

Properties and Applications of Wrong Answers in Online Educational Systems

Radek Pelánek, **Jiří Řihák**

Masaryk University Brno



Wrong answer

Learner input to wrongly answered question

Feedback for teachers

common mistakes of a class

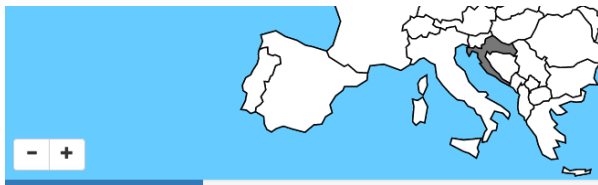
Detecting level of knowledge

$$5 \times 5 \neq 30$$

$$5 \times 5 \neq 24$$

$$5 \times 5 \neq 17$$

Question construction



What is highlighted?

 Albania

 Bulgaria

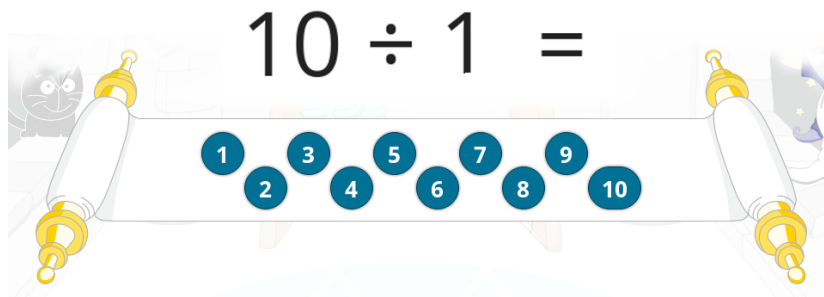
 Croatia

 Italy

 Luxembourg

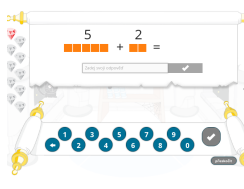
 Serbia

Problem in user interface



... and much more

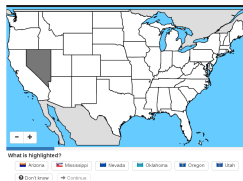
Systems



matmat.cz

basic arithmetic

elementary school



outlinemaps.org

geography

high school

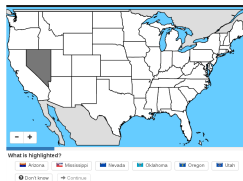
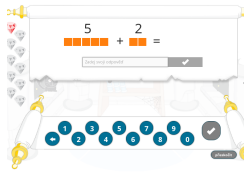


practiceanatomy.com

human anatomy

university

Systems



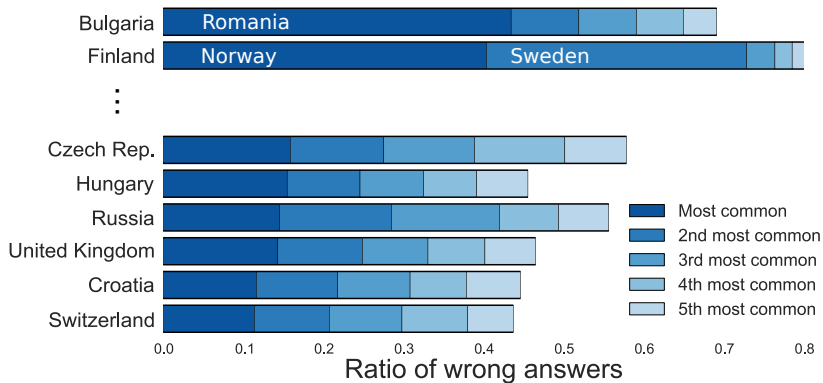
- simple tasks
- adaptivity - selection of questions
- > 200 000 answers

Wrong Answers - Geography

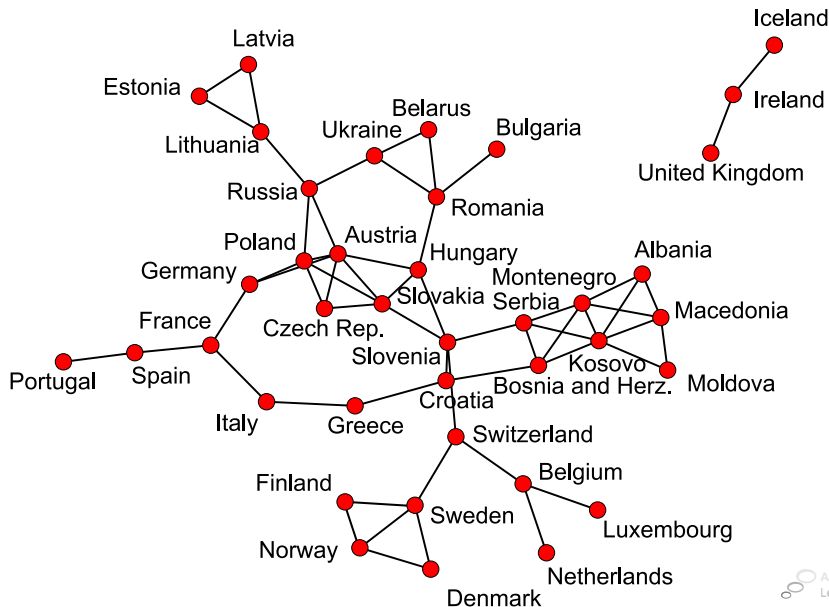
Countries

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

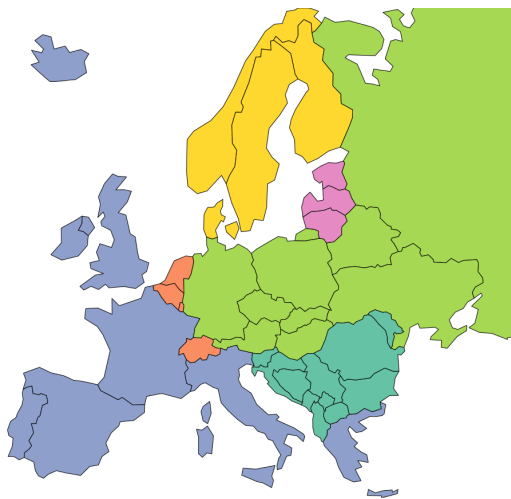
Common Wrong Answers - Geography



Confusion Graph



Item Clustering

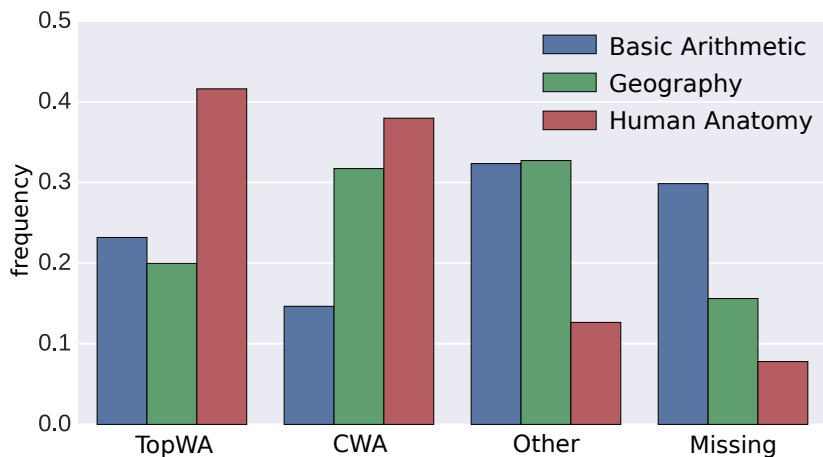


Cross-system Comparison

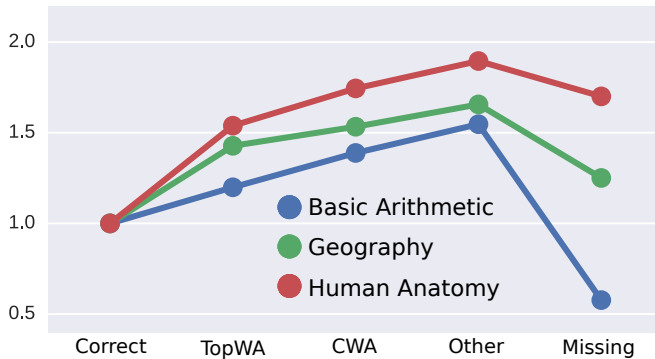
Categories of Wrong Answers

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

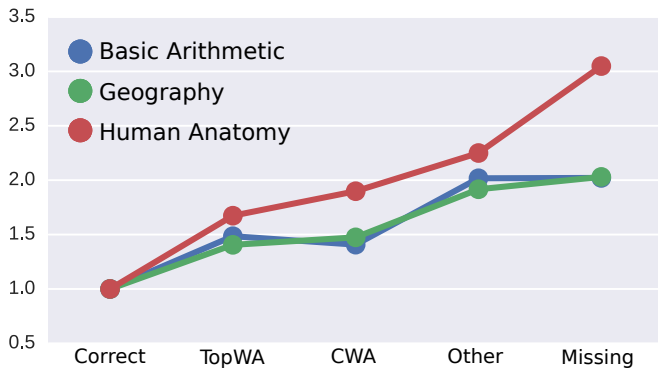
System comparison



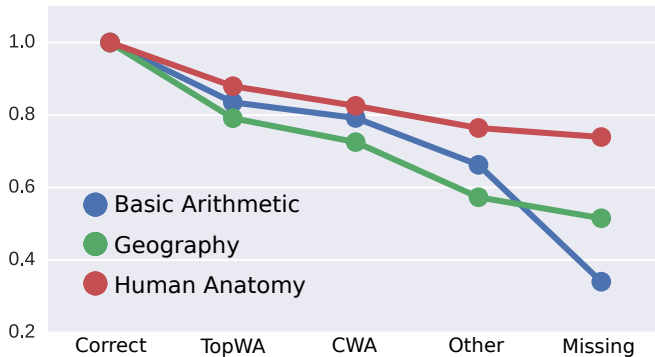
System comparison - Response time



System comparison - Probability of Leaving



System comparison - Future Success



- **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**
- has **many applications**: question and hint construction, feedback and inspiration, ...

Contributions

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