Innovative ICT-based teaching materials in mathematics and science

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Introduction

FaSMed

Raising Achievement through Formative Assessment in Science and Mathematics Education

Examining use of technology in formative assessment (FA) practices in mathematics and science teaching.

Research question

We pose the following question:

Which factors promote or impede the implementation of innovative materials in practice?
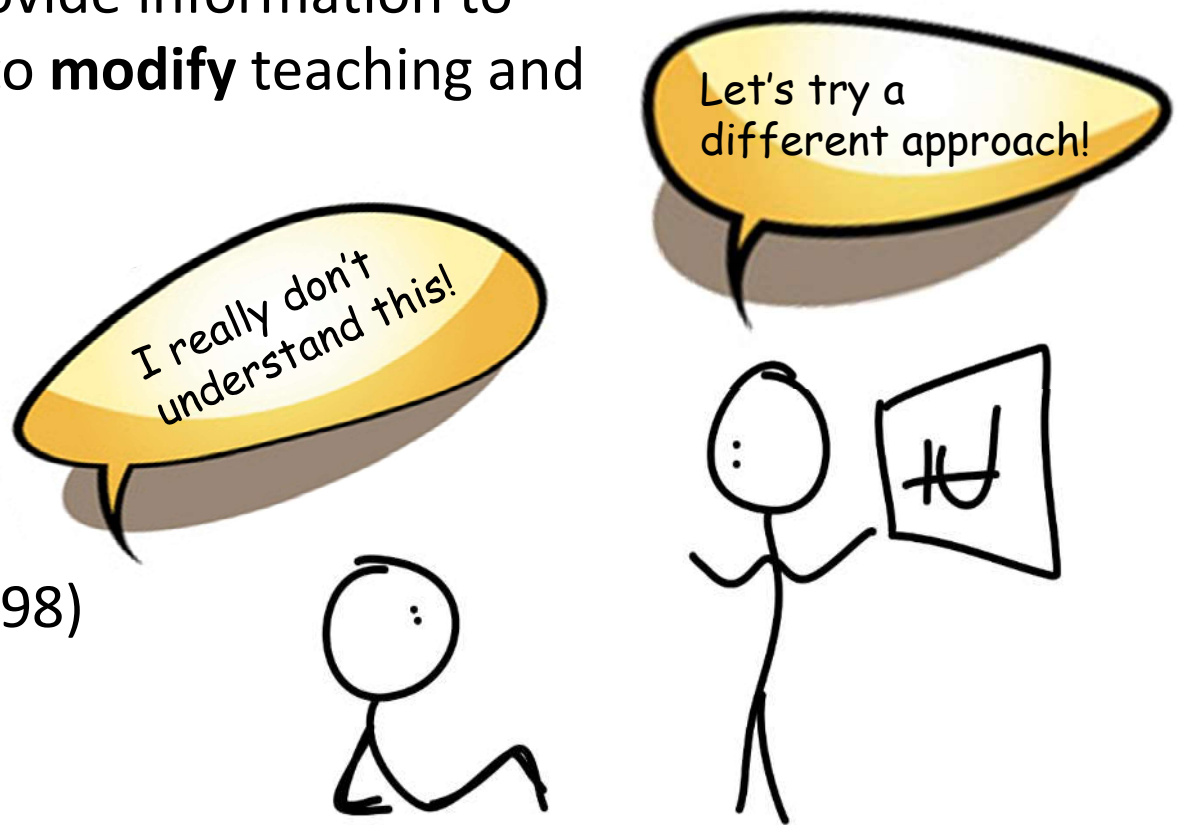
Innovativity

(1) Facilitates student centered learning

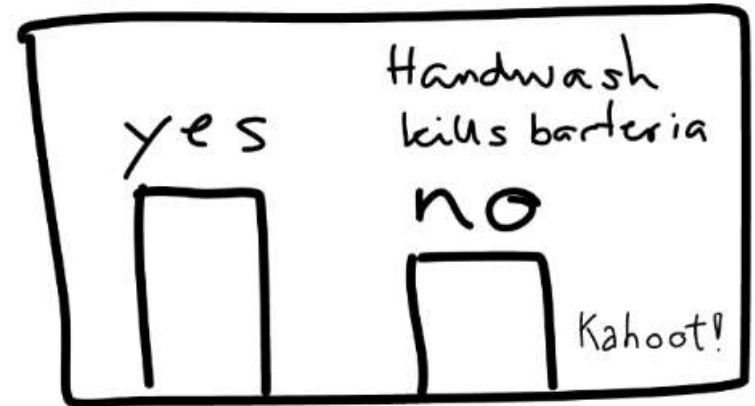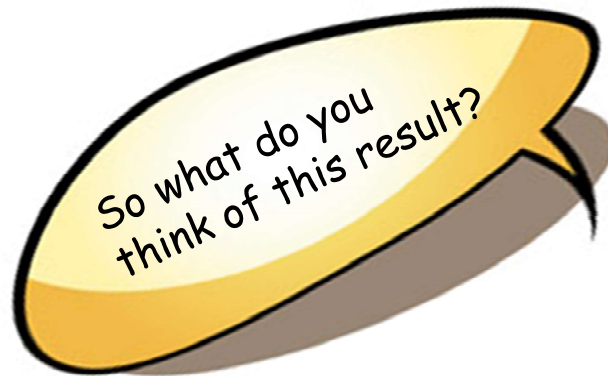(2) There is a variety in the selection of ICT tools being used

Drent & Meelissen (2008, p.191)

Theoretical background

'those activities undertaken by **teachers** – and by their **students** in **assessing themselves** – that provide information to be used as feedback to **modify** teaching and learning activities.'
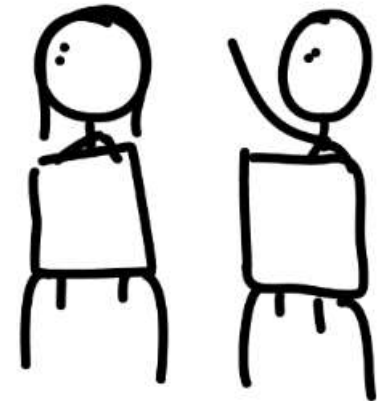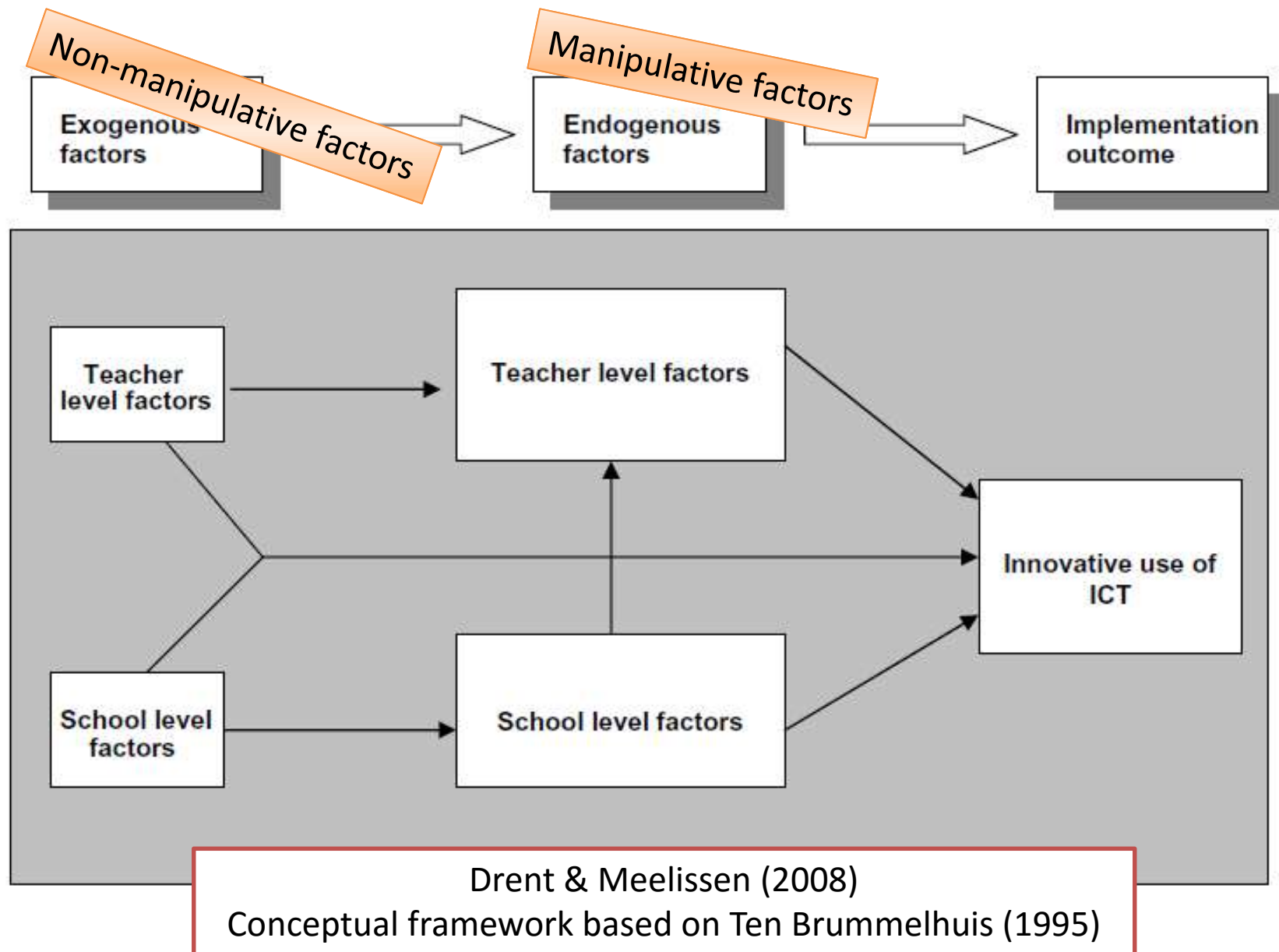
Black and William (1998)

Technology «can help teachers plan, implement, and refine classroom formative assessment stratgies.»
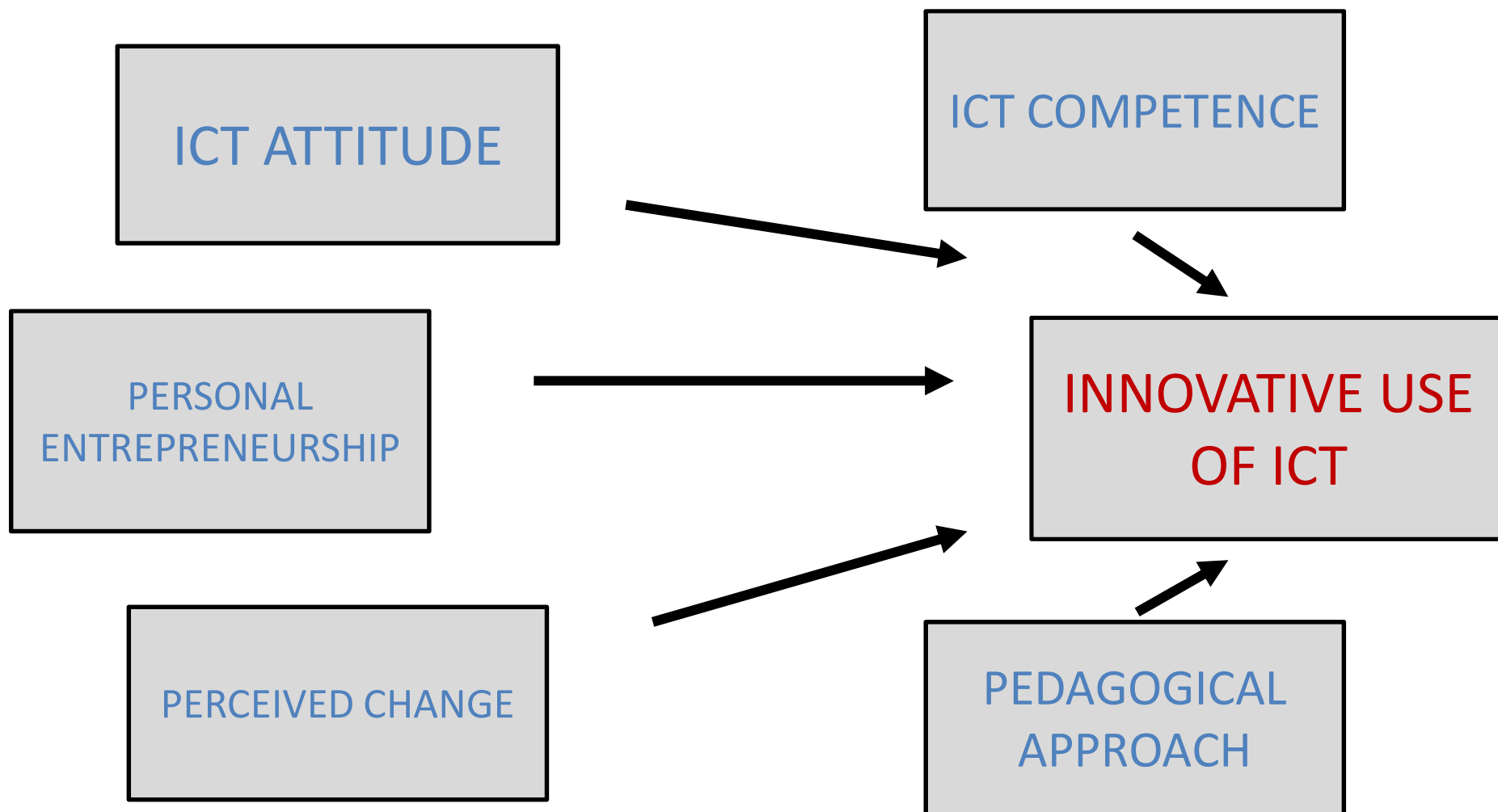
Quellmalz (2013)

Drent & Meelissen (2008)
Conceptual framework based on Ten Brummelhuis (1995)
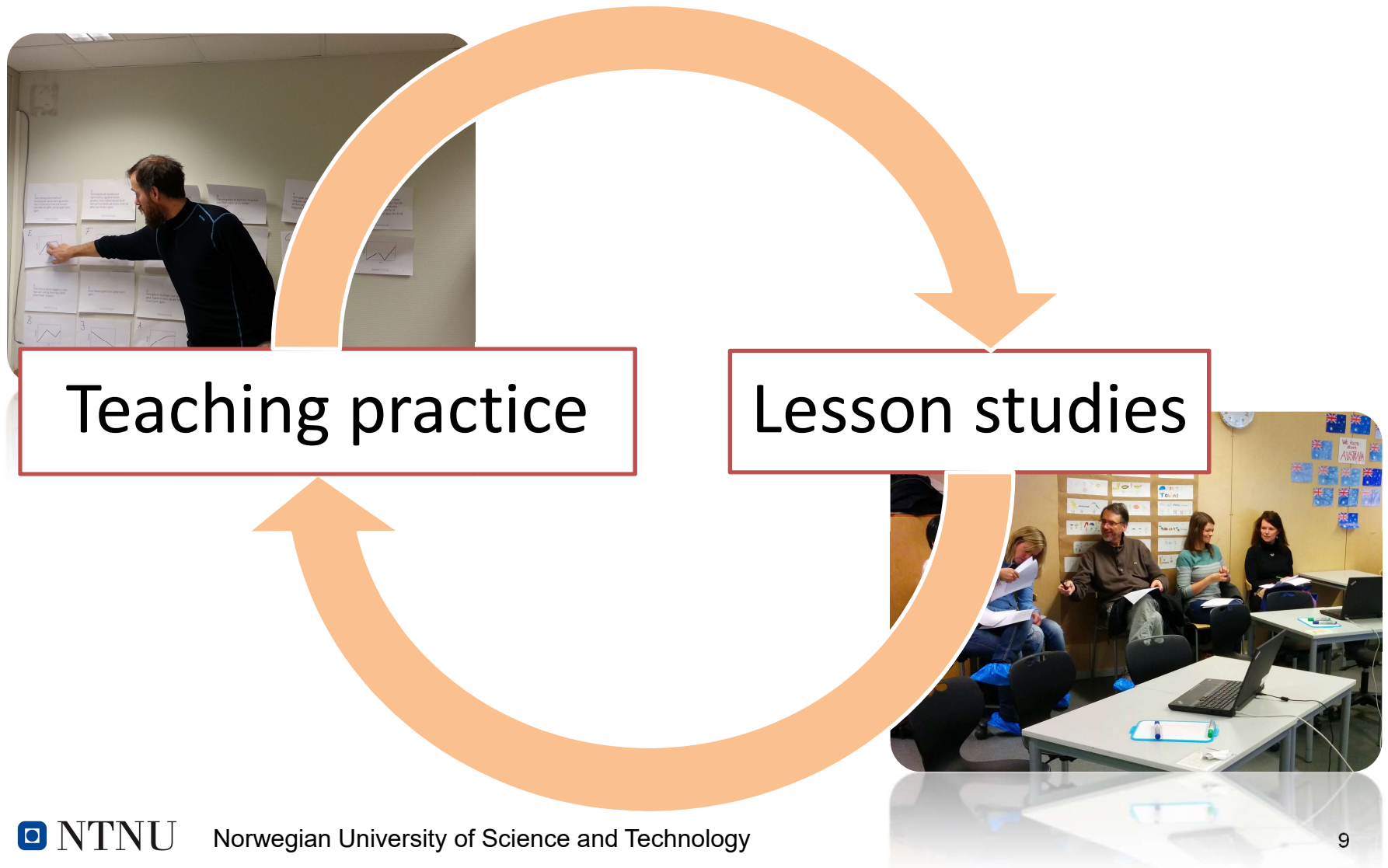
Redesigned from Drent, M. & Meelissen. 2008. Computers & Education 51 pp. 187-199.

Manipulative factors at teacher level

ICT ATTITUDE

ICT COMPETENCE

PERSONAL ENTREPRENEURSHIP

INNOVATIVE USE OF ICT

PERCEIVED CHANGE

PEDAGOGICAL APPROACH

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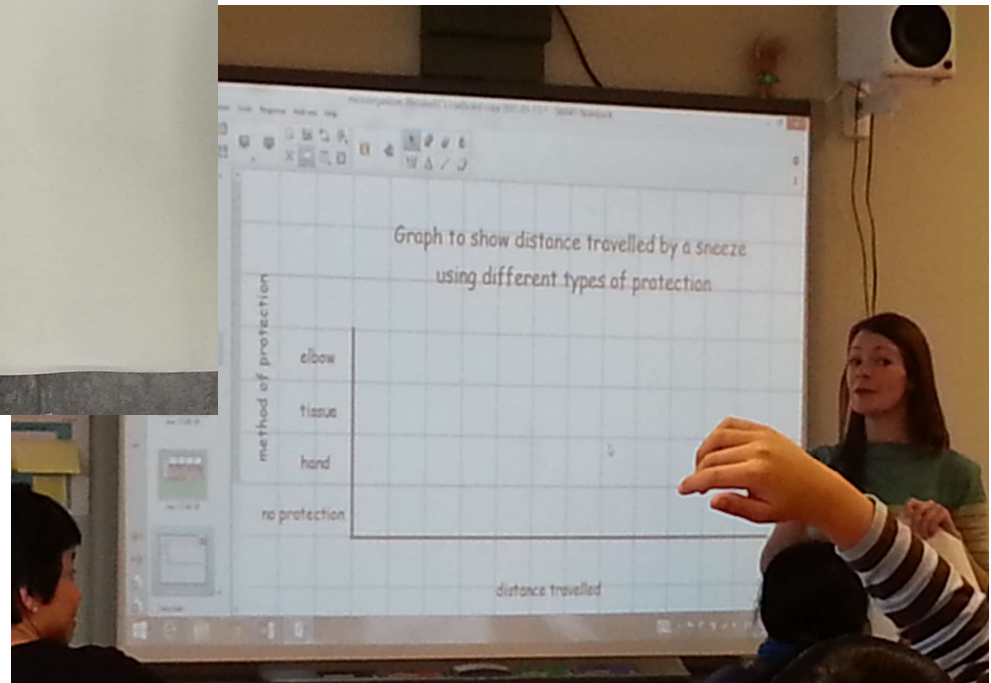
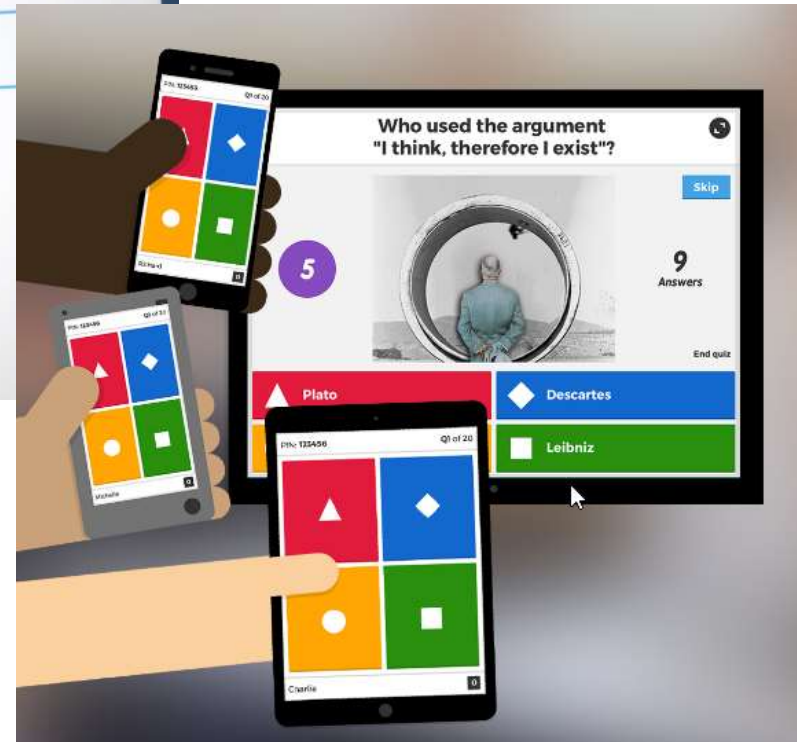# Materials and method

Teaching practice

Lesson studies

Case study 1
Travel of microorganisms when sneezing
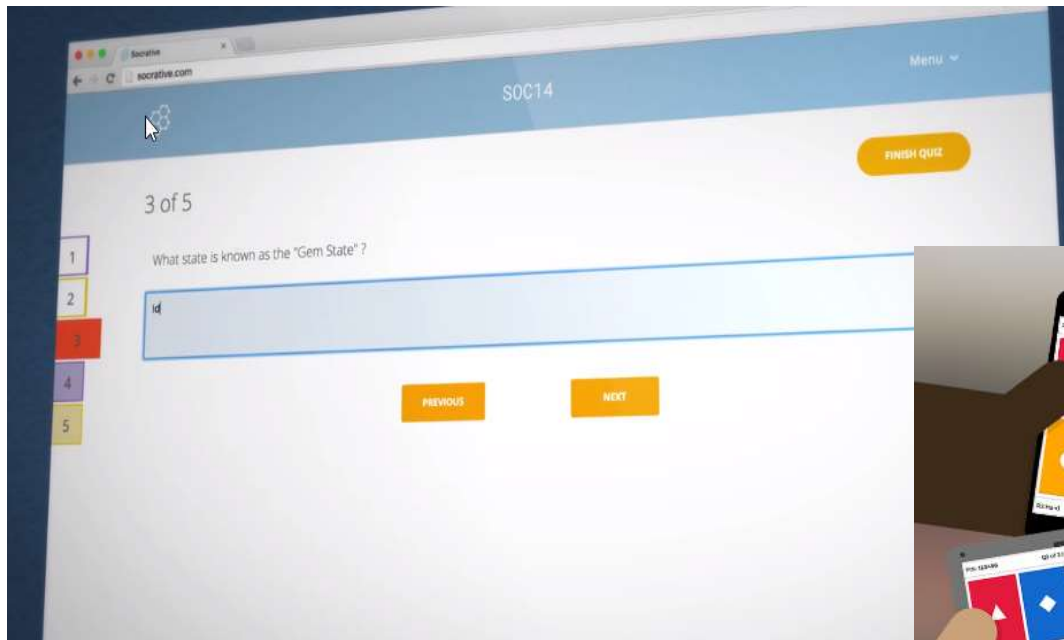
SRS – Socrative & Kahoot

Case study 2
Echo loggers and graphing

«Walk a graph»
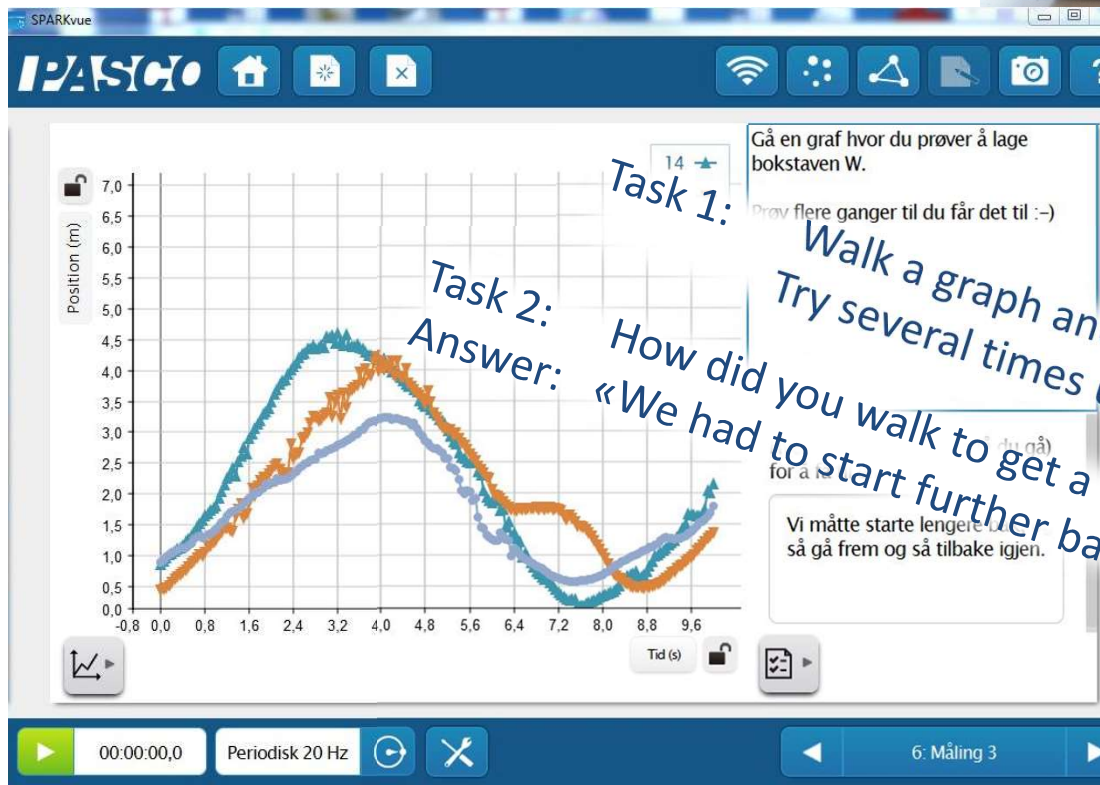
- https://www.youtube.com/watch?v=MkXEJkOktQo

Case study 2
Echo loggers and graphing

Task 1: Walk a graph and try to make the letter W. Try several times until you succed

Task 2: How did you walk to get a W?

Answer: «We had to start further back and then walk to and from».

Some examples from teachers

ICT ATTITUDE

Positive to new technology

ICT COMPETENCE

Using previously unknown ICT

PERSONAL ENTREPRENEURSHIP

Interested in new approches to teaching

participation in Fasmed

INNOVATIVE USE OF ICT

PERCEIVED CHANGE

«do a quick thing»

Instant feedback (with SRS)

PEDAGOGICAL APPROACH

«motivating»

Echo sound data logger used to walk a graph

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Conclusions (observations and interviews)

Impeding
Promoting

	Non-manipulative factors	Manipulative factors
Teacher level	-Young age -Male -Educational experience with ict -Economy -Interests in new approaches to teaching	-Positive attitude -Teachers becoming more conscious about own use of ICT
School level	-Internet stability -Installation procedures	-Economy -Participation in professional development

BECTA (2004), Ely (1999), Grunberg and Summers (1992) and Mumtaz (2000)

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Other findings

- Engaging
  - Both low and high achievers highly engaged

- ICT Pedagogy
  - Changed – using new type of digital tools
  - SRS used frequently after the Fasmed introduction

- Competance
  - Improved teacher competance through new digital tools

- Technical aspects of SW and HW
  - Bugs
  - Version
  - User interface

Finally

- There are thus different approaches and impacts - in some schools ICT was identified as responsible for a significant shift in teaching and learning practices while in others it is seen as reinforcing traditional methods.

- BUT ANYWAY - Change in ICT ought to be followed by changed pedagogy (using an interactive whiteboard as a blackbord – useless - except you miss the dust of the chalk)

(OECD report: ICT and Innovative Schools. Report by the CERI/OECD Secretariat.)

Literature

- British Educational Communications and Technology Agency [BECTA] (2004). A review of the research literature on barriers to the uptake of ICT by teachers.
- Black, P., & Wiliam, D. (1998). *Inside the black box: raising standards through classroom assessment*. London: King's College London School of Education.
- Drent, M. & Meelissen. 2008. Computers & Education 51 pp. 187-199
- Ely, D. P. (1999). Conditions that facilitate the implementation of educational technology innovations. Educational Technology, 39(6), 23–27.
- Grunberg, J., & Summers, M. (1992). Computer innovation in schools: A review of selected research literature. Journal of Information Technology for Teacher Education, 1(2), 255–276.
- *OECD report. n.d. ICT and Innovative Schools. Report by the CERI/OECD Secretariat. Downloaded Nov. 2016 from: http://www.oecd.org/site/schoolingfortomorrowknowledgebase/themes/ict/41187025.pdf*