MEReP

4TU + RUG

4TU.AMI-SRI MATHEMATICS EDUCATION RESEARCH PROJECT

4TU.AMI

MATHEMATICS FOR INNOVATION

OUTLINE

- People in this SRI
- Objectives
- Mathematical Competencies
- Transition from secondary to higher education

4TU.AMI
MATHEMATICS FOR INNOVATION

PEOPLE

MEREP TEAM

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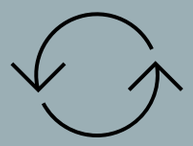
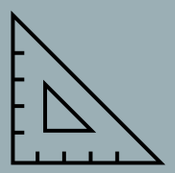
OBJECTIVES

Advancing Mathematical Competencies:
A Framework for Higher Education Collaboration



Updating Mathematical Education:
Meeting 21st Century Skills Effectively



Assessing/Quantifying Achievement in Mathematics Teaching:
Exploring Metrics and Strategies for Measuring Success in Mathematics Teaching Innovations

OBJECTIVES

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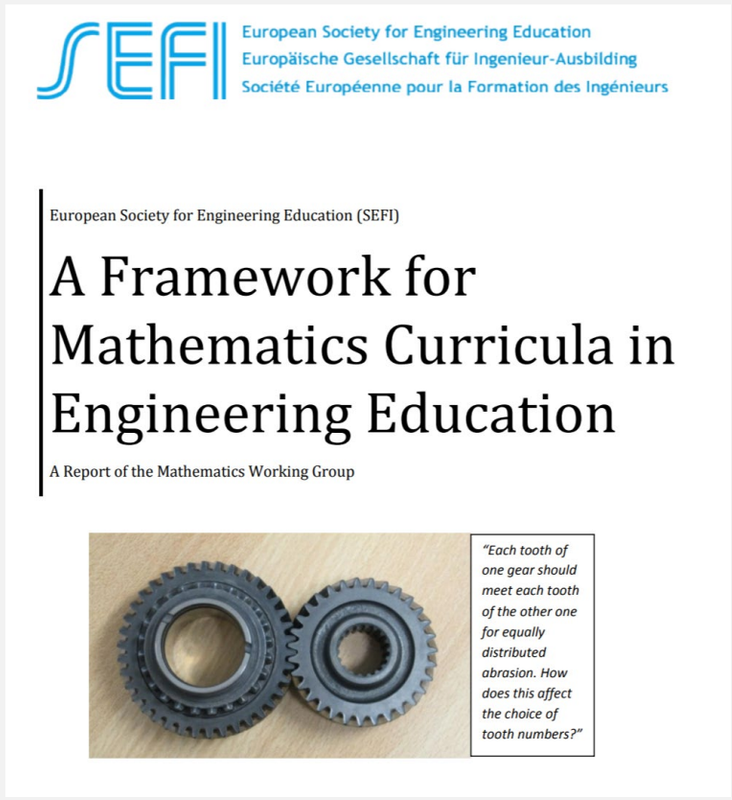
MATHEMATICAL COMPETENCIES

MATHEMATICAL COMPETENCY: DEFINITION

- "A *mathematical competency* is someone's insightful readiness to act appropriately in response to a specific sort of mathematical challenge in given situations"



Niss & Højgaard, 2019, p.14)

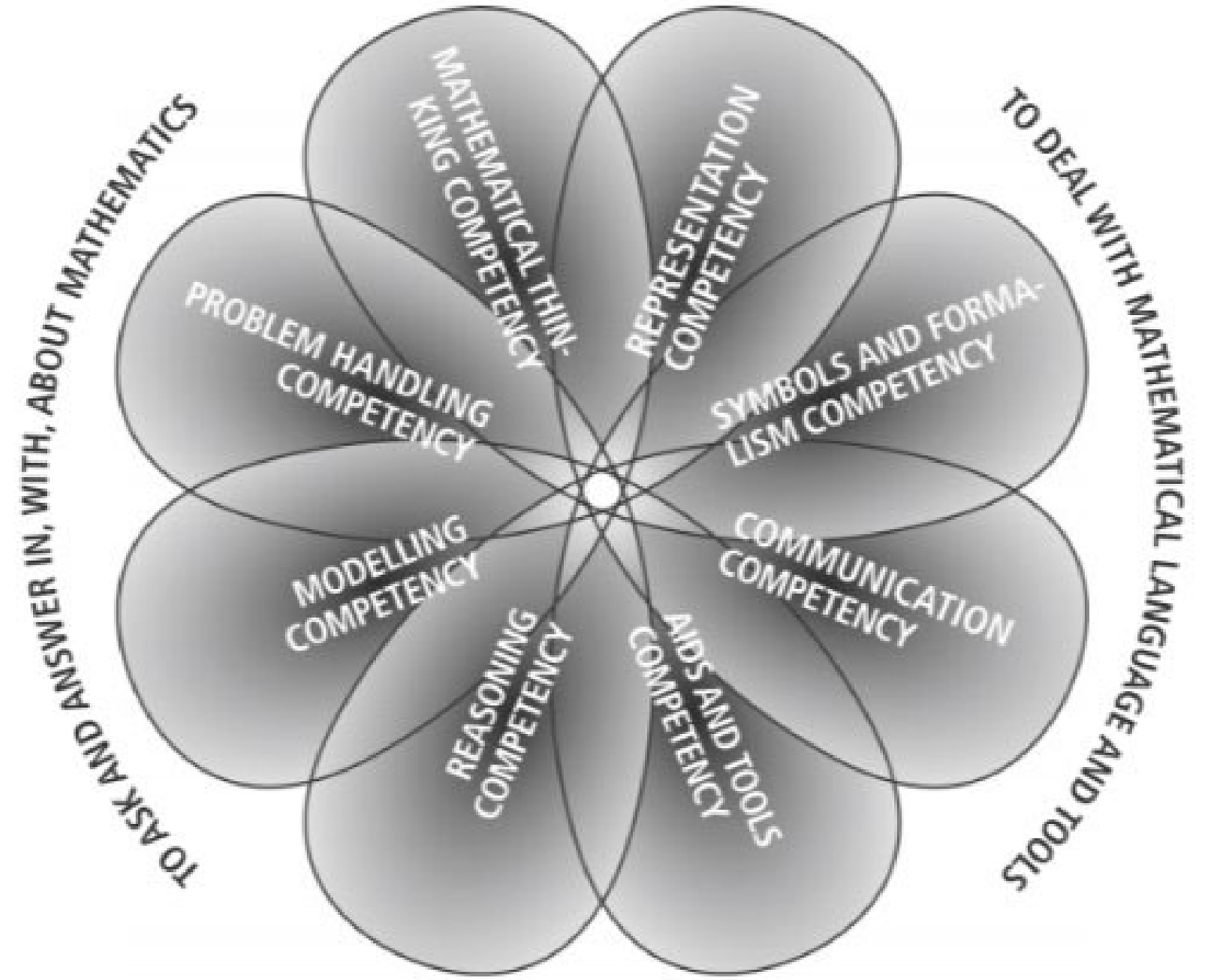
EIGHT MATHEMATICAL COMPETENCIES

(Niss & Højgaard, 2019)

1. Thinking mathematically
2. Reasoning mathematically
3. Posing and solving mathematical problems
4. Modelling mathematically
5. Representing mathematical entities
6. Handling mathematical symbols and formalism
7. Communicating in, with, and about mathematics
8. Making use of aids and tools

EIGHT MATHEMATICAL COMPETENCIES

(Niss & Højgaard, 2019)



RESEARCH ON MATHEMATICAL COMPETENCIES IN ENGINEERING EDUCATION: WHERE ARE WE NOW?

J. Wong, E. Papageorgiou, R.G. Klaassen,
N.J. van der Wal, L.E. Menschaart, & A.J. Cabo, 2022

RQ1:

WHAT IS THE CURRENT STATE OF RESEARCH ON MATHEMATICAL COMPETENCIES?

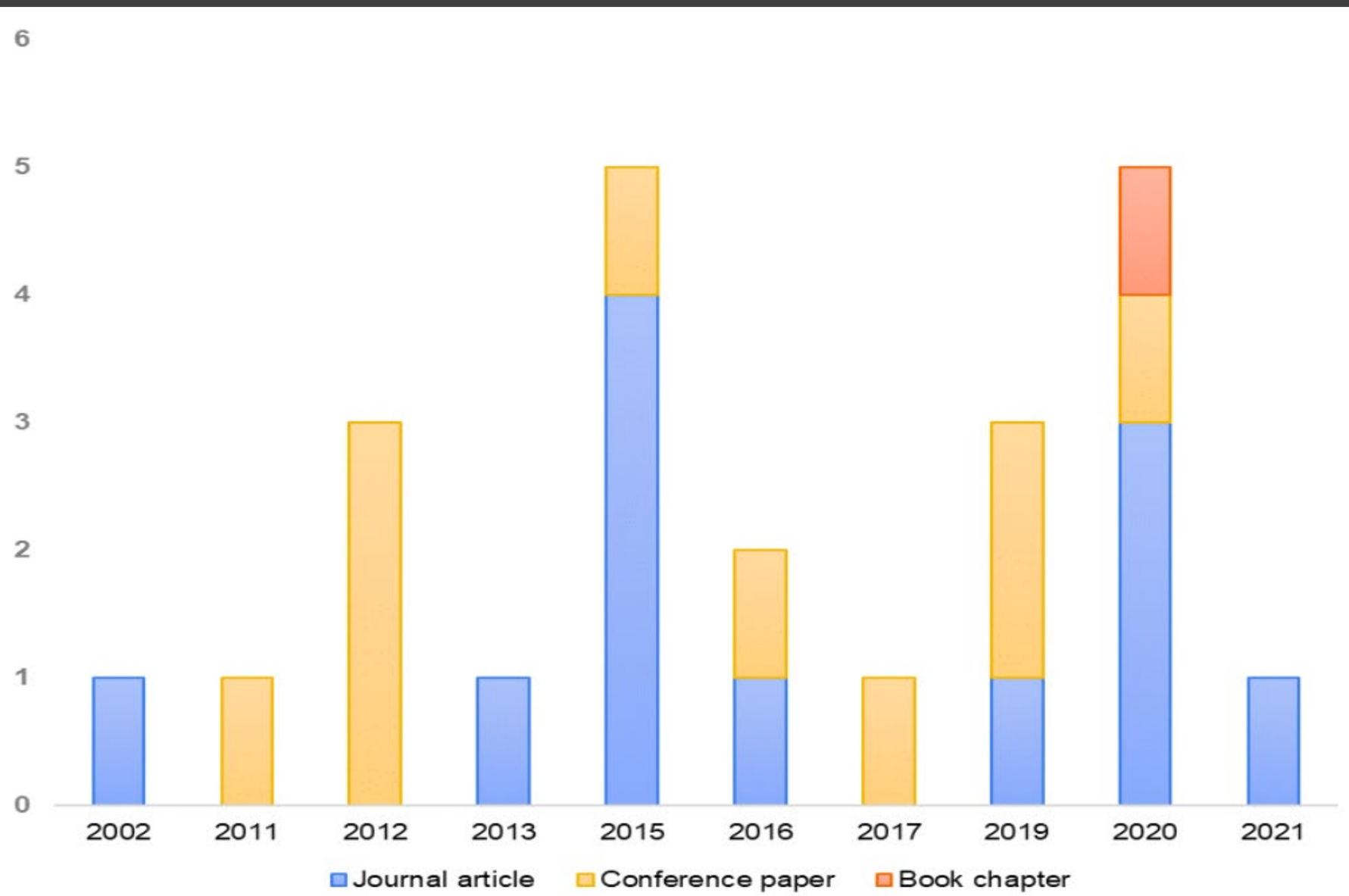
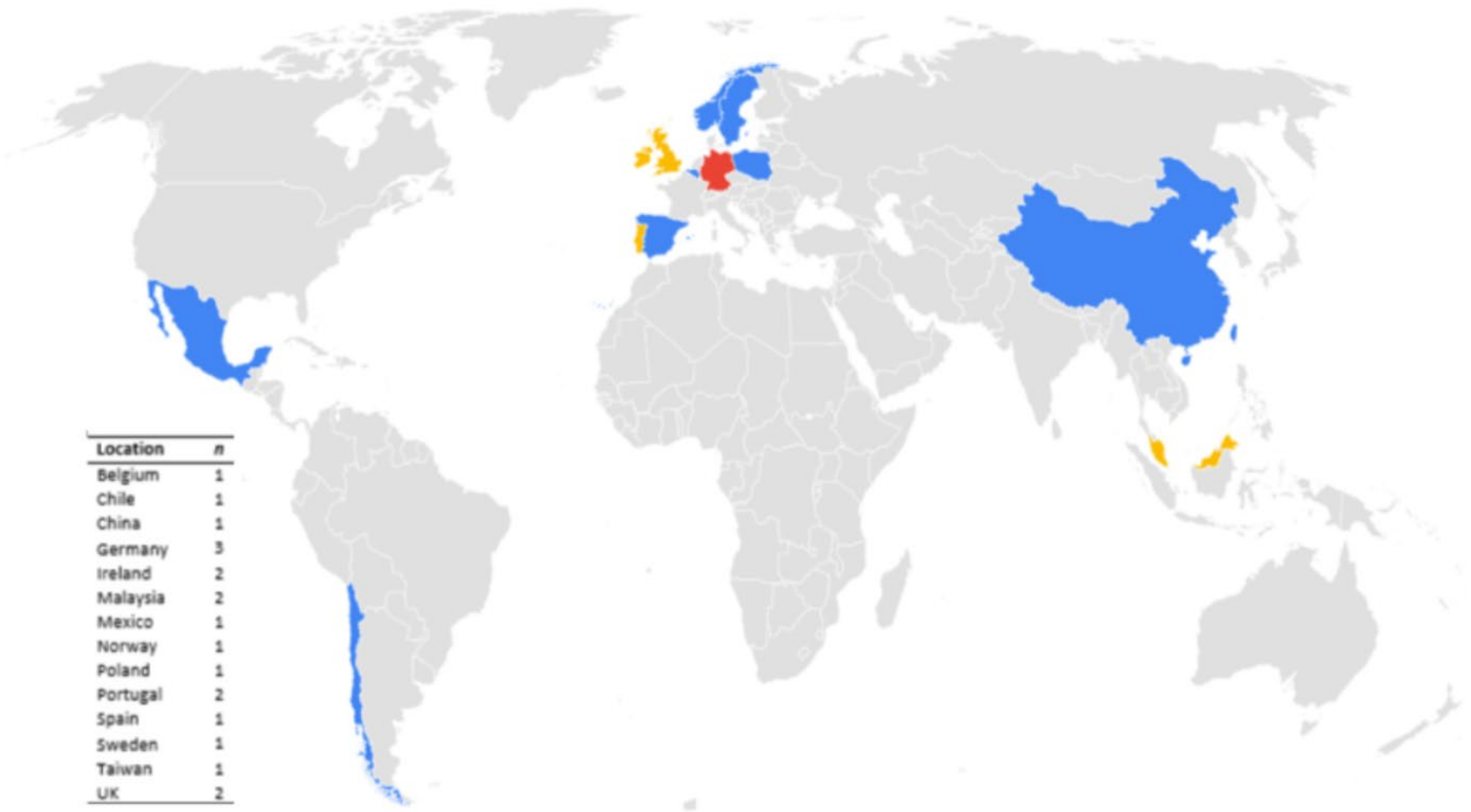


Fig. 1. Distribution of publication's number across the years



Location	*n*
Belgium	1
Chile	1
China	1
Germany	3
Ireland	2
Malaysia	2
Mexico	1
Norway	1
Poland	1
Portugal	2
Spain	1
Sweden	1
Taiwan	1
UK	2

Fig. 2. Geographical locations of the reviewed papers

RQ2:

WHICH MATHEMATICAL COMPETENCIES WERE RESEARCHED IN THE STUDIES?

A focus on two specific mathematical competencies: modelling and problem solving

RQ3:

HOW ARE MATHEMATICAL COMPETENCIES EMPLOYED IN HIGHER ENGINEERING EDUCATION?

Task, Course, Programme:

An emerging interest in the connections of mathematical competencies at task level and the role of technology

KEY TAKE AWAYS AND RECOMMENDATIONS

1. Definition

- A shift towards adoption of Niss's definition of mathematical competencies
- Empower math educators in embracing and owning the notions of mathematical competencies

2. Specific math competencies

- A focus on two specific mathematical competencies, modelling and problem solving
- Consider other mathematical competencies and the connections among them

3. Task, Course, Programme

- An emerging interest in the connections of mathematical competencies at task level and the role of technology
- Consider connections at course and programme level and mathematical competencies linked to digital technologies

RESEARCH QUESTION

How to embed the concepts of mathematical competencies in Engineering Education?

Research Questions:

- What are the most relevant competencies needed for transfer of mathematics towards engineering?
- Which pedagogical activities are needed to acquire these competencies according to educators/students?
- How are the competencies currently embedded in the curriculum?

Impact

- Better curriculum design
- Retention
- Supporting transfer

We need your help!

- Mapping learning objectives to math competencies
- Sharing your expertise and experience
- Supporting curricular design
- Evaluation

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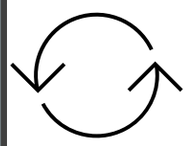

UPDATING MATHEMATICAL EDUCATION

TRANSITION FROM SECONDARY TO HIGHER EDUCATION

The Importance of Supporting the Transition

Challenges and Solutions in Transitioning

SOME INITIATIVES IN ALL INSTITUTIONS

EXAMPLES:

- The Bridging Course project
- Pre-University Calculus MOOC
- Summer school

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