



Computing-related Pre-conceptions of Primary School Children: Initial Insights from a Pre-study

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Support

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(Charles University)

Starting point I.

Computer science curricula

- Updated across the world
- Including lower **primary** education
- Czechia: compulsory in Grade 4+ (age ~9+)

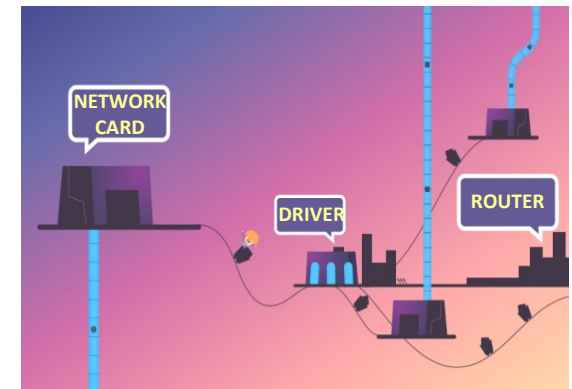
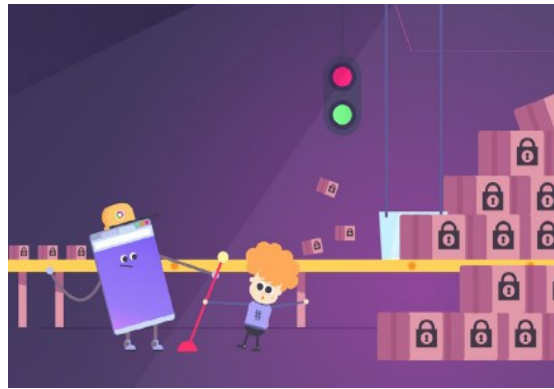
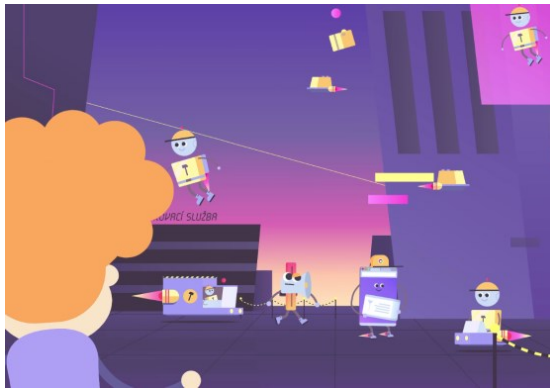
- Programming
- **Principles of the digital world**

Starting point II: How Computers Function

Data Newtown

- animated educational series (10 episodes, 5 min)
- talkshow (7 episodes, 5-8 min)
- model lessons for teachers

decko.cz/datovalhota



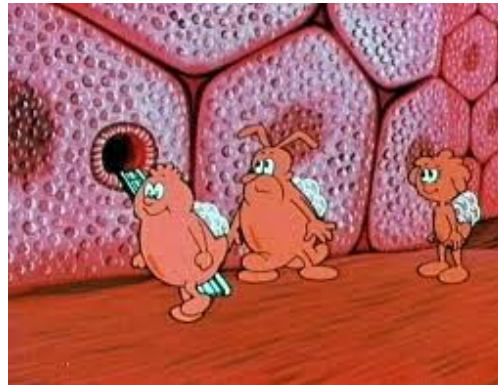
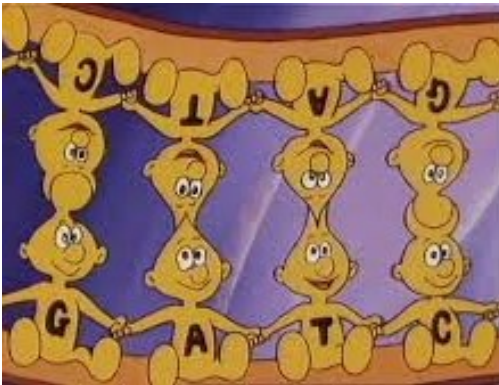
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Starting point II.

Once Upon a Time... Life

- animated series for children (1-5-graders)
- functional model of human body





Preconceptions:
Preliminary mapping study

Preconceptions: Literature

- Patchy literature
- Older children
- Sometimes extant

- Patchy knowledge

e.g. Brinda et al., 2018; Brinda & Terjung, 2017; Diethelm et al., 2012; Dinet & Kitajama, 2011; Kafai, 2008; Papastergiou, 2005; Robertson et al., 2017; Rucker & Pinkwart, 2016

Topics

Computer viruses

Computer antiviruses

Software updates

Data storage

Data size

Internet

Computer code

Programmable entities

Method

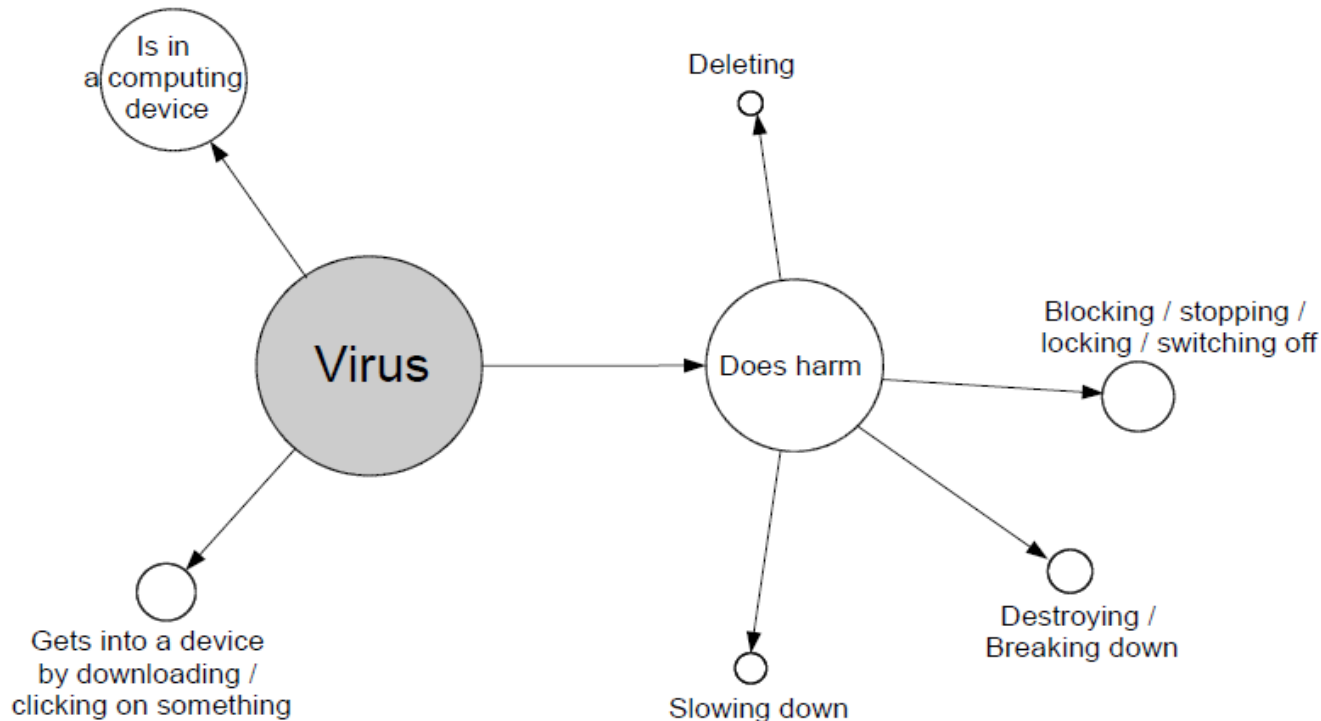
- N ~ 700, 27 Czech classes (not only Prague)
 - $n = 28$, German, after-school clubs
- 2-5-graders (age: 8-11)
- 2019 – 2020

- Data collection:
 - classroom observations (model school lessons)
 - brief interviews (2-3 min)
 - tests

Katerina Tsarava, Manuel Ninaus

Key Results: Viruses

- Prior knowledge, 2-graders:
 - 1/3: some limited knowledge about viruses
 - no knowledge about antiviruses and software updates



size for:
all children
have this
conception

Key Results: **Viruses**

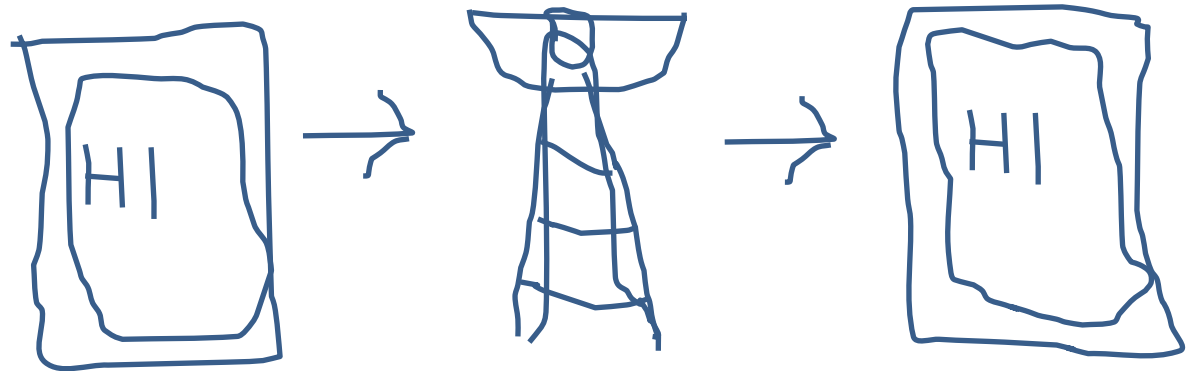
- Prior knowledge, 3-5-graders
 - basics about viruses: “they harm computers”
 - only modest awareness of antiviruses and software updates
 - misconceptions, e.g., “antiviruses delete viruses from the internet”
- 20 – 40 min long lessons
 - teaching by analogies
 - Data Newtown
 - knowledge improvement (2-4-graders)

Key Results: Data

- Prior knowledge, 2-3-graders:
 - sometimes: lack of the notion of data size, thus data storage
 - data = paid, mobile wifi
- 20 – 40 min long lessons
 - knowledge improvement (2-4-graders)

Key Results: Internet

- Tough topic (even 5-graders)
- Various meanings (cf. “what is television”)
 - specific icons on the smart phone
 - inside the smart phone
 - central tower
- Limited structural understanding (5-graders)
 - direct
 - via a tower
 - via a satellite



Key Results: Programmable entities

- 45 min long lessons (2-4-graders)
 - computer does not have emotions
 - computer does not have a brain
 - computer is a programmable entity
 - computer code is a sequence of instructions

Summary

- 2-graders: limited knowledge about viruses and protection against them, but teachable
- 2-graders: teachable that computer is programmable
- 2-3-graders: sometimes lack the idea of data size, but teachable
- 5-graders: understanding of the internet: difficult

Key questions for the round table

- What type of knowledge entities?

- explanatory primitives? – **click-and-have**
- action-specific facets? – **virus harms**
- mental models? – **text messages goes via a tower**
- spatial models? – **a virus can be in a PC**

Kapon & diSessa, 2012

Minstrell, 1992

- How to measure pre-conceptions?

- clinical / semi-structured interviews
- **scaling up**: knowledge tests?

Ginsburg, 1997; Kapon & diSessa, 2012

- Conceptual change perspective

- preconception difficult to change?

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Thanks!

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Kateřina Kačerovská, Pavel Ježek,
Tereza Stárková, Anna Yaghobová,
Katerina Tsarava, Manuel Ninaus

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