

MatRIC Mathematical Modelling  
Colloquium  
Spring 2015

# **Authenticity in extra-curricular mathematics activities;**

## **Researching authenticity as a social construct**

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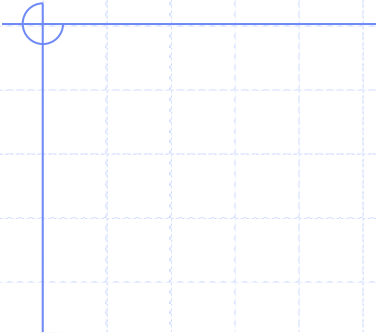
# A context is..

the surroundings, circumstances, environment, background or settings that determine, specify, or clarify the meaning of an event or other occurrence.

# *"You have a green light"*

The meaning depends on the context:

- ◆ You have a green traffic light at a crossing.
- ◆ You can go ahead with the project.
- ◆ Your body has a green glow.
- ◆ You possess a light bulb that is tinted green.



Context

**Something  
mathematical**

Context

**Something  
mathematical**

# Problem

John's fastest time to run  
100 meter is 17 seconds.  
How much time will he  
need to run 1 km?

Dressed-up mathematical word problem

## Athletics, running

John's fastest time to run  
100 meter is 17 seconds.

How much time will he  
need to run 1 km?

**proportionality**

## Athletics, running

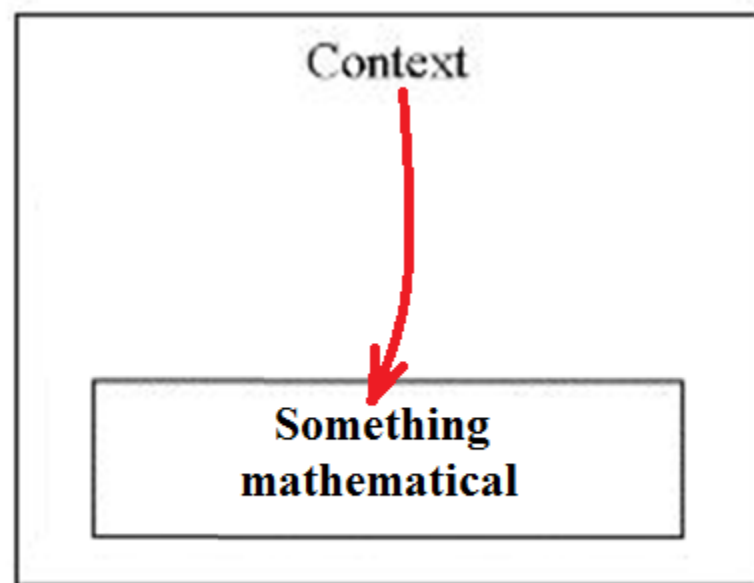
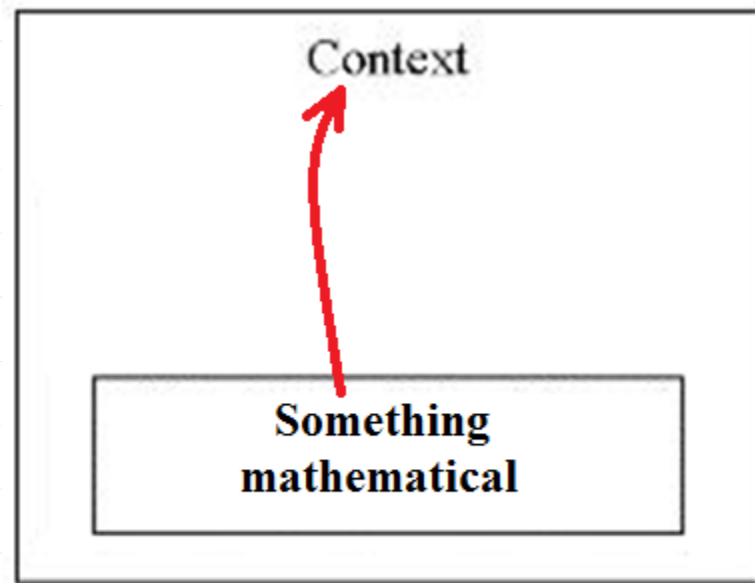
### School situation

John's fastest time to run  
100 meter is 17 seconds.

one answer is "right"

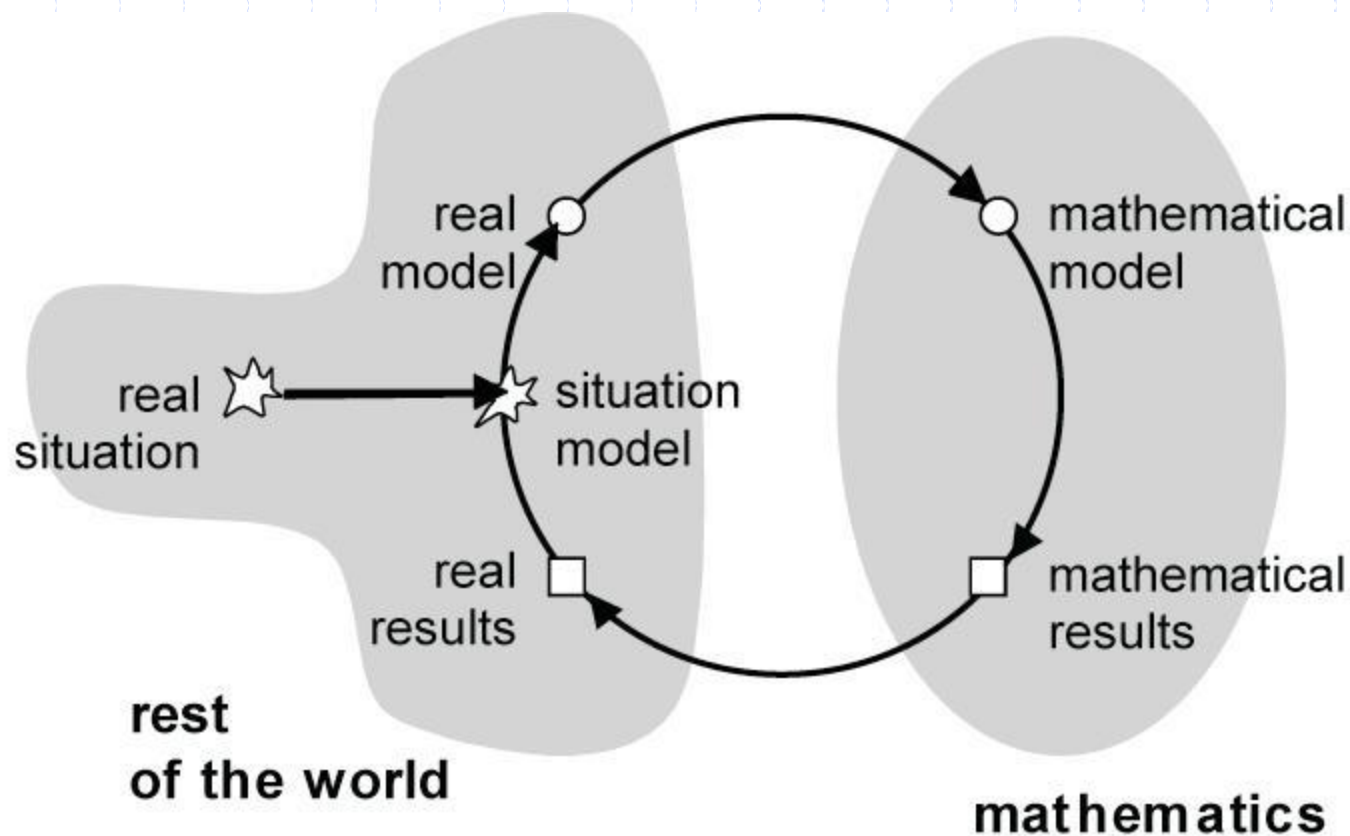
How much time will he  
need to run 1 km?

**proportionality**





# Modelling cycle



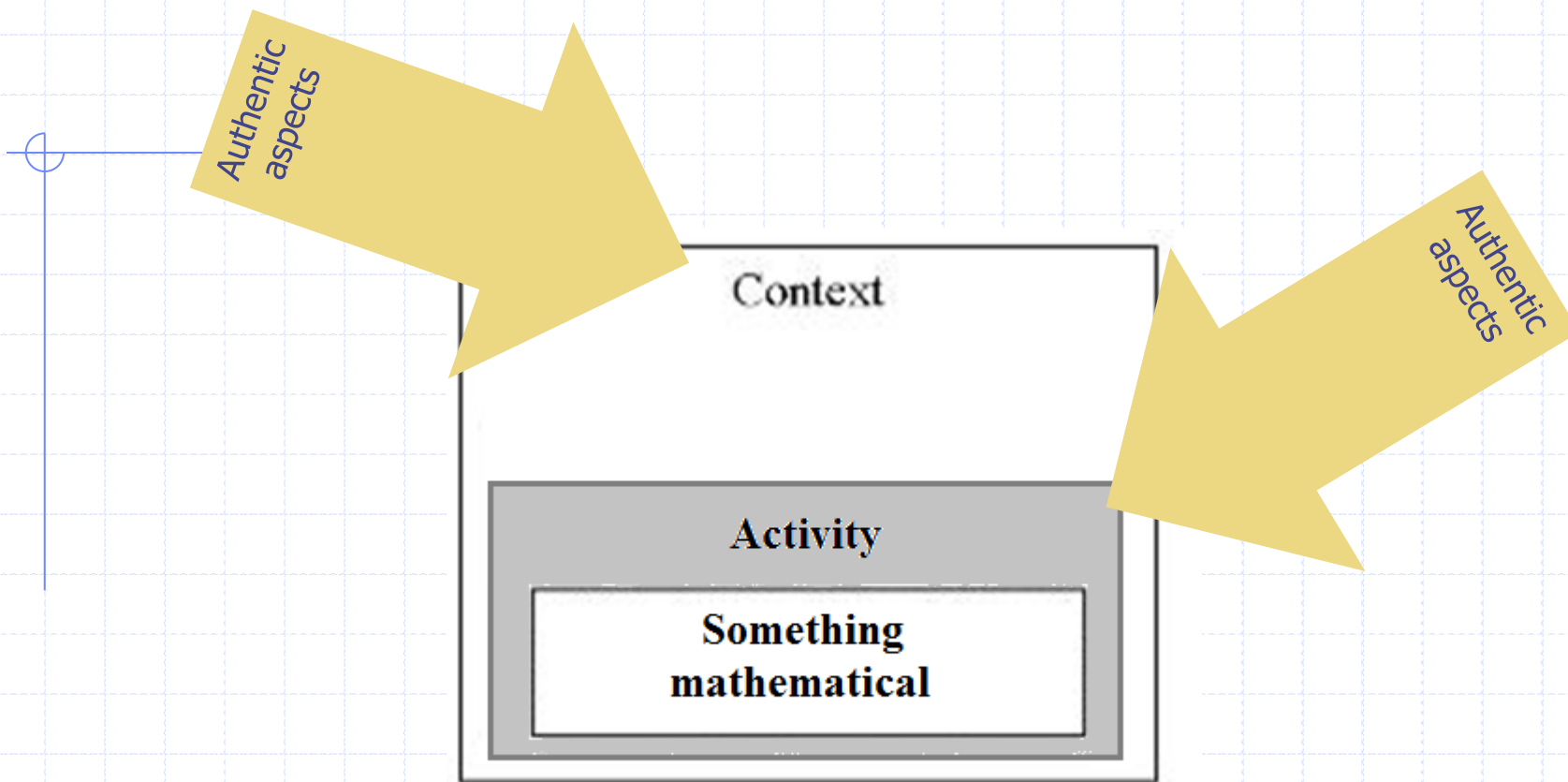
- ◆ Mathematics as a tool for solving real problems
- ◆ Modelling as a vehicle to learn (about) mathematics

Contexts should be

- ◆ relevant
- ◆ meaningful
- ◆ motivating
- ◆ justifying and justifiable



ICTMA-17  
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# Research on authentic aspects

## Conclusions from earlier research:

- ◆ authentic resources in themselves do not ask for mathematical activities
- ◆ authentic resources foster motivation
- ◆ authentic resources embody a link between extra-institutional experiences and mathematical content

Vos, P. (2015). Authenticity in extra-curricular mathematics activities; researching authenticity as a social construct. In M.S. Biembengut, et al (Eds.), *Teaching mathematical modelling: History and future prospects*. New York: Springer.

Vos, P. (2011). What is 'Authentic' in the Teaching and Learning of Mathematical Modelling? In G. Kaiser, et al. (Eds.), *Trends in Teaching and Learning of Mathematical Modelling* (pp 713-722). New York: Springer.

Vos, P., Devesse, T.G. & Rassul Pinto, A.A. (2007). Designing Mathematics Lessons in Mozambique: Starting from Authentic Resources. *African Journal for Research in Mathematics, Science and Technology Education*, 11(2), 51-66.

# Simulation: inauthentic



# Steering Bridge simulator

- ◆ “Authentic learning environment”
- ◆ Relevant for future helmsmen on big ships
- ◆ Realistic aspects:
  - readings, instruments, software
  - horizon with harbor of Singapore
  - dress code
- ◆ Cheaper
- ◆ Risc = 0

# Wikipedia: authenticity

- ◆ **authenticity** refers to the truthfulness of origins, attributions, commitments, sincerity, and intentions; not a copy or forgery.

**Authenticity** can be used in relation to:

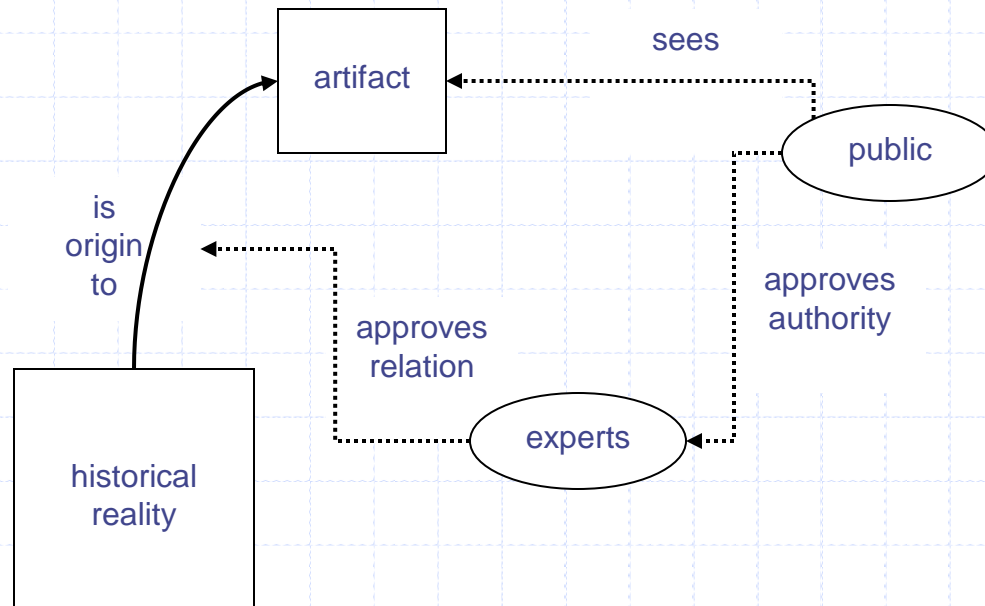
- ◆ Archaeological forgery is the process of creating works lacking authenticity in that they claim a false ancient origin and history.







# 'Authenticity' in Archaeology



# 'Authenticity' in Archaeology

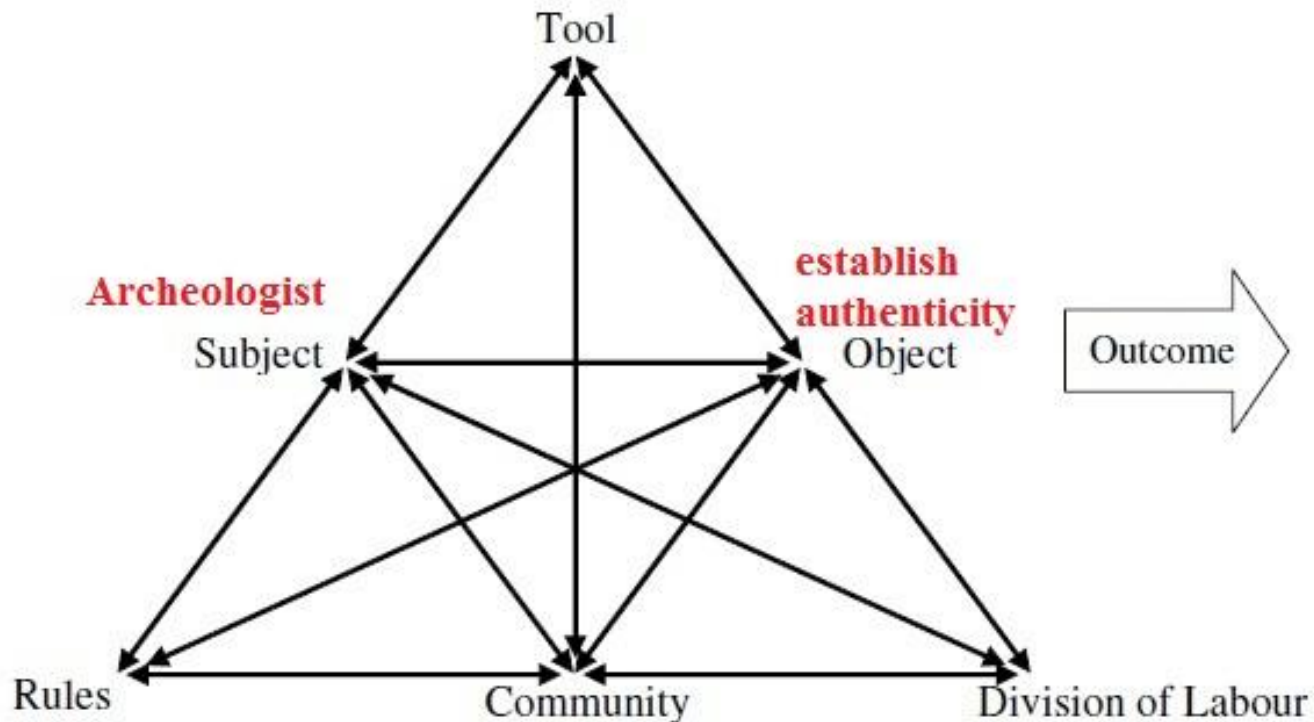



Figure 1. Engeström's Extended Activity Theory Model (Engeström, 2001)

# Authenticity is a social construct

Needed for an artifact to be authentic:

- ◆ an origin
- ◆ a certification



# What authentic aspects can we see in Mathematical Modelling education ?

## A case study

# 2010-2011: students go on mathematics excursions

- ◆ Excursions for secondary school students to universities

Age 15-18, they follow "Mathematics D" (Further Advanced Mathematics)

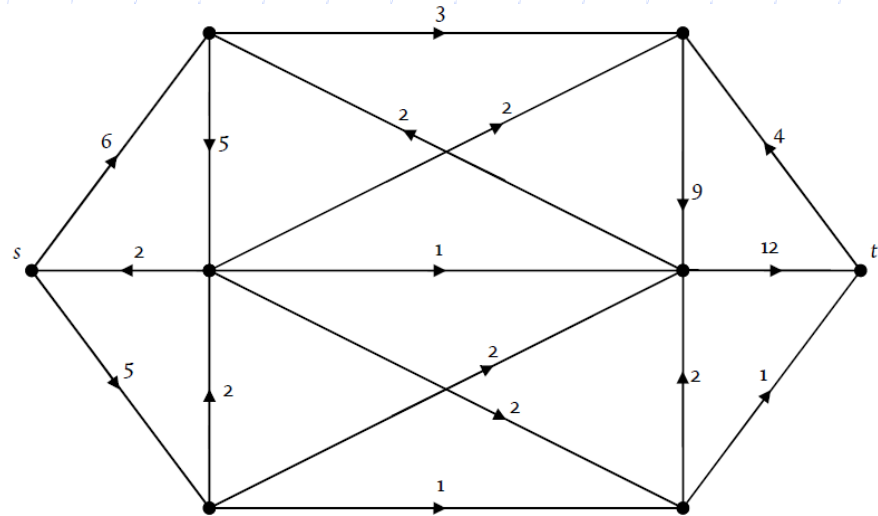
- ◆ Connect to mathematics used by professionals

- ◆ Seven excursions were developed

Cryptography, Stock market, Biodiversity, Naval Navigation, Bicycle with Square Wheels, Geometry on a Ball, Railway Time Table

# Case: Railway Time Table

◆ Connects to  
Graph Theory  
(Discrete  
Mathematics)



◆ In 2007 the Dutch Railways (NS) renewed their time table with help of mathematics researchers from University of Amsterdam

# Excursion

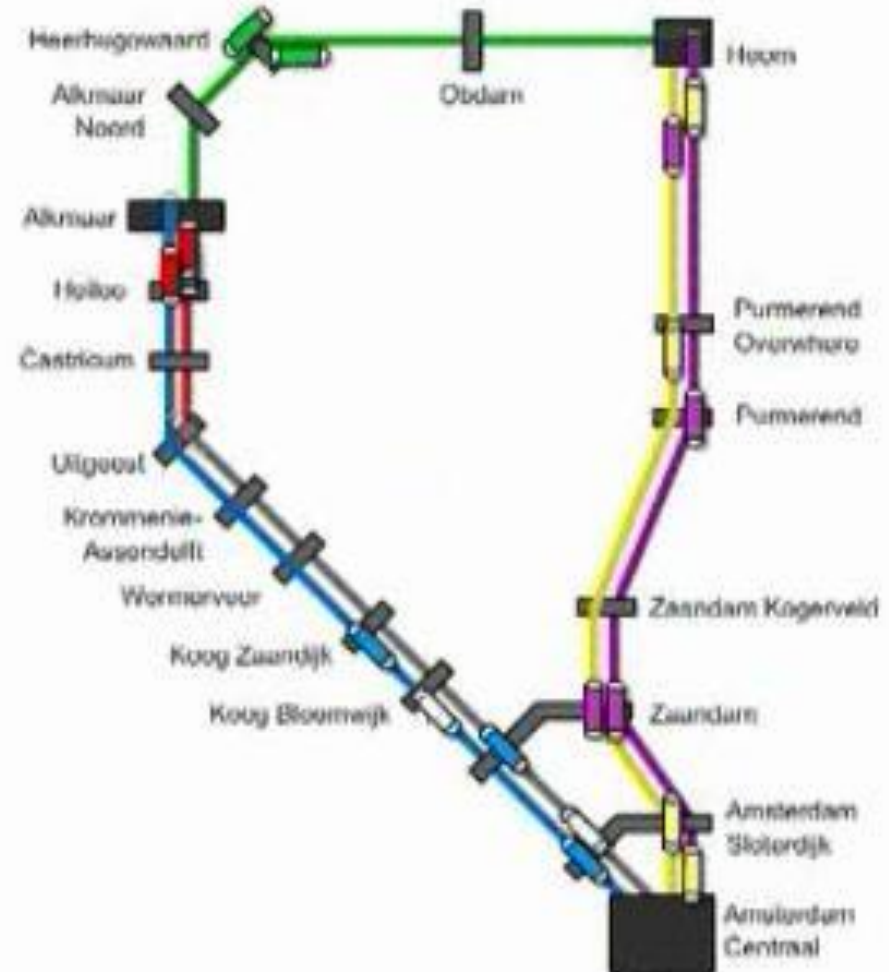
## “Railway Time Table Dynamics”

- ◆ Excursion to UvA for groups of pre-university students (grades 11-12), max 20 students
- ◆ Full day (10.00-15.00h)
- ◆ Supervised by UvA student
- ◆ Video conferencing with NS-spokesperson
- ◆ Laptops with planning software
- ◆ One task

# Task in “Railway Time Table Dynamics”

One task:

to create  
a cyclic time table  
for North Holland  
(a peninsula)





# Excursion

## “Railway Time Table Dynamics”

<http://www.youtube.com/watch?v=4V4k57oQdks>

# Method

- ◆ Observation
- ◆ Interviews
- ◆ Coding on authenticity by identifying
  - Origin
  - Certification

# Results: (in-)authentic aspects

## Inauthentic:

- Scaffolding in the beginning of the task
- Making a time table for North-Holland
- software specially developed for the excursion

## Authentic:

- University building, mathematicians, university students
- Problem of creating a time table (origin: NS; certif: video conferencing)
- Application of mathematics (origin: NS, UvA research; certif: video conferencing)
- "The frustration of the researcher" (origin: research world; certif: testimony of researchers)

# Conclusion

- ◆ Authenticity: defined as a social construct with origin and certification
  - ◆ Authenticity is not something you can “feel”
  - ◆ Authenticity does not depend on personal perceptions
- ◆ The certification is not always given, while this could easily be done
- ◆ Not all aspects from a task need to be authentic
- ◆ In-authentication on behalf of educational attainability

# For the research agenda ...

- ◆ More research into question authentic aspects for math<sup>cal</sup> modelling education
  - Theory needed on what is public (social constructs) and what is personal (perceptions, constructions) in modelling education
  - How to make the mathematics *visible* that is hidden in so many aspects of daily life, and how to use the revealing in mathematical tasks
  - How to include authentic aspects into project-based work, assessment, etc
  - What is “authentic mathematics”?



Thank you

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