Mathematics education for professions of future

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Current state in mathematics education

- EU initiative: Lisabon Agenda (2000-2010) and **Europe 2020**
  - sustainable economic growth, knowledge-based society, promoting equity and active citenzinship, making lifelong learning and mobility a reality, supporting EU states to develop their own education and training systems and improve quality and efficiency, enhancing creativity and innovation, including entrepreneurship
  - **mathematical competence and basic competences in science and technology is one of eight key competences for lifelong learning**
- international surveys – PISA results
- personal experiences: skills of university students
  - mathematical competence, soft skills, self-confidence, motivation
- motivation and interests of high school students for STEM
- status of teaching profession, quality of teaching (at all levels)
- comprehensive curricular reform in Croatia

Project MERIA

- **Mathematics Education – Relevant, Interesting and Applicable**
- skills and attitudes of in-service teachers towards inquiry-based learning
  - case studies, research, qualitative analysis, measuring impact
- examples of good practice, new teaching scenarios and modules
- theoretical background:
  - **Realistic Mathematics Education** (RME), The Netherlands
  - **Theory of Didactical Situations** (TDS), France, Denmark
- support for **in-service** teachers – workshops

Realistic Mathematics Education

- Freudenthal, 1970's (*Revisiting Mathematics Education*, 1991)
- adopted by a large number of countries all over the world such as England, Germany, Denmark, Spain, Portugal, South Africa, Brazil, USA, Japan, and Malaysia (de Lange, 1996)
- **mathematics as human activity**, not a closed system
  - students are guided to **re-invent mathematics** by doing it
- mathematics must be connected to reality
  - Dutch 'zich realiseren' means 'to imagine'
  - context is not necessary one from the real world, but it must be real in student's mind

Professions in Education

- **Linking higher and school education** – pre-service teachers / in-service teachers
- Role of university

- Education of pre-service teachers includes:
  - **content** (mathematics) knowledge
  - pedagogical **content knowledge**
  - pedagogical knowledge

Professions in Education

- **FELIX KLEIN – „DOUBLE DISCONTINUITY"**

"First one had to forget school mathematics upon beginning one's university studies and later as a teacher one had to forget university mathematics and return to school mathematics."

- "Vicious circle"

- **"Change of paradigm" – from "factual knowledge" to "processes in mathematics",** in particular transversable (problem solving, abstract thinking, modelling,…)

Professions in Education

- **TEDS-M - Teacher Education and Development Study in Mathematics**

Students' beliefs on:

- nature of mathematics,
  - **e.g.mathematics as a process of inquiry**
- learning of mathematics,
  - **e.g. learning mathematics through active involvement (students' active learning)**
- mathematics achievement,
- preparedness for teaching mathematics,
- program effectiveness and coherence,
- opportunities to learn school and university-level mathematics,
- opportunities to learn mathematics didactics,
- opportunities to learn about general education, pedagogy and how to teach,
- opportunities to gain school experience and the field practice.

Professions in Education

1. **Strongly disagree** **2. Disagree** **3. Slightly disagree** **4. Slightly agree** **5. Agree** **6. Strongly agree**

STATEMENT	N	MEAN	STDEV	1 - 4	5 - 6
Mathematics involves creativity and new ideas.	36	5,61	4,61	2,8%	**97,2%**
In mathematics many things can be discovered and tried out by oneself.	36	5,42	4,42	11,1%	**88,9%**
If you engage in mathematical tasks, you can discover new things (e.g., connections, rules, concepts).	36	5,50	4,50	2,8%	**97,2%**
Mathematical problems can be solved correctly in many ways.	36	5,64	4,64	2,8%	**97,2%**
Many aspects of mathematics have practical relevance.	36	5,44	4,44	5,6%	**94,4%**
Mathematics helps solve everyday problems and tasks.	36	5,44	4,44	5,6%	**94,4%**

A. Čižmešija, Ž. Milin Šipuš, Mathematics Teacher Education at the Department of Mathematics, Teacher Education Policy in Europe, 2014.

A. Čižmešija, Ž. Milin Šipuš, Beliefs about mathematics and mathematics teaching of students in mathematics education programme at the Department of Mathematics, University of Zagreb, Osijek 2015.

Professions in Education

1. Not relevant at all. 2. Of minor relevace. 3. Relevant. 4. Very important.

RELEVANCE FOR MATHEMATICS TEACHER PROFESSION

AREA OF TERTIARY MATHEMATICS	N	MEAN	STDEV	1 - 2	3 - 4
Elementary geometry	36	3,61	2,61	0,0%	**100,0%**
Analitical/coordinate geometry	36	3,61	2,61	0,0%	**100,0%**
Begining topics in calculus (e.g. sequences, limits, series)	36	3,75	2,75	0,0%	**100,0%**
Number theory (e.g. divisibility, prime numbers, structure of integers)	36	3,50	2,50	0,0%	**100,0%**
ICT - use of specialized software tools	36	3,42	2,42	11,1%	**88,9%**
Probability	36	3,14	2,14	16,7%	**83,3%**
Single variable calculus	35	3,23	2,23	20,0%	**80,0%**
Constructive geometry	36	3,06	2,06	22,2%	**77,8%**
Linear algebra	36	3,06	2,06	22,2%	**77,8%**
Combinatorics and discrete mathematics	36	2,83	1,83	27,8%	**72,2%**
Statistics	35	2,91	1,91	28,6%	**71,4%**

Professions in Education

AREA OF TERTIARY MATHEMATICS	N	MEAN	STDEV	1 - 2	3 - 4
Numerical mathematics	35	2,51	1,51	**51,4%**	**48,6%**
Physics	35	2,49	1,49	**51,4%**	**48,6%**
Differential geometry	36	2,47	1,47	**52,8%**	**47,2%**
Descriptive geometry	36	2,53	1,53	**52,8%**	**47,2%**
Programming basics	35	2,29	1,29	**60,0%**	40,0%
Mathematical logic	34	2,29	1,29	**64,7%**	35,3%
Ordinary differential equations	35	2,09	1,09	**68,6%**	31,4%
Multivariable calculus	35	2,14	1,14	**71,4%**	28,6%
Set theory	34	1,82	0,82	**79,4%**	20,6%
Mathematical biology	35	1,66	0,66	**82,9%**	17,1%
Complex analysis	34	1,74	0,74	**88,2%**	11,8%
Projective geometry	31	1,81	0,81	**90,3%**	9,7%
Partial differential equations	36	1,69	0,69	**91,7%**	8,3%
Noneuclidean geometry	32	1,47	0,47	**93,8%**	6,3%
Algebraic structures (e.g. group theory, ring theory, ideals)	36	1,44	0,44	**94,4%**	5,6%
Topology (e.g. metric spaces)	35	1,51	0,51	**97,1%**	2,9%
Measure theory	33	1,42	0,42	**100,0%**	0,0%

STRUKTURNI I INVESTICIJSKI FONDOVI

EUROPSKA UNIJA

ULAGANJE U BUDUĆNOST

PROJEKT JE SUFINANCIRALA EUROPSKA UNIJA IZ EUROPSKOG SOCIJALNOG FONDA

HUMAN RESOURCES DEVELOPMENT

Usklađivanje studija računarstva i matematike s potrebama tržišta rada

HR.3.1.15-0017 Razvoj studija ekologije, računarstva i matematike uz primjenu Hrvatskoga kvalifikacijskog okvira – EkoRaMa

9. lipnja 2016.

DRŽAVNI ZAVOD ZA ZAŠTITU PRIRODE

SVEUČILIŠTE U ZAGREBU PMF PRIRODOSLOVNO - MATEMATIČKI FAKULTET

EKORAMA

RAZVOJ STUDIJA EKOLOGIJE, RAČUNARSTVA I MATEMATIKE UZ PRIMJENU HKO-A

Association BIOM Udruga BIOM

e-KOLEKTOR ENVIRONMENTALLY FRIENDLY

MATEMATIKA U UPRAVLJANJU IMOVINOM FONDOVA

U srijedu, 08.06.2016. u 18 sati u predavaoni A001 u organizaciji HMD-a, PMF-MO i Udruženja društava za upravljanje mirovinskim fondovima i mirovinskih osiguravajućih društava (sponzora 6. hrvatskog matematičkog kongresa) održava se okrugli stol pod nazivom **Matematika u upravljanju imovinom fondova.**

Discussion

- Maths learning outcomes
- Curriculum design and delivery
- Student support
- Extra-curricular activities

- Highlight the most important /missing ones!