UNIVERSITY OF APPLIED SCIENCES UTRECHT

Trends in mathematics for vocational education

The Dutch Connection

Chapter 17
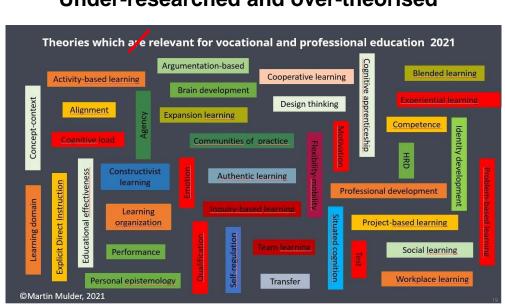**The Impact of Dutch Mathematics Education on Danish Mathematics Education**

Mogens Niss

Monday, 13 September 2021
NCUM – conference
kees.hoogland@hu.nl

Under-researched and over-theorised

HU

... could be ...

Theories which are relevant for vocational and professional education 2021

Concept-context · Activity-based learning · Argumentation-based · Cooperative learning · Cognitive apprenticeship · Blended learning · Brain development · Design thinking · Experiential learning · Alignment · Agency · Expansion learning · Competence · Cognitive load · Communities of practice · Flexibility-mobility · Motivation · HRD · Identity development · Educational effectiveness · Constructivist learning · Emotion · Authentic learning · Professional development · Problem-based learning · Learning domain · Explicit Direct Instruction · Learning organization · Inquiry-based learning · Project-based learning · Performance · Qualification · Self-regulation · Team learning · Situated cognition · Test · Social learning · Personal epistemology · Transfer · Workplace learning
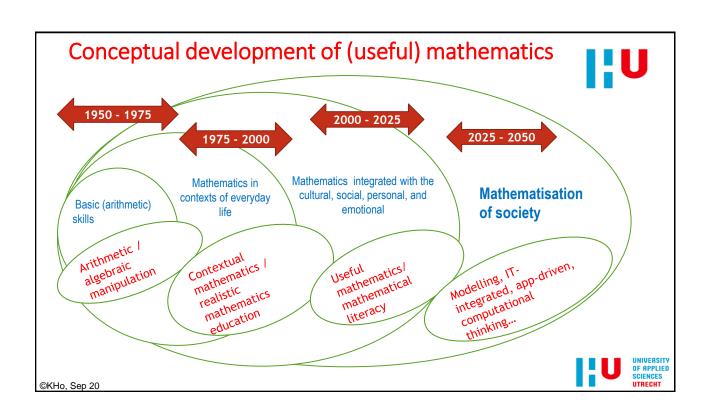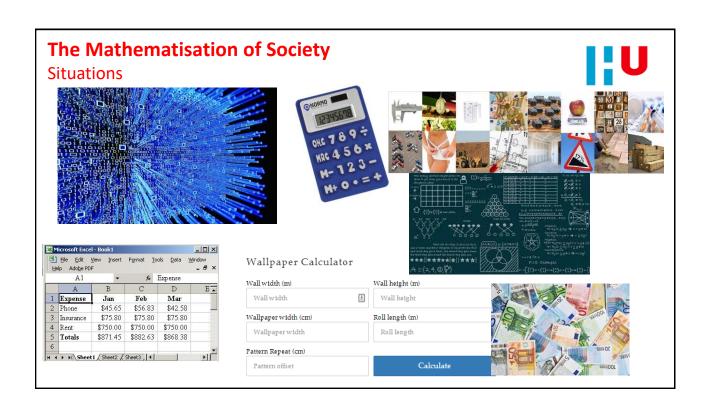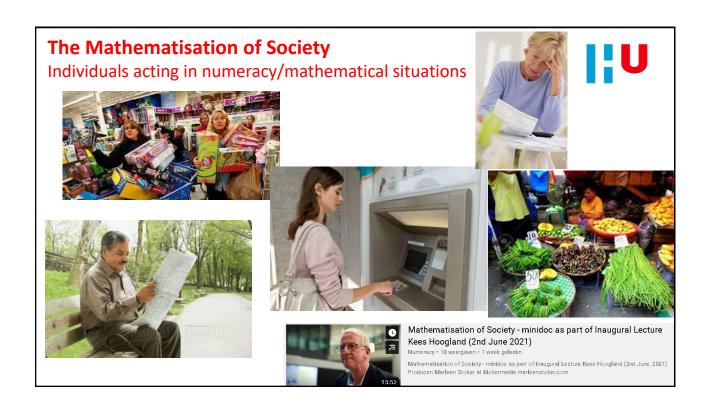
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Long-lasting dilemma's around Voc. Math. Ed.

- School mathematics or functional mathematics or "craft" mathematics

- Mathematics for professional use and/or Mathematics for citizenship

- Separate discipline/subject matter or Integrated in meaningful authentic tasks

Conceptual development of (useful) mathematics

1950 - 1975

1975 - 2000

2000 - 2025

2025 - 2050

Basic (arithmetic) skills

Mathematics in contexts of everyday life

Mathematics integrated with the cultural, social, personal, and emotional

Mathematisation of society

Arithmetic / algebraic manipulation

Contextual mathematics / realistic mathematics education

Useful mathematics/ mathematical literacy

Modelling, IT-integrated, app-driven, computational thinking...

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The Mathematisation of Society
Situations

Wallpaper Calculator

Wall width (m)
Wall height (m)

Wallpaper width (cm)
Roll length (m)

Pattern Repeat (cm)
Calculate

The Mathematisation of Society
Individuals acting in numeracy/mathematical situations

Mathematisation of Society - minidoc as part of Inaugural Lecture Kees Hoogland (2nd June 2021)
Numeracy • 10 weergaven • 1 week geleden

Mathematisation of Society - minidoc as part of Inaugural Lecture Kees Hoogland (2nd June, 2021)
Producer: Marleen Stoker at Mokermedia marleenstoker.com

Mathematisation of society

- Numbers are the new language
- Technology and digitalisation have mathematical ground structures
- Even traditional crafts are a blend of "old" craftman skills and digital tools and innovations

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Vocational: New Dutch framework for 2022+

- Functional domains
  - Quantities and Units
  - Orientation in the 2 and 3-dimensional world
  - Recognising and using proportionality
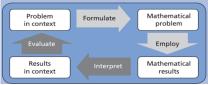 - Using percentages
  - Dealing with quantitative information

For each domain there is a set of "descriptors" of the **desired mathematical behaviour**

Vocational: New framework for 2022+

- Problems in context
- Addressing themes: Study & work, Transportation, Housing, Leisure
- Using tools like calculators / apps / spreadsheets
- Using the problem solving /modelling cycle form PISA
- Assessment:
  - Examination
  - Credits for process of solving
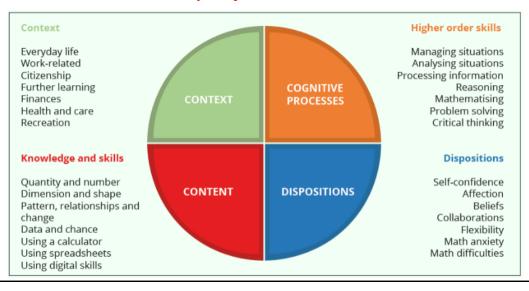 - Partly integrated in vocational tasks (under development)

OECD 2015 /2018 / 2021
PISA Frameworks

Classroom approaches, like emergent modeling

The quality of mathematical/numerate behaviour

What matters in the quality of mathematical behaviour?

Context

Everyday life
Work-related
Citizenship
Further learning
Finances
Health and care
Recreation

CONTEXT | **COGNITIVE PROCESSES**
CONTENT | **DISPOSITIONS**

Higher order skills

Managing situations
Analysing situations
Processing information
Reasoning
Mathematising
Problem solving
Critical thinking

Knowledge and skills

Quantity and number
Dimension and shape
Pattern, relationships and change
Data and chance
Using a calculator
Using spreadsheets
Using digital skills

Dispositions

Self-confidence
Affection
Beliefs
Collaborations
Flexibility
Math anxiety
Math difficulties

C | E
N | F

End of presentation

For information, collaboration, and
comments, please contact me
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- Programme manager of Erasmus+ project: Common European Numeracy Framework
- Member of the OECD - Numeracy Expert Group - PIAAC 2nd cyle
- Trustee of Adults Learning Mathematics – A research Forum
- Fellow of the International Society for Design and Development in Education
- Chair of the Thematic Working Group - Adult Mathematics Education - at CERME 12 (Bolzano, Italy, 2-6 February 2022)

Just published:
- ALM: key-note https://www.gecijferdheid.nl/adult-numeracy-practices-imperative-implications-for-education/
- Springer: National Reflections on the Netherlands Didactics of Mathematics: https://link.springer.com/book/10.1007/978-3-030-33824-4
- ZDM: "Computer-based assessment of mathematics into the twenty-first century: pressures and tensions" https://rdcu.be/Oz4e