

***A framework of learning outcomes  
for research and innovation  
designed in dialog with stakeholders***

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# About us



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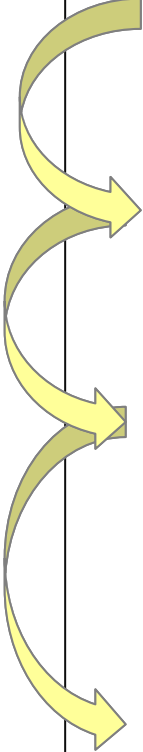
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  - B.S., M.S. in Applied Physics and Mathematics MIPT, 1998-2004
  - PhD in Computational aeroacoustics, University of Leeds (UK), 2007-2010
  - Postdoc Thermo-acoustic instabilities, TU Munich (Germany), 2010-2012
  - Curriculum design, Skolkovo Institute of Science and Technology, April 2012

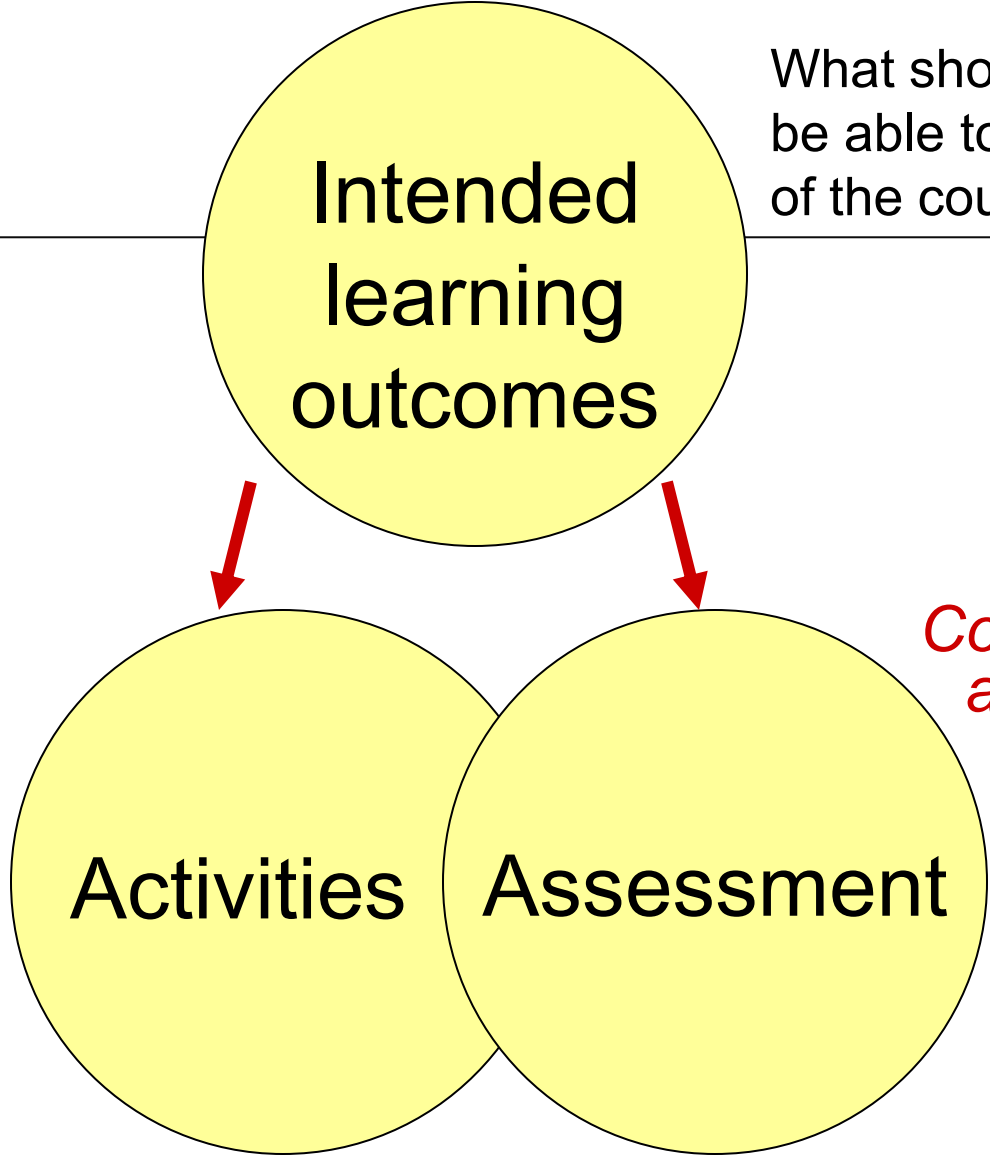
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# ***A structured outcomes-based approach***

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- **High-level goals – establishing a vision of the graduates**
    - Starting from an analysis of stakeholder needs, the context and conditions
  - **Formulating program learning outcomes**
    - Specific learning outcomes for professional skills, as well as disciplinary knowledge, validated by program stakeholders
  - **Integrated curriculum design**
    - Designing a curriculum structure with mutually supporting courses, integrating disciplinary knowledge and professional skills
    - Systematically assigning high-level goals to course level learning outcomes
  - **Integrated learning experiences – course design**
    - Designing integrated learning experiences that lead to the acquisition of disciplinary knowledge and professional skills
    - Designing learning activities and assessment in alignment with the intended learning outcomes

Learning outcomes are the basis for course design

What should the students be able to do as a result of the course?

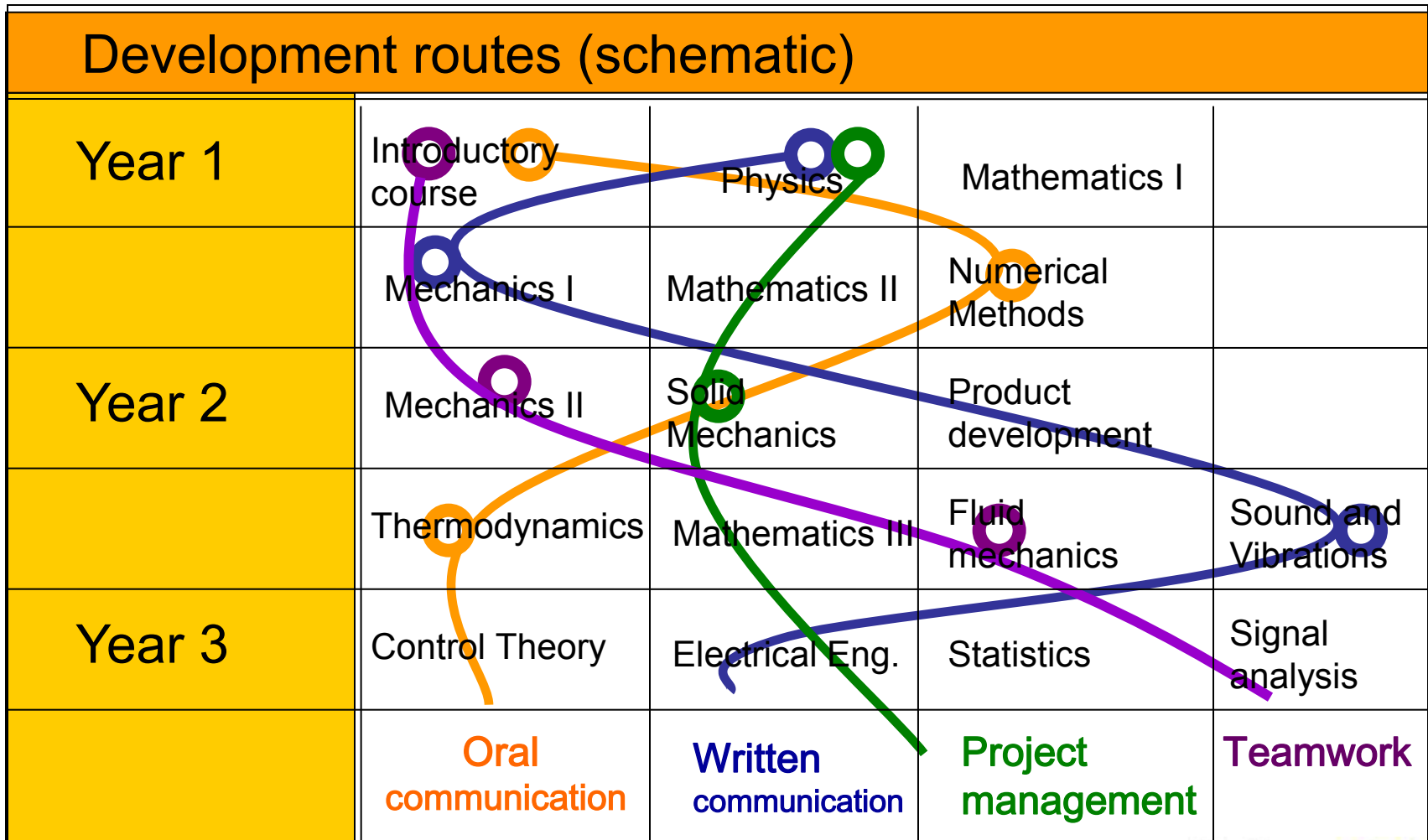


*Constructive alignment*  
[Biggs]

What work is appropriate for the students to do, to reach the learning outcomes?

What should the students do to demonstrate that they fulfil the learning outcomes?

# Systematic integration of engineering competencies



# Stakeholder perspectives

External stakeholders  
- *main interest is in results (outcomes)*

**Employers**

**Students**

Internal stakeholders  
- *additional interest in processes*

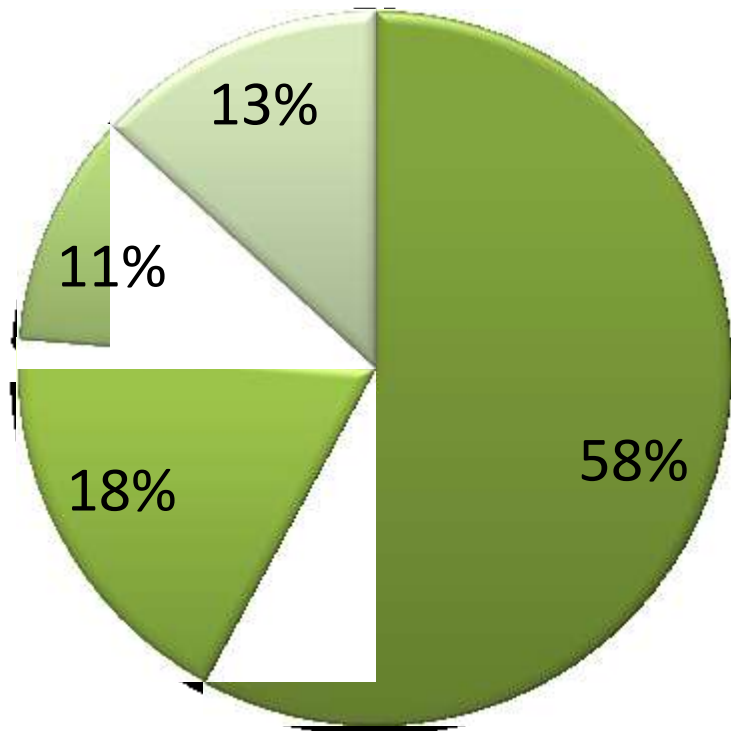
**Society**

**Faculty**

**Education**

# Stakeholders survey

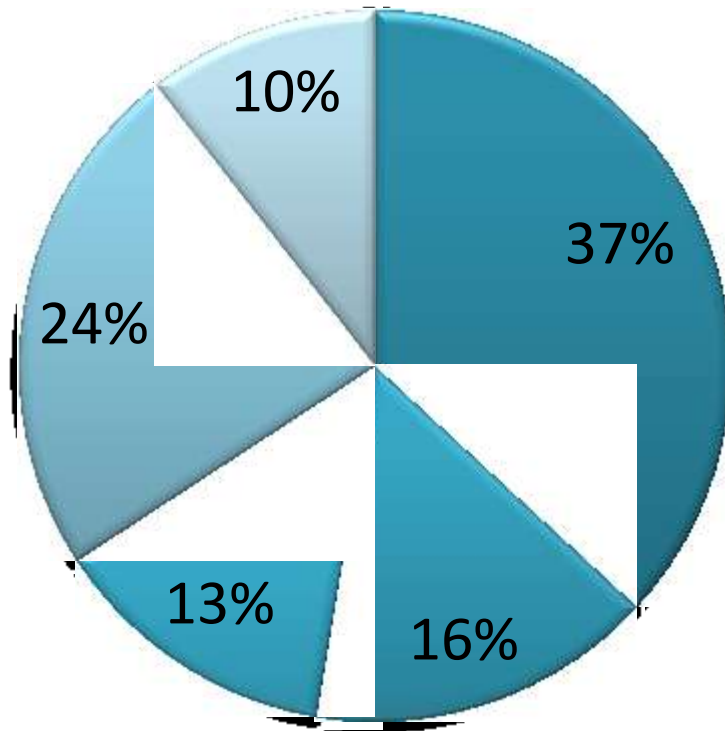
Survey Participants by Region



- Russian Stakeholders
- International Companies in Russia
- Participants from EU
- Participants from USA

# Stakeholders survey

Survey Participants by Type



- Large Companies
- Mid size Companies
- Startups
- Educational & Research Institutions
- Governmental Organizations



## ***More results to be published***

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# *Learning Outcomes Framework*

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- 1. DISCIPLINARY KNOWLEDGE AND REASONING**
- 2. PERSONAL ATTRIBUTES – THINKING, BELIEFS AND VALUES**
- 3. RELATING TO OTHERS – COLLABORATION AND COMMUNICATION**
- 4. LEADING THE INNOVATION PROCESS**

# ***1. DISCIPLINARY KNOWLEDGE AND REASONING***

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**1.1 KNOWLEDGE OF MATHEMATICS AND SCIENCES**

**1.2 KNOWLEDGE OF APPLIED SCIENCE AND ENGINEERING  
SCIENCE**

**1.3 KNOWLEDGE OF INNOVATION AND ENTREPRENEURSHIP**

**1.4 INTERDISCIPLINARY THINKING, KNOWLEDGE STRUCTURE  
AND INTEGRATION**

**1.5 KNOWLEDGE AND USE OF CONTEMPORARY METHODS AND  
TOOLS**

## **2. PERSONAL ATTRIBUTES – THINKING, BELIEFS AND VALUES**

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### **2.1 COGNITION AND MODES OF REASONING**

Analytical reasoning and problem solving

Experimentation, investigation and knowledge discovery

System thinking

Creative thinking

Decision making (with ambiguity, urgency etc)

Critical thinking and meta-cognition

### **2.2 ATTITUDES AND LEARNING**

Initiative and the willingness to take appropriate risks

Willingness to make decisions in the face of uncertainty

Responsibility, perseverance, urgency and will to deliver

Resourcefulness, flexibility and an ability to adapt

Self-awareness and a commitment to self-improvement, lifelong learning and educating

### **2.3 ETHICS, EQUITY AND OTHER RESPONSIBILITIES**

Ethical action, integrity and courage

Social responsibility

Equity and diversity

Trust and loyalty

Proactive vision and intention in life

# **3. RELATING TO OTHERS – COLLABORATION AND COMMUNICATION**

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## **3.1 COMMUNICATIONS**

Communications strategy and structure

Written, electronic and graphical communication

Oral presentation and discussion

Inquiry, listening and dialogue

## **3.2 COMMUNICATIONS IN INTERNATIONAL ENVIRONMENTS**

Communications in English in scientific, business and social setting

Effective interaction in different cultural and international settings

## **3.3 TEAMWORK**

Forming effective teams

Team operations and project management

Team coordination, decision-making and leadership

Team growth and evolution

Technical and multidisciplinary teaming

## **3.4 COLLABORATION AND CHANGE**

Establishing diverse connections and networking

Appreciating different roles, perspectives and interests

Negotiation and conflict resolution

Advocacy

Bringing about intentional change

# **4. LEADING THE INNOVATION PROCESS**

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**4.1 MAKING SENSE OF GLOBAL SOCIETAL, ENVIRONMENTAL AND BUSINESS CONTEXT**


**4.2 VISIONING – INVENTING NEW TECHNOLOGIES**

**4.3 VISIONING – CONCEIVING AND DESIGNING**

**4.4 DELIVERING ON THE VISION – IMPLEMENTING AND OPERATING**

**4.5 DELIVERING ON THE VISION – ENTREPRENEURSHIP AND ENTERPRISE**



An aerial night view of a modern university campus. The buildings are illuminated from within, and the surrounding area is lit up with streetlights and landscape lighting. The sky is dark with some clouds. The campus features a mix of modern architecture and green spaces.

Thank you for your attention!

Questions?