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MetaMath: the goals, the approach, the outcomes

16/02/2017, St. Petersburg, Russia

Project Profile

- Full Title: MetaMath: Modern Educational Technologies for Math Curricula in Engineering Education of Russia

- Funded under Tempus IV program (6th call)
- Overall budget: 1 144 862,55 €

- Start: 01/12/2013
- Planned to end: 30/11/2016
- Will end: 28/02/2017

11 partners:

- 5 from EU (FI, FR, DE)
- 6 from Russia

- 9 Universities
- 1 Research Institute
- 1 NGO

Consortium Structure

Tempus

UNIVERSITÄT DES SAARLANDES

Coordinator

Consortium Management

RU

Quality Control and Accreditation

EU

Technical Expertise

Project Coordination Board

EU

Pedagogical Expertise

RU

TAMPERE UNIVERSITY OF TECHNOLOGY

Lyon 1

TECHNISCHE UNIVERSITÄT CHEMNITZ

Нижегородский государственный университет им. Н.И. Лобачевского

Казанский национальный исследовательский технический университет им. А.Н. Туполева

НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ МОРДОВСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ им. Н. П. ОГАРЁВА

Project Motivation: Key Challenges in Engineering Education

Responding to the changes in global context

Improving perception of engineering subjects

Retention of engineering students

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Nature of technical problems is changing, as technology penetrates more of society

Responding to the changes in global context

The global environment requires changes in Engineering education

Engineering knowledge and competencies evolve with increasing speed

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Engineering disciplines are often perceived as difficult and boring

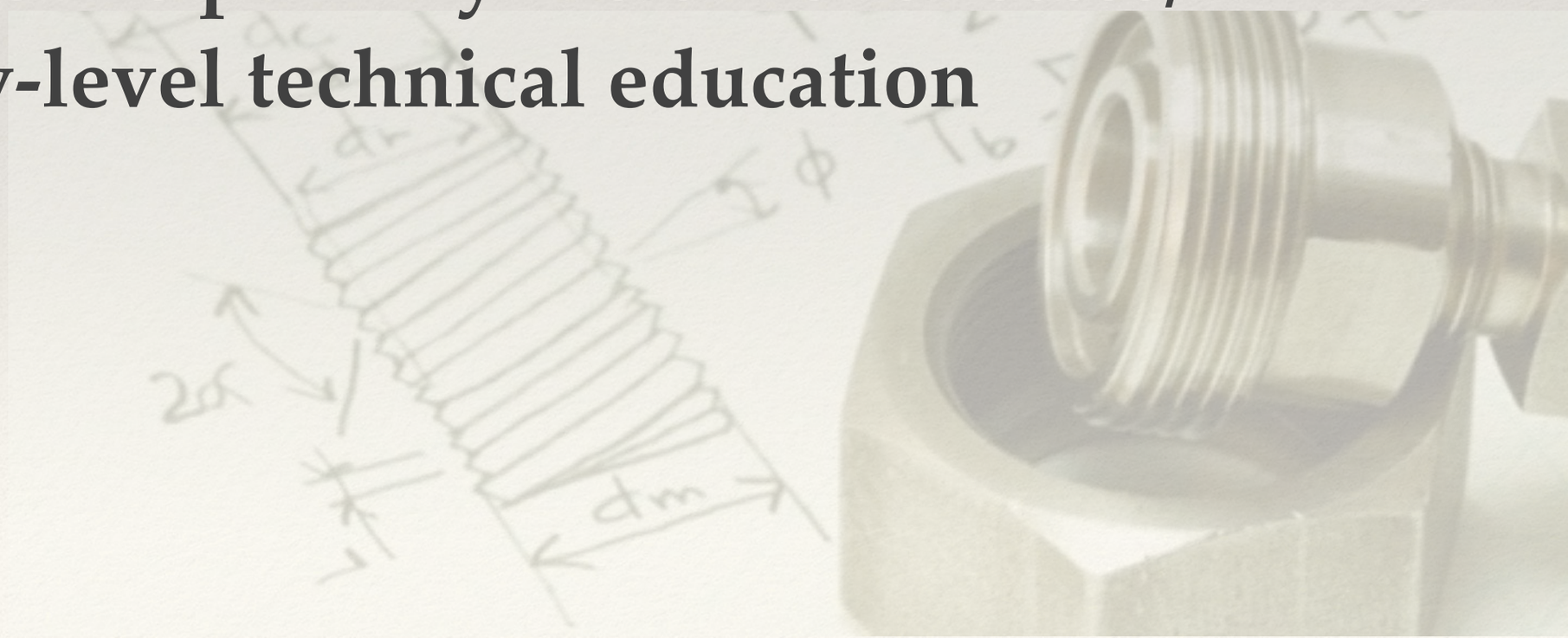
Engineering students often develop little professional identity in the beginning of their studies

Retention of Engineering students

Drop out rates in Engineering programs are very high

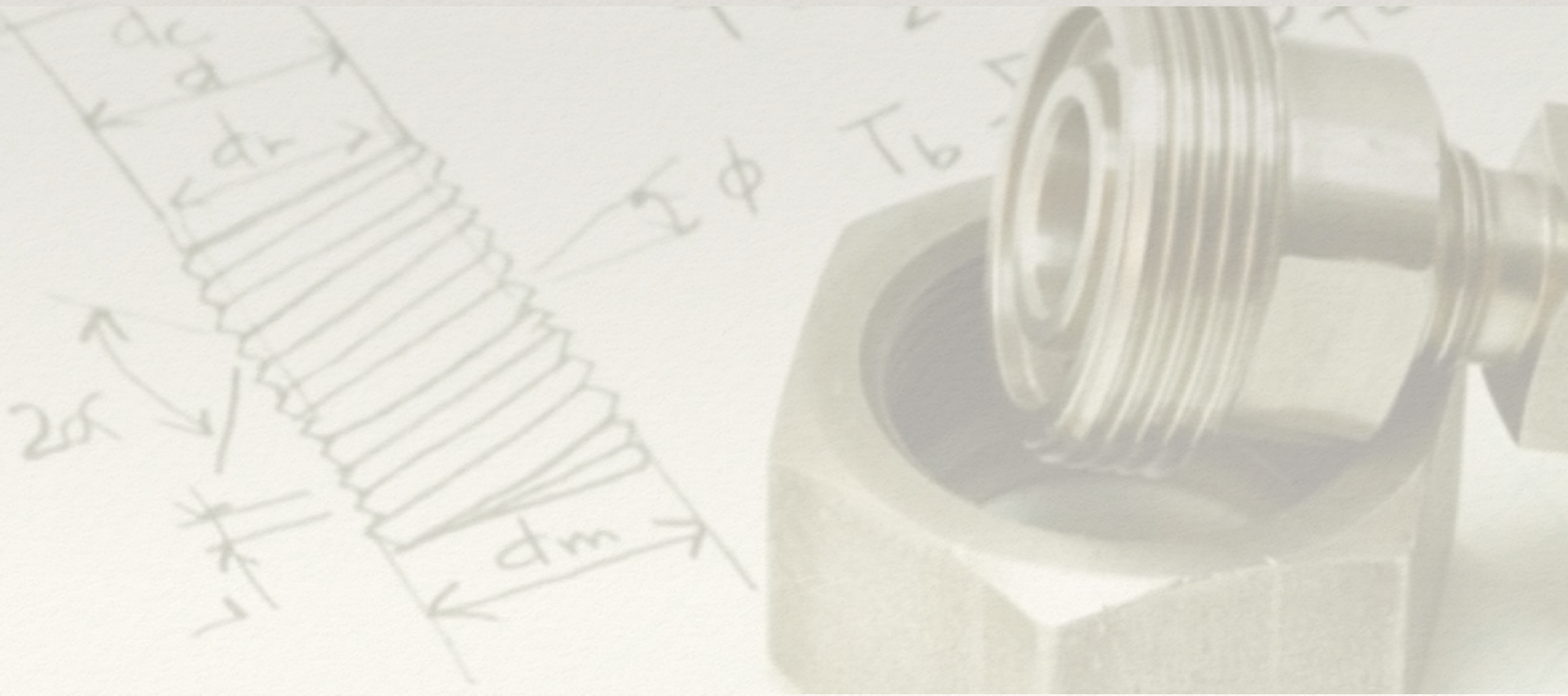
Role of Math in Engineering Education

- Math is the key subject for all engineering disciplines
- Basic math competencies are prerequisites for many technical skills
- **Study after study show that the level of math knowledge is the primary factor for success/failure in university-level technical education**



University mathematics

- There is a big difference between school and university mathematics
- Lack of engineering students and demand for more engineering graduates forces universities to lower entrance math standards
- Students tend to underestimate the volume of mathematics in technical studies



MetaMath Approach

- Russia has great traditions of both math education and technical education
- But, there is a lack of exchange with international community, and insufficient level of usage of modern ICT in real classrooms
- Hence the goals of MetaMath:

MetaMath Approach

- **Study** EU experience of math education for engineers
- **Conduct** a comparative analysis of EU and RU best practices
- **Identify** potential ways to improve RU math courses

Phase 1

- **Build up** necessary capacities in RU universities
- **Implement** a selected set of modernised courses

Phase 2

- **Evaluate** modernised courses in real classrooms

Phase 3

Phase 1: Similarities

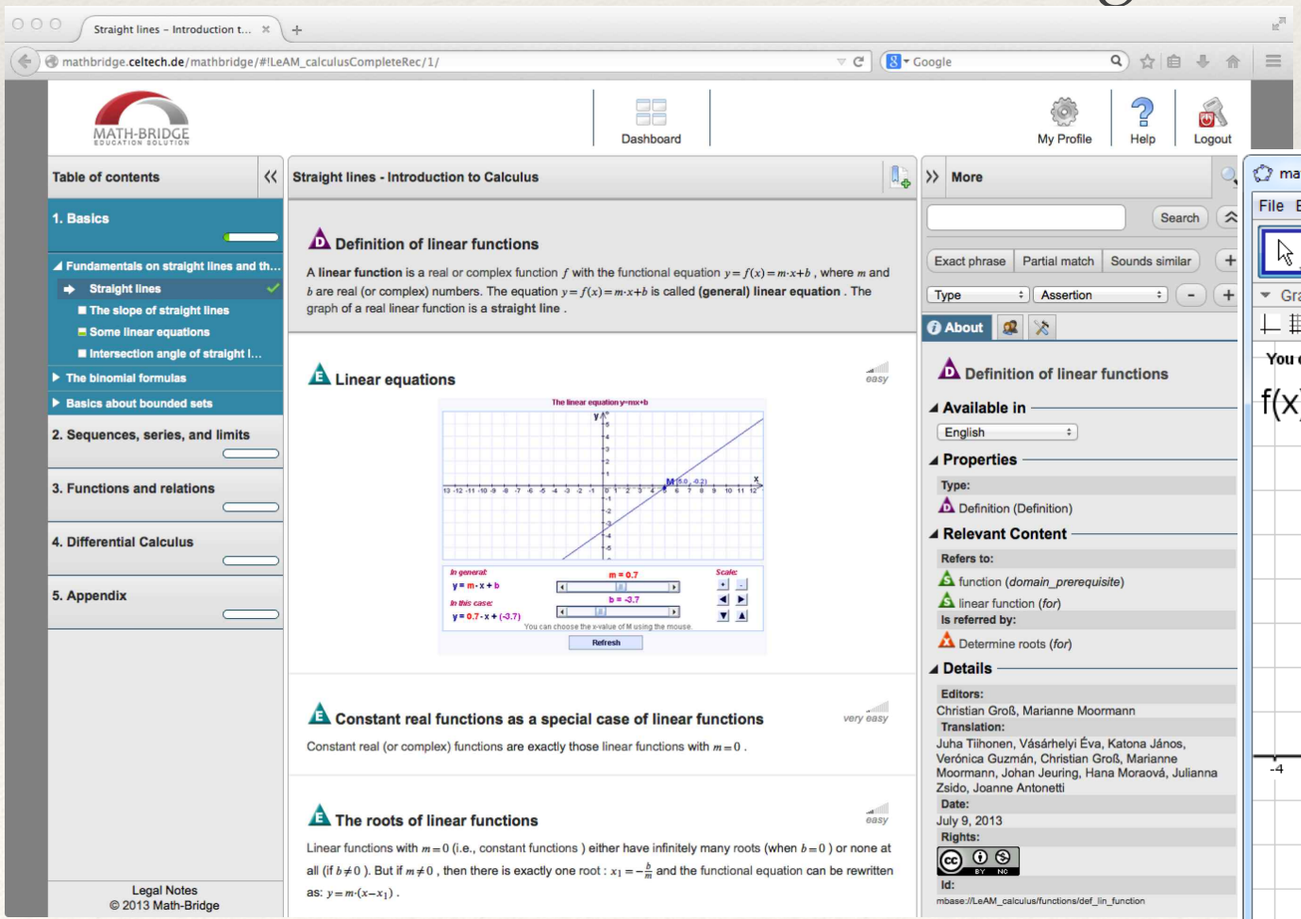
- No significant differences, when it comes to:
  - Learning content (courses and topics)
  - Number o credits (ECTS),
  - Course compositions (lecture / practice / independent work)
  - Course size and teacher availability

Phase 1: Differences

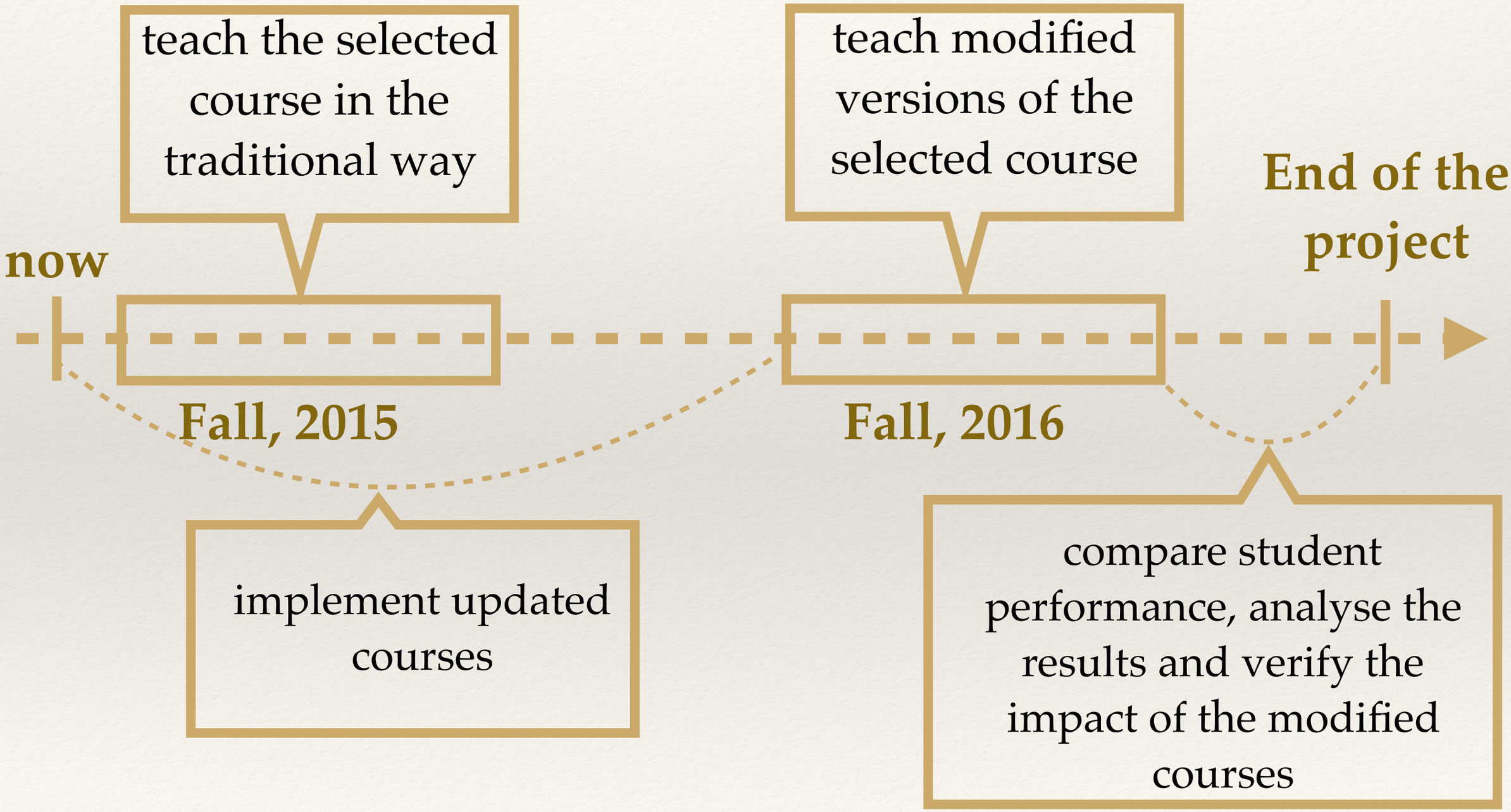
- In EU, the system is more **elastic**:
  - students have more freedom in terms of choosing their courses;
  - universities have more freedom in terms of modifying courses if needed;
  - a standard practice of student-based course evaluation provides constant and timely feedback.
- In EU, the universities also phase the problem of low math competencies of new students, but
  - there is common solution - **Bridging Courses**
- In EU, usage of **e-Learning** technologies and tools is broader
- In EU, **math for engineers** is taught in a much more **applied** way:
  - focus is made on learning how to use math as a tool when solving practical engineering problems, not on theorem proving

Phase 2

- We cannot address all problems, we have chosen 2:
  - Modification of course material to focus on more applied competencies
  - Introduction of e-Learning technologies:



Phase 3: Large-scale Evaluation



Details of MetaMath Activities and Outcomes

- **Comparative analysis of math courses for engineers in Russian and EU**

  Seppo Pohjolainen, TUT

- **Modification of math courses in Russian universities**

  Alexey Syromyasov, OMSU

- **Evaluation of modified courses**

  Chistian Mercat, UCBL

- **Perception of EU Math Education by Russian students**

  Wolfram Hardt, TUC

- **Relations between the MetaMath project and the ongoing reform of higher education in Russia**

  Oleg Kuzenkov, NNSU

Thank you