

Properties and Applications of Wrong Answers in Online Educational Systems

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Feedback for teachers

common mistakes of class

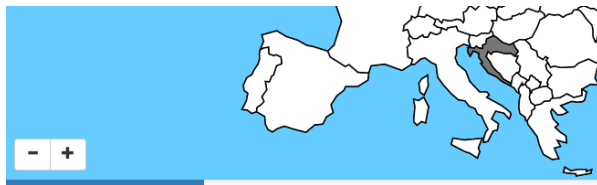
Detecting misconceptions

$$5 \times 5 \neq 30$$

$$5 \times 5 \neq 24$$

$$5 \times 5 \neq 17$$

Question construction



What is highlighted?



Albania



Bulgaria



Croatia



Italy



Luxembourg



Serbia

Problem in user interface



Wrong answers

...

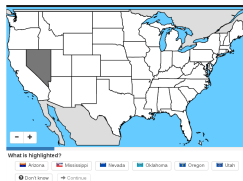
Systems



matmat.cz

basic arithmetic

elementary school



outlinemaps.org

geography

high school

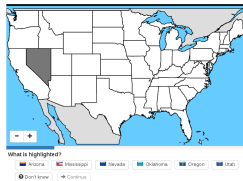


practiceanatomy.com

human anatomy

university

Systems



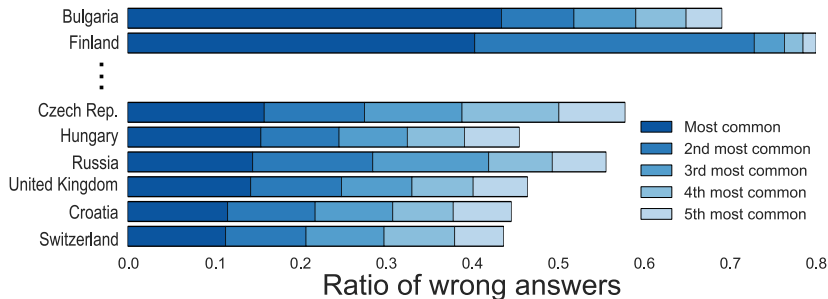
- simple tasks
- adaptivity - selection of questions

Wrong Answers - Geography

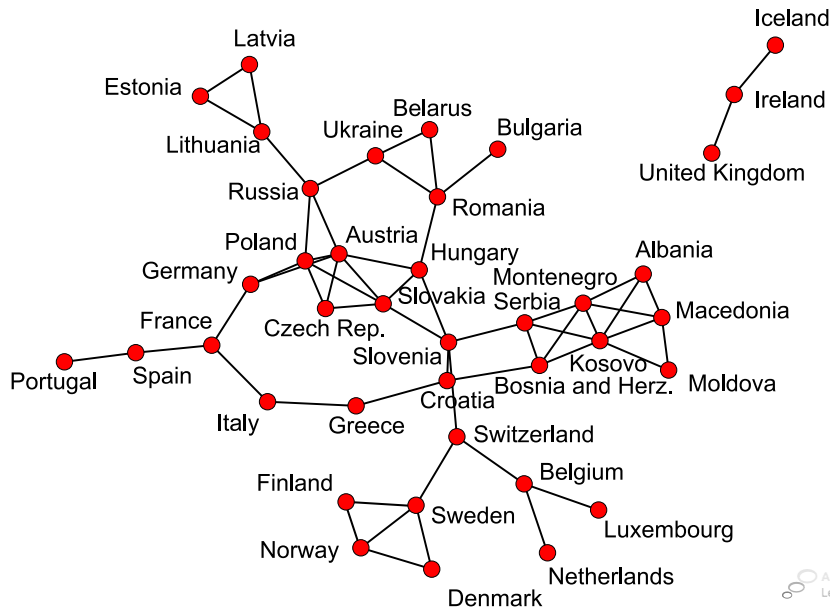
Countries

- common border, similar size, same first letter
- within the same continent
- islands are confused together
- . . .
- importance of practice context - Madagascar

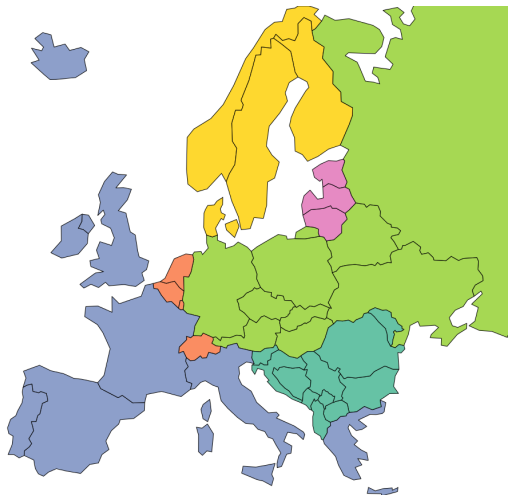
Common Wrong Answers - Geography



Confusion Graph



Item Clustering

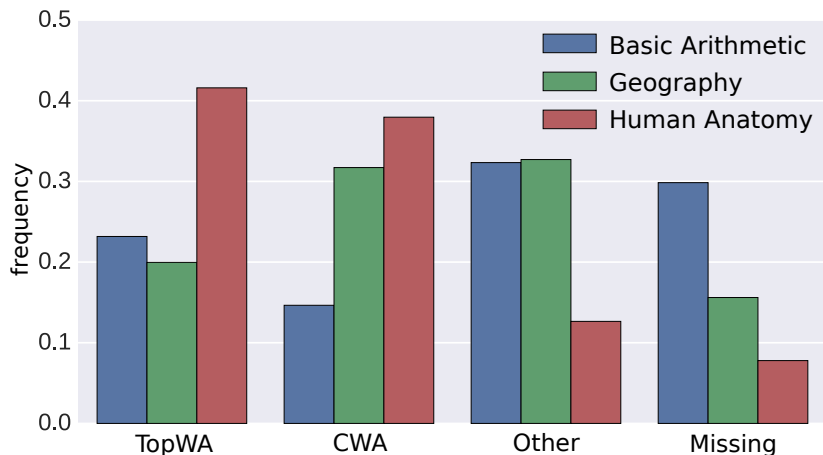


Cross-system Comparison

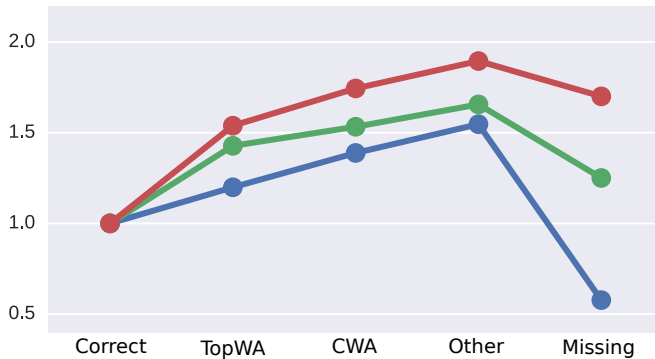
Categories of Wrong Answers

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

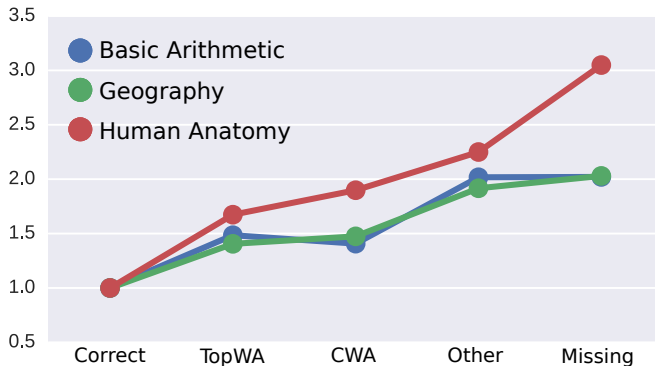
System comparison



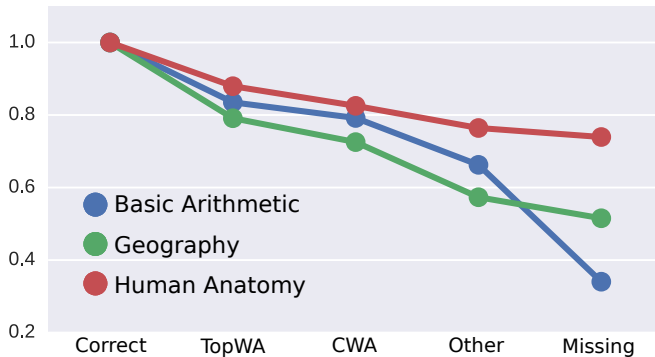
System comparison - Response time



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

Wrong answers

- are **easy to collect**
- has **many applications**: question and hint construction, feedback and inspiration, ...
- for **item clustering**
- as **measure of wrongness**