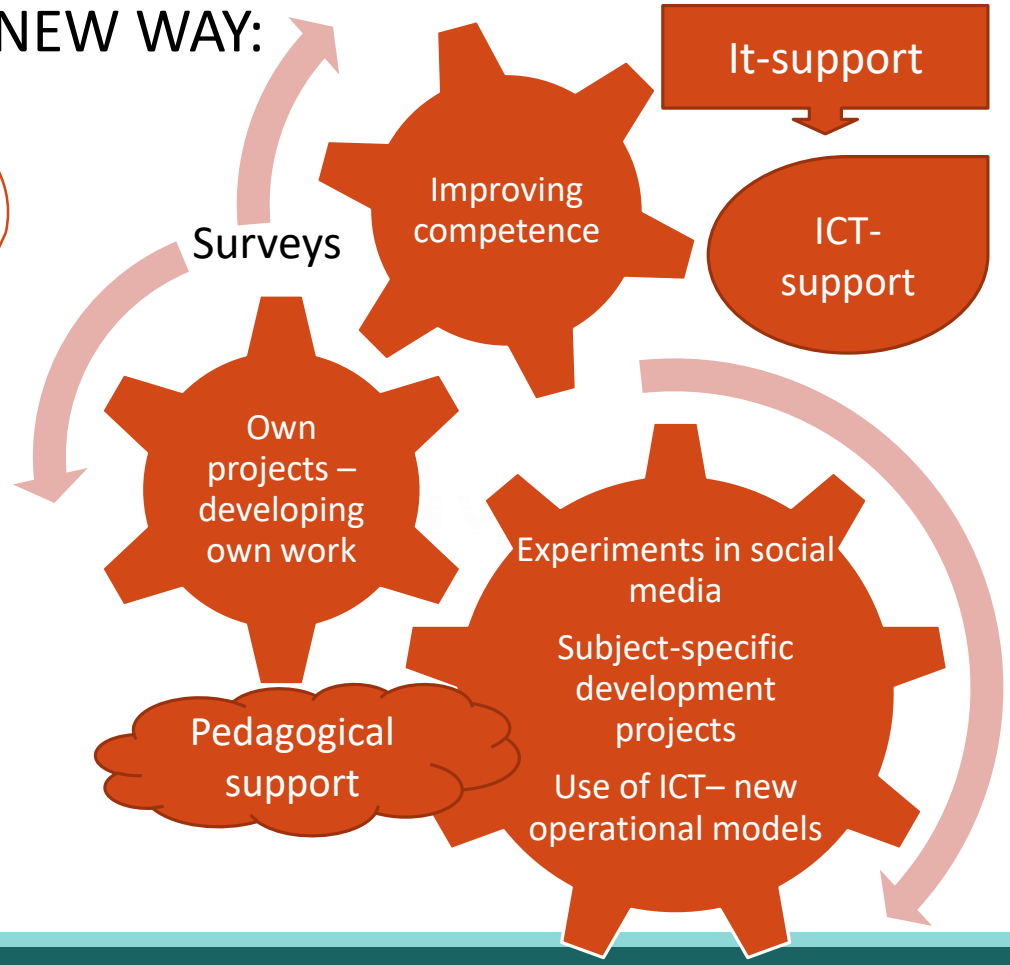


What we are doing differently? The model of Viikki TTS? ICT?

BEFORE:



NEW WAY:



PIRE-project

Michigan State University

University of Helsinki

This study contributes to the **research on student engagement** in three ways:

1. by combining questionnaire and situational measures of engagement using the Experience Sampling Method (ESM)
2. by applying a demands-resources model to describe the positive and negative aspects of student engagement,
3. by adopting a person-oriented approach to describe subgroups of students with different profiles of engagement and burnout symptoms.

Two studies were conducted among US and Finnish high school students about the engagement using mobile phones (ESM)

Engagement → the definition according to this project

Student engagement is a multifaceted construct that describes malleable aspects of motivation and behavior that are beneficial for learning and adjustment in the school context.

This **broad concept** comprises

- emotional,
- cognitive and
- behavioral aspects.

Engagement in the context of flow theory (Csikszentmihalyi, 1990)

- Situational momentary experience which vary in intensity across different domains and situations
- Preconditions for engagement are
  - the situational interest of the activity or the task, (knowledge, value and feelings)
  - student's skills related to the activity or the task (situational resources),
  - challenge of the activity or the task (situational task demands).
- Preconditions are associated with subjective feelings such as happiness, enjoyment, confidence and a lack of boredom or confusion

Optimal learning moment

Enhancers (+)
- Enjoyment
- Succesful
- Happy
- Confident
- Active

Pre-Conditions of Engagement
- Interest
- Skill
- Challenge

Optimal Learning Moment

Detractors (-)
- Bored
- Confused

Accelerants (+/-)
- Stress
- Anxious

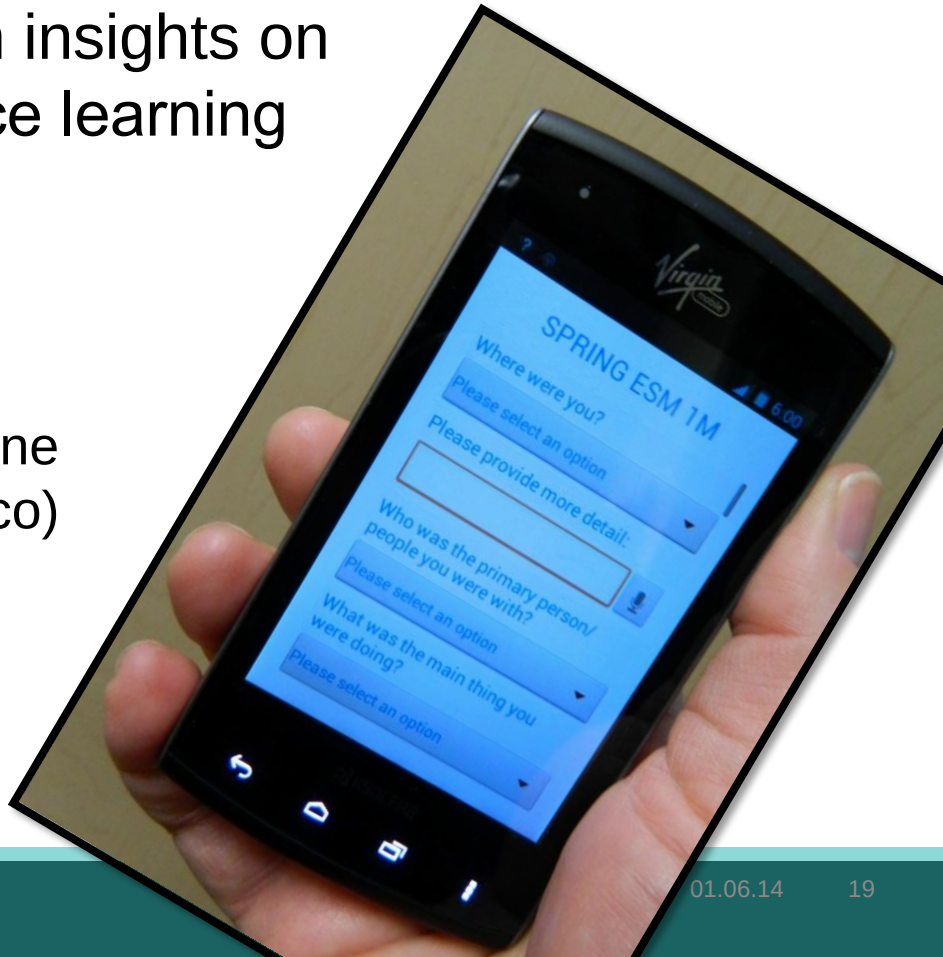
Measurements in real situations through experience sampling method (ESM)

(Csikszentmihalyi & Schneider, 2000)

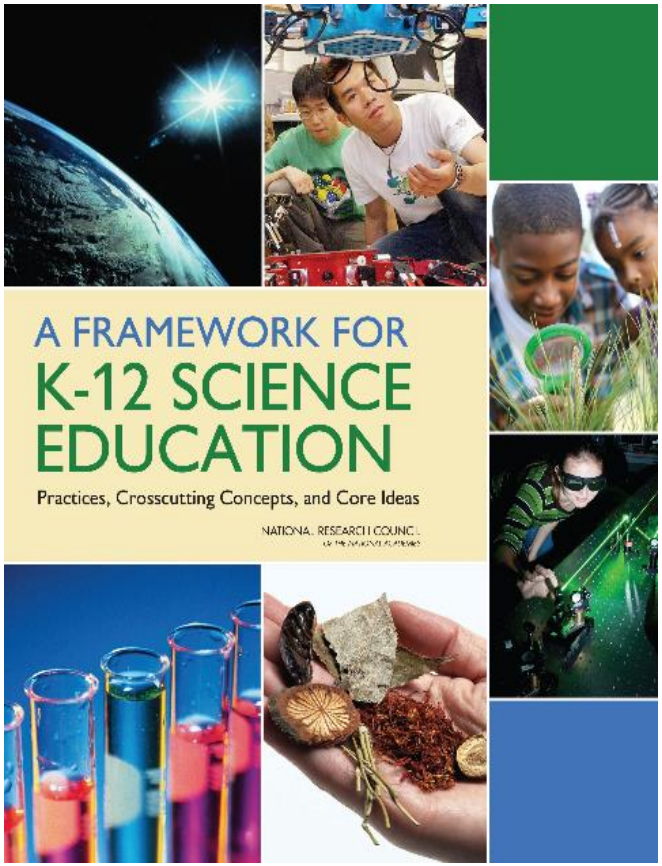
As a part of project or program you learn and be familiar to new research tools. Trying to find an insights on students' engagement in science learning situation.

Use of smart phones:

- Students signaled on smartphone using a special application (Paco)
- ESM Survey is the same each time
- A hybrid of random and scheduled signaling



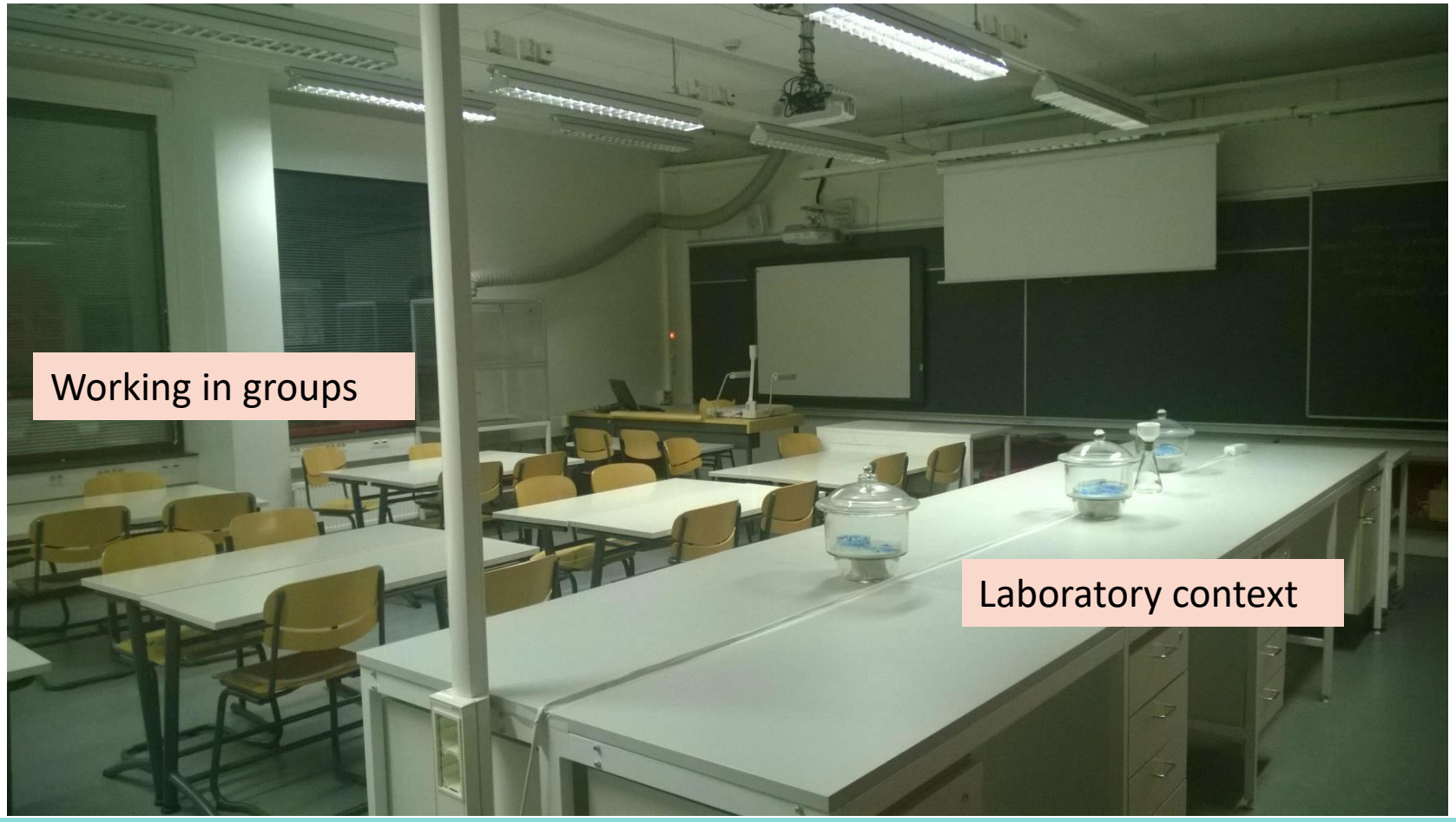
The new Finnish curriculum emphasizes core scientific knowledge and practices in a similar way than the NGSS in the USA



1. Focus on explaining phenomena or designing solutions to problems
2. 3-Dimensional Learning
   1. Organized around disciplinary core explanatory ideas
   2. Central role of **scientific and engineering practices**
   3. Use of crosscutting concepts
3. Coherence: building and applying ideas across time

Working environment is crucial – chemistry classroom is not a lecture room

Working environment is crucial – chemistry classroom is not a lecture room



Working in groups or alone

Scientific Practices

The multiple ways of knowing and doing that scientists use to study the natural world and design world.

1. **Asking questions and defining problems**
2. **Developing and using models**
3. **Planning and carrying out investigations and designing solutions**
4. **Analyzing and interpreting data**
5. **Using mathematics and computational thinking**
6. **Constructing explanations and designing solutions**
7. **Engaging in argument from evidence**
8. **Obtaining, evaluating, and communicating information**

The practices work together – they are not separated!

Scientific Practices

Case CHEM

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1. Asking questions and defining problems
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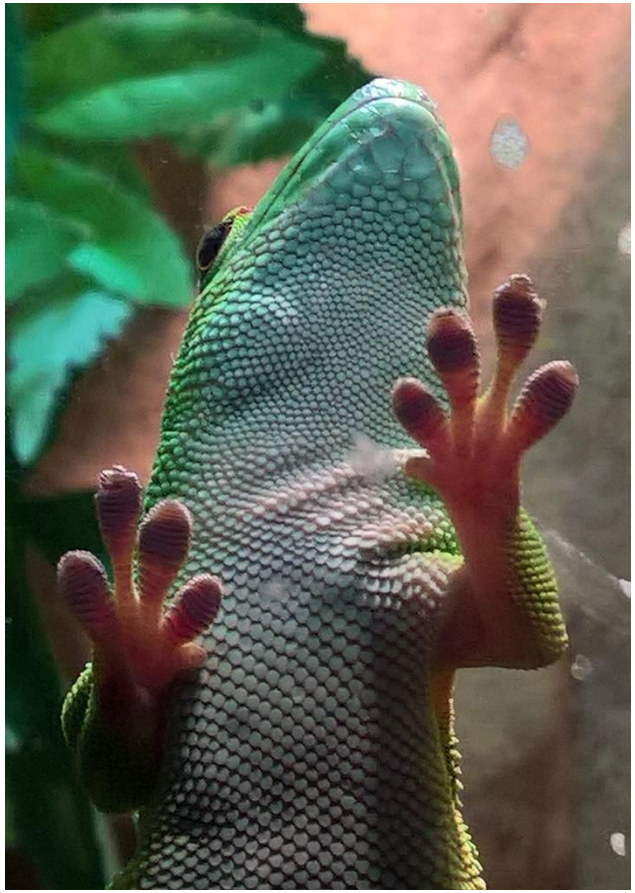
Asking questions and defining problems
DRIVING QUESTIONS (Chem):



Why do Gecko lizard stick to the window or wall? See explanation

Why metalls conduct electricity and sugars or solid salts don´t? And why water doesn´t conduct electricity (so well) but water with salt does?

Why different elements and compounds has different melting and boiling points?

Planning and carrying out investigations and designing solutions

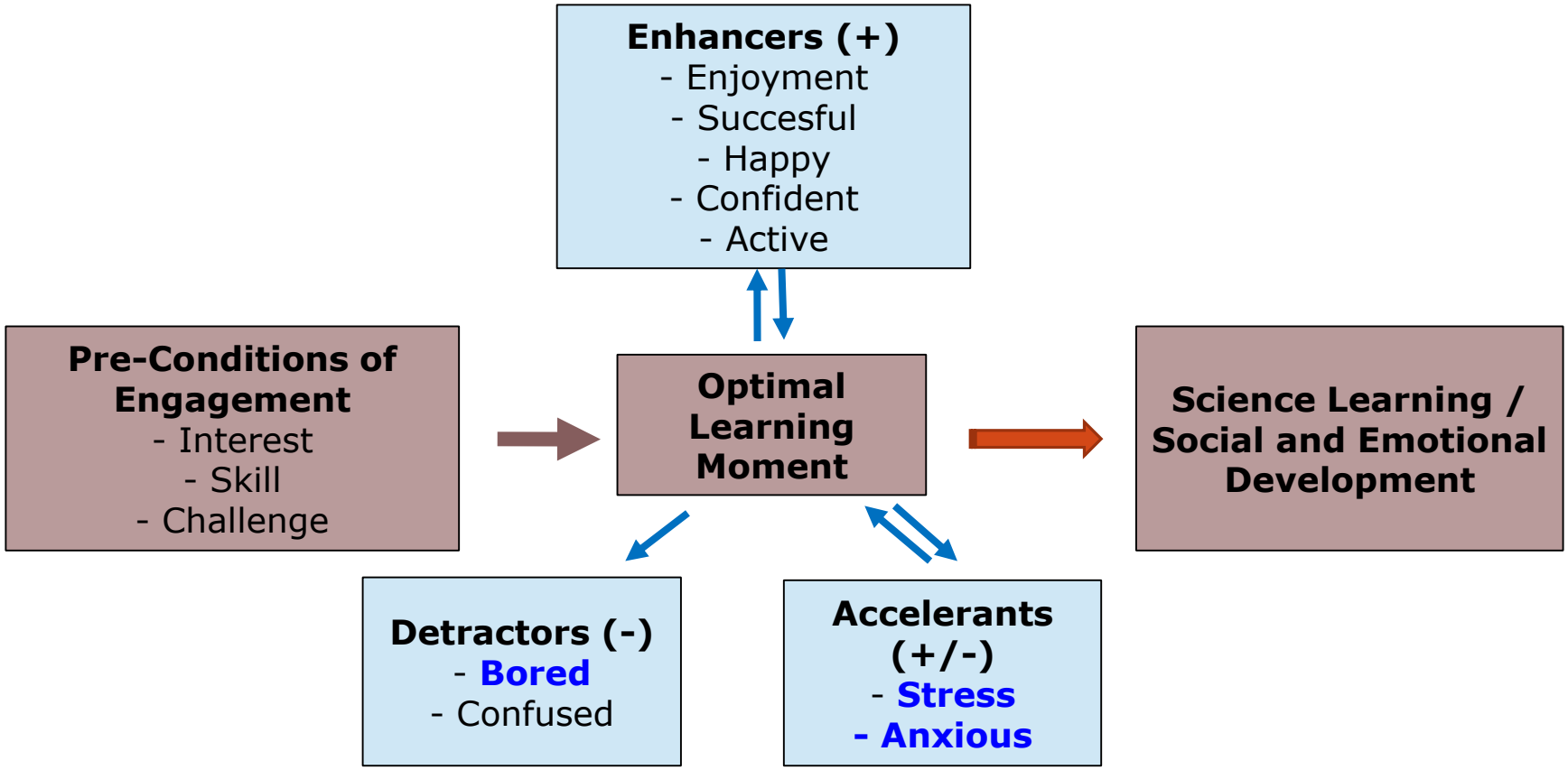
Four different transparent liquids?

Demostration shows that all liquids burns – one with blue flame – and the reaction products are water H_2O and carbon dioxide CO_2

What are they?

- **Plan the experiments:** You can carry out two experiments – plan the experiment and ask for tools when needed.

Optimal Learning Moments - Engagement



A Conceptual framework for optimal leaning moments

Some results

(the process itself is one result)

Teachers’ academic growth

This PDP-process was not – in the beginning – so much focused on teacher´s development than developing and testing new teaching methods and PBL-approach.

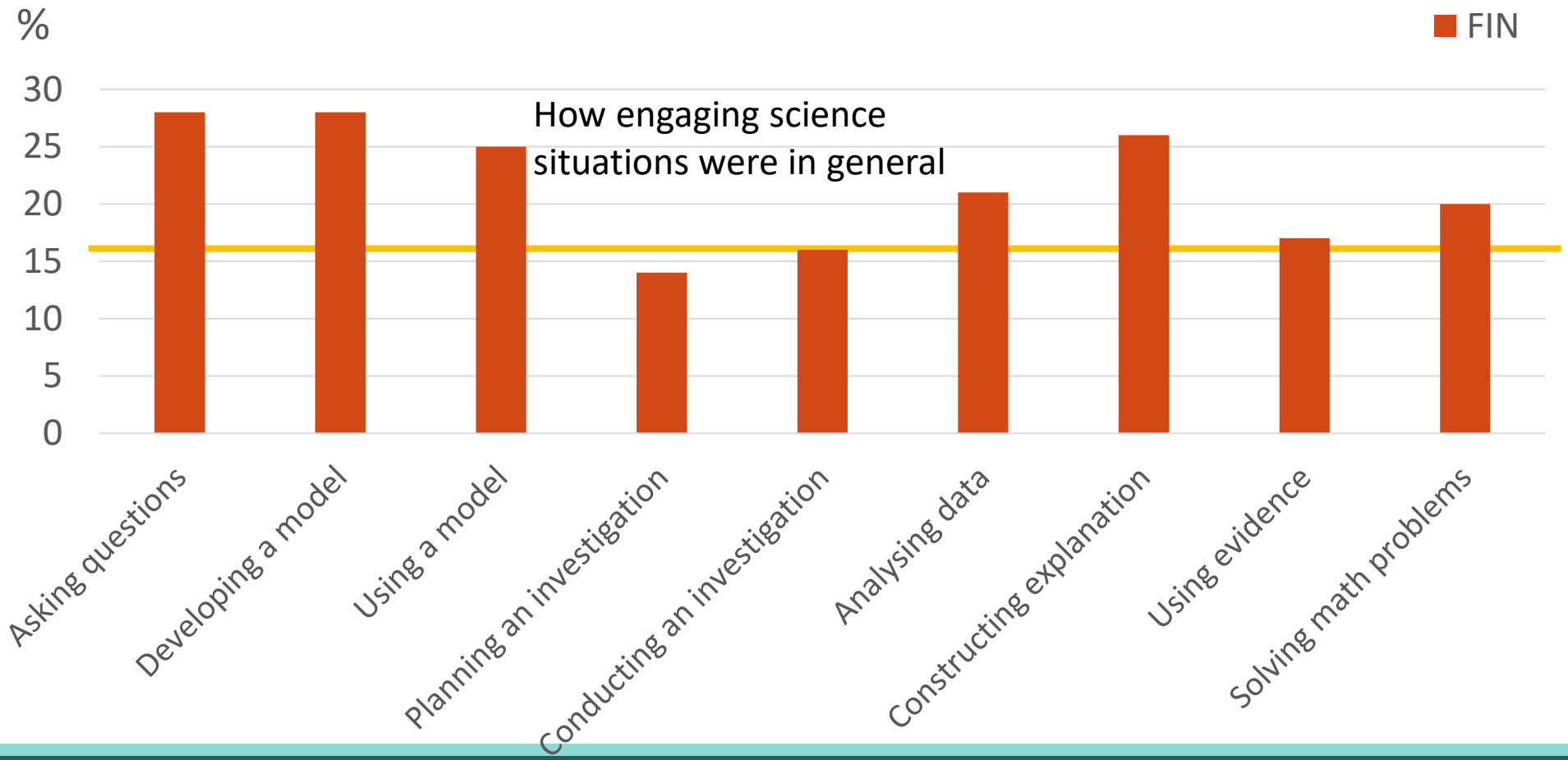
Finally, it influenced also the **teacher´s future PDP-processes** - implementing and testing new teaching methods you are making serious changes in teacher´s own skills and professional development, even then when they are not primary goals.

The systematic approach in creating lesson plans has helped – you had certain key words and questions to answer.

When the PDP-process is well planned, it includes also **theoretical and deeper arguments for pedagogical choices**.

Third added value in this process is the created **network and interaction between** teachers and researchers.

Percentage of Engaged Responses in the Scientific Practices in 2015



Thanks for your attention

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