

# Properties and Applications of Wrong Answers in Online Educational Systems

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# Wrong answer

Student modeling - input: **0,1**

are some wrong answers more wrong?

## Feedback for teachers

common mistakes of a class

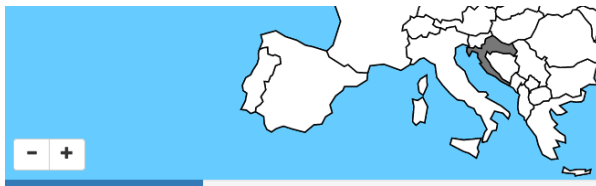
## Detecting level of knowledge

$$5 \times 5 \neq 30$$

$$5 \times 5 \neq 24$$

$$5 \times 5 \neq 17$$

## Question construction



What is highlighted?



Albania



Bulgaria



Croatia



Italy



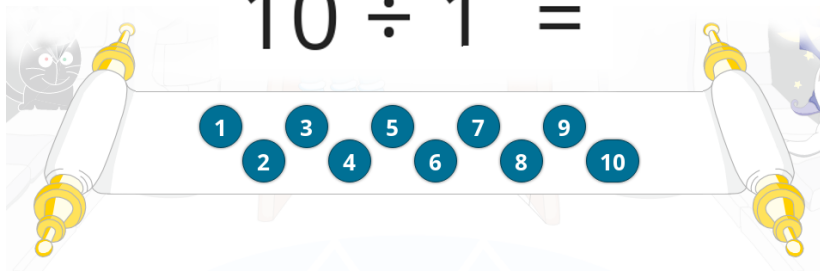
Luxembourg



Serbia

## Problem in user interface

$$10 \div 1 =$$



... and much more



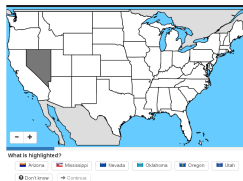
# Systems



matmat.cz

basic arithmetic

elementary school



outlinemaps.org

geography

high school

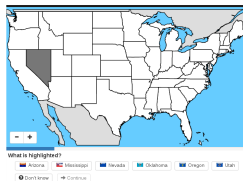
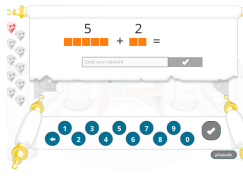


practiceanatomy.com

human anatomy

university

# Systems



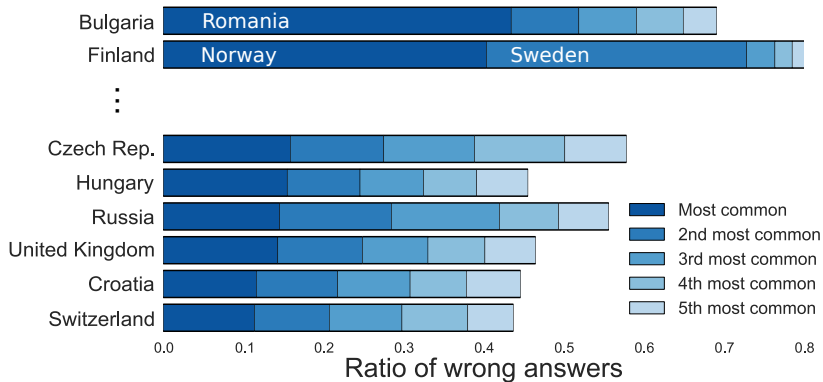
- simple tasks
- adaptivity - selection of questions
- > 200 000 answers

# Wrong Answers - Geography

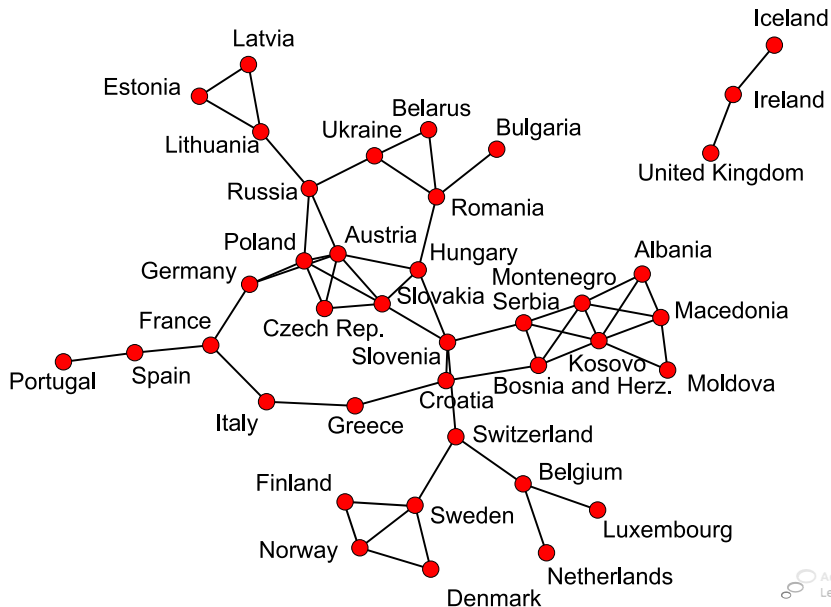
## Countries

- common border, similar size, same first letter
- importance of practice context - Madagascar

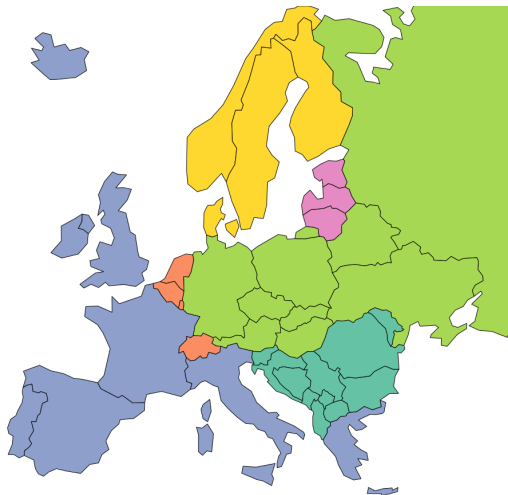
# Common Wrong Answers - Geography



# Confusion Graph



# Item Clustering



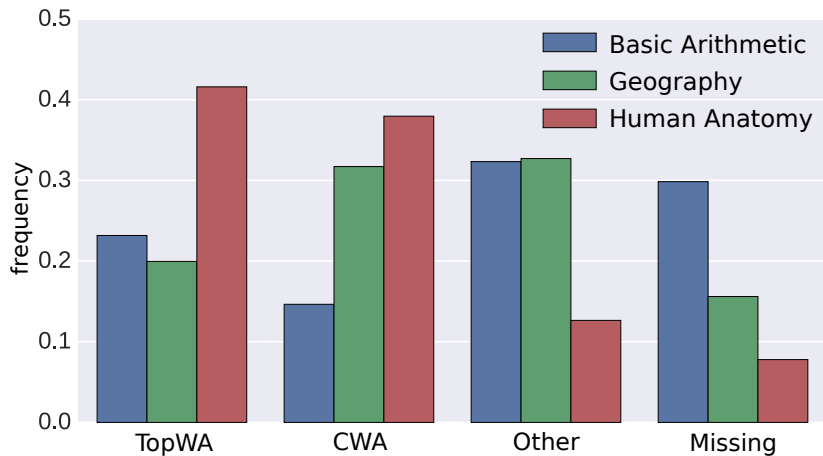
# Cross-system Comparison



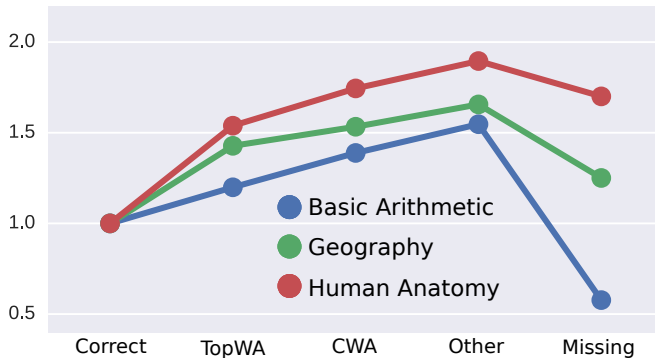
# Categories of Wrong Answers

- **TopWA** - most common wrong answer
- **CWA** - other common wrong answers -  $> 5\%$
- **Other**
- **Missing** - question skipped by learner

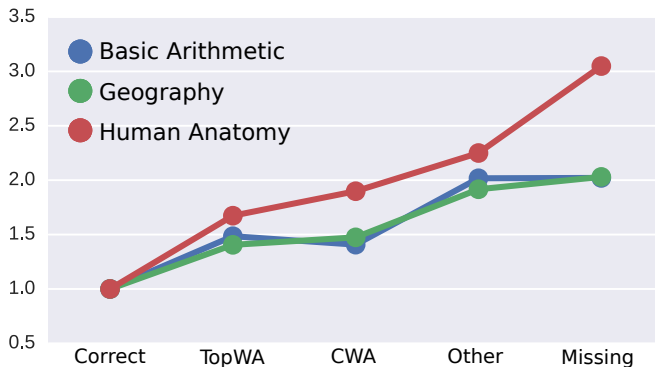
# System comparison



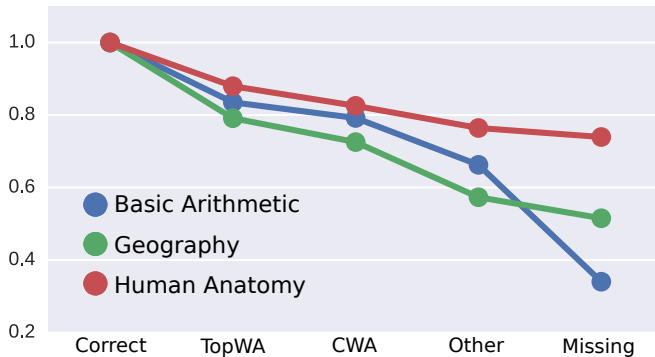
# System comparison - Response time



# System comparison - Probability of Leaving



# System comparison - Future Success



# Categories of Wrong Answers

- **TopWA, CWA, Other, Missing**
- equally distributed
- linear behaviour
- similar behaviour in different domains
- good measure of wrongness - interval variable

## Wrong answers

- are **easy to collect**
- have **many applications**: question and hint construction, feedback and inspiration, ...

## Contributions

- **item clustering**
- **measure of wrongness**