Introduction into Parametrised Quizzes and LA with the STACK Framework

Hands-on Tutorial

Schweizerischer Tag über Mathematik und Lehre
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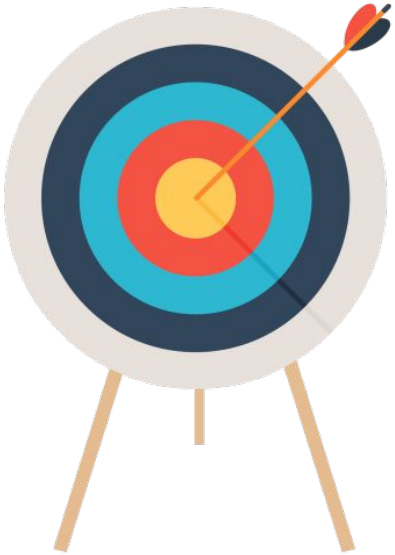
Context of online exercises

Training



Final assessment

How to create online exercises?

Built-in question types

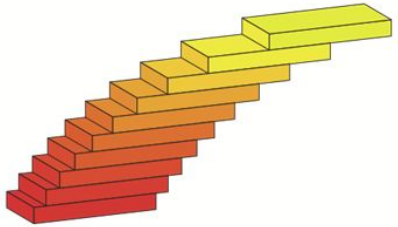
- Multiple choice question
- Short answer question
- Essay question
- Matching question
- Cloze question
- Image map question
- Numeric question
- Formula question

Are these question types handy for training and assessing mathematics?

Challenges

- Time investment
- One input (type) per question
- No matrix or vector inputs possible
- Parametrisation possible to some limited extent.

What is STACK?



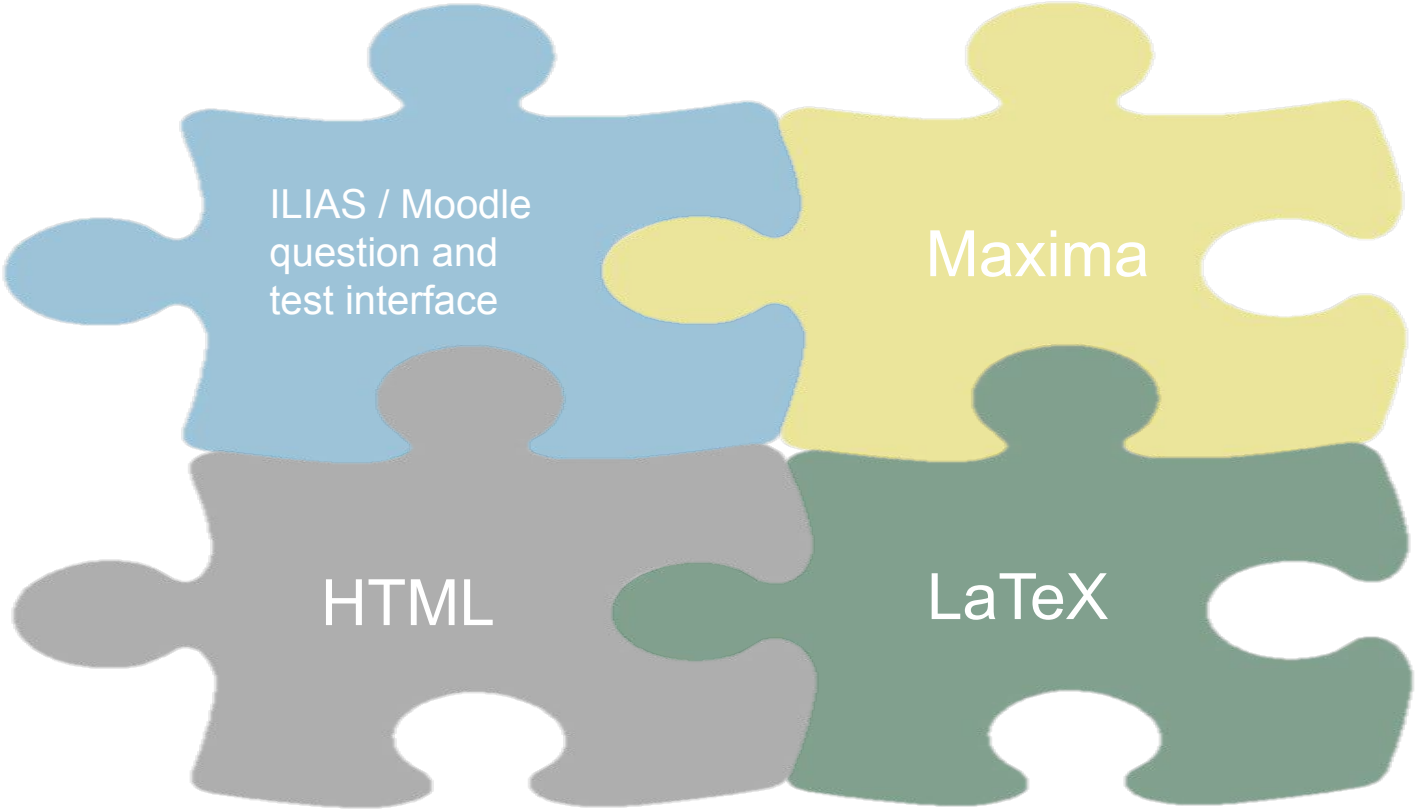
System for **T**eaching and **A**ssessment using a **C**omputer algebra **K**ernel

- is able to carry out **symbolic calculations**
- is able to **evaluate the result** of symbolic calculations
- allows for **several input fields** (of different type) in a single exercise
- allows for the creation of **parametrised** exercises.

More about STACK

- Open-source & free
- Was developed at University of Birmingham 18 year ago, and now it is hosted by University of Edinburgh
- Integration:
  - via plugin to Moodle and ILIAS
  - via LTI protocol to other LMSs

Expertise


ILIAS / Moodle
question and
test interface
Maxima
HTML
LaTeX

STACK question

Question authoring elements

compulsory
- name
- question text
- model answer
- evaluation of answer (PRT)

- question variables
- feedback

Checking the answer

- validity
- correctness

Demo: Link to the course environment

Hands-on exercises

Exercise 1. We provide the equation of two lines and students will decide, whether these lines have an intersection point, do not have any common point or are identical.

Exercise 2. We introduce some **random factors** in the equations of the lines.

Exercise 3. We extend Exercise 1 by asking students to provide an example for two lines that don't have any common points.

Exercise 4. We ask students to eliminate the variable *x* from the second equation of a system of linear equations with two variables, and ask them to decide, whether the system is compatible or not. Here we **evaluate the answer to the second question as a function of the first answer**.

STACK - our use cases

1. Linear Algebra exercises
2. Online Self-Assessment in mathematics
3. Formative assessments for the maths course for economists
4. Online module “Focus on Reasoning and Proofs”

Learning Analytics

LEARNING ANALYTICS is the measurement, collection, analysis and reporting of **data about learners and their contexts**, for purposes of **understanding** and **optimising learning** and the **environments** in which it occurs …

As a research and teaching field, Learning Analytics sits at the convergence of **Learning** (e.g. educational research, learning and assessment sciences, educational technology), **Analytics** (e.g. statistics, visualization, computer/data sciences, artificial intelligence), and **Human-Centered Design** (e.g. usability, participatory design, sociotechnical systems thinking).

(Society for LA Research: https://www.solaresearch.org/about/what-is-learning-analytics/)

Key uses

Some of the most popular goal of learning analytics include:

1. Prediction of student academic success (identification of students at risk)
2. Supporting student development of lifelong learning skills and strategies
3. Provision of personalised and timely feedback to students regarding their learning
4. Supporting development of important skills such as collaboration, critical thinking, communication and creativity
5. Develop student awareness by supporting self-reflection
6. Support quality learning and teaching by providing empirical evidence on the success of pedagogical innovations

Linear Algebra

Solved part (%)	Number of students
100%	61
90% - 99.99%	11
Below 90%	6

Available Data	Number of students	Coefficient of correlation
OSA & Traditional HW	48	0.53
OSA & Grade in Lin. alg. I	34	0.72

Psychological Assessment

1. We are introducing dashboards to give a visually intuitive feedback about the learning progress of students.
2. From a previous study we understood, that

- additional online formative exercises have different impact for students belonging to different time investment & performance groups.

Therefore,

- we are **predicting** the (low, low), (low, high), (high, low), (high, high) time investment & performance groups
- with the intention to carry out an **intervention** after the first half of the semester

Thank you for your participation

Questions?