

MAA MathFest, Denver, Aug. 3rd, 2018 1:30-2:50PM



Introducing ALL High School Students to Contemporary Mathematics: Meeting the Challenge



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Our Agenda

- The problem and the challenge
- A proposed solution
- Behind the scenes
- Accompanying studies
- Future plans

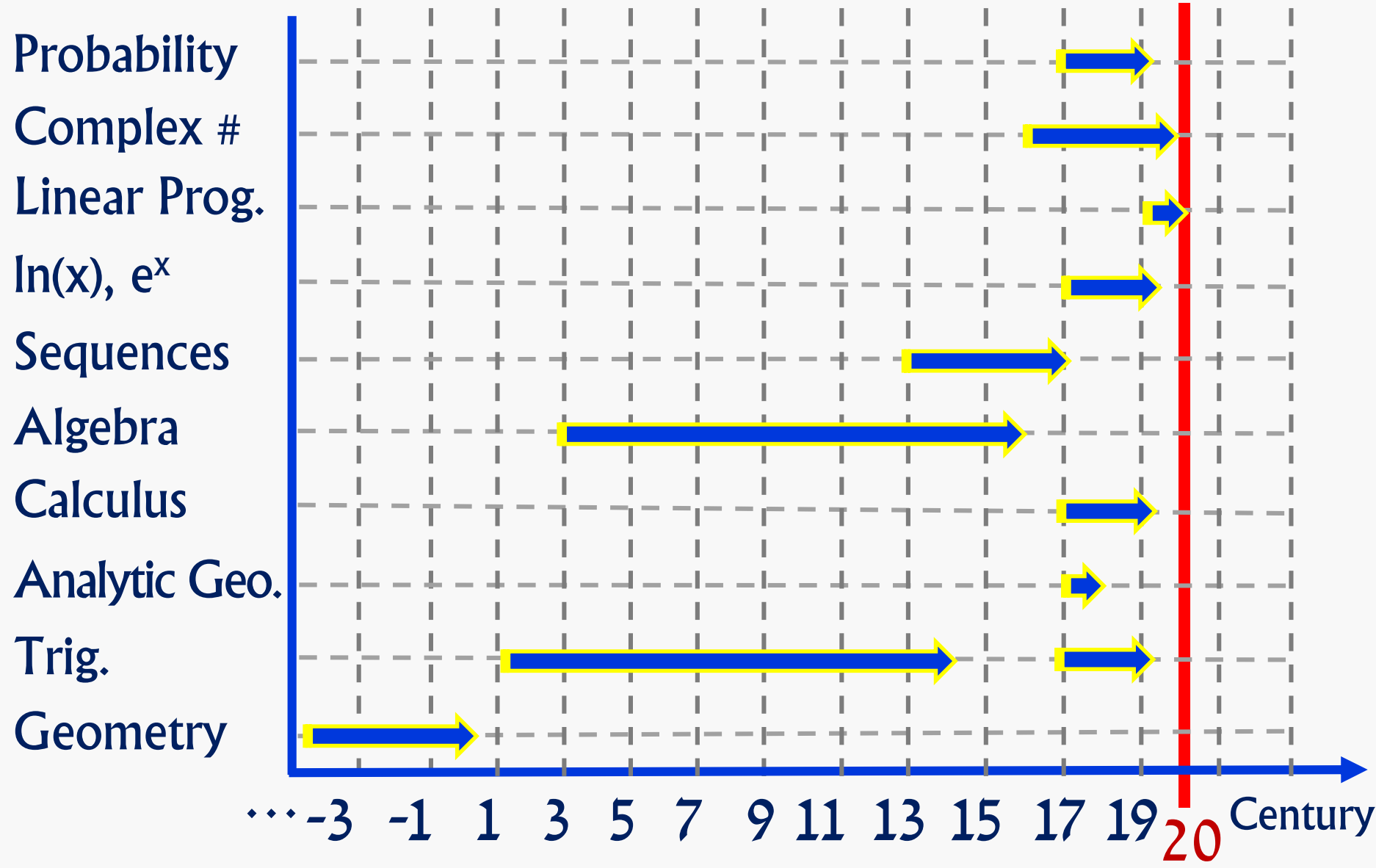
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The Problem

- What are the typical characteristics of mathematics?
 - Endless chain of question-result-new question
 - Built on curiosity, creativity, intellectual courage
 - Usually not application-driven, but very applicable
- Why don't school mathematics curricula reflect these aspects, nor modern breakthroughs?
 - Hierarchical nature
 - (Almost) Never obsolete

Mathematical Topics – a Timeline



Common Misconceptions about Math

What are typical statements you hear from students and adults about mathematics?



- All answers are known (to the teacher...)
- Boring and formulaic: no room for creativity
- What is it good for? Hardly any practical applications
- Not for me. Only for some selected individuals

The Challenge

How can we communicate the true nature of contemporary mathematics, to **ALL** high-school students, while:

- Accounting for the tight **teaching** schedule;
- Avoiding a decline in **student** grades;
- Respecting the overloaded **teachers**;
- Allowing for the gap between the necessary background and the existing knowledge **students** (and some teachers) possess?

The Challenge

How can we communicate the true nature of contemporary mathematics, to **ALL** high-school students?

- Should/shouldn't we face this challenge? And why?
- What attempts have been made to meet it?



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“A glass bottom boat tour”
without getting wet

Once every 2-3 weeks,
during HS math class

Our proposed solution

Bridging the gaps by interweaving
Mathematics-News-Snapshots

A recent result
(published in
the last ~40
years) and its
significance



PPTs: 25-30 mins,
relevant result(s),
brief history, and
notable related
mathematicians

Sudoku and
math

Prime
numbers

Kepler
conjecture

Fermat's last
theorem

Map
coloring

The digits
of π

Goldbach
conjecture

Soap
bubbles

Art
Gallery

Benford's
law

Julia
sets

Efron's
dice

Fibonacci
numbers

<http://www.mns.co.il>

Random
walks

Origami

Pentagonal
tiling

Non-round
wheels

Rubik's
cube

Möbius
strip

Fair cake-
cutting

Stable
marriage

And
more...

Get Acquainted with the MNS website

<http://www.mns.co.il>

- Choose an MNS (or two) and explore it.
- Try to uncover some of our design principles.
- Write down any issue you wish to raise.



Comments? Issues for discussion?

- What do you like/dislike in the MNSs you explored?
- Were you able to uncover some of the design principles we follow in the development of our MNSs?
- Do these MNSs have a potential of improving students' awareness to the true nature of mathematics?



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How to?

- Select an appropriate recent result (NMH, Prague 2008):
 1. Interesting problems (and solutions?)
 2. Recently solved open problems
 3. Recently revisited problems
 4. New/Generalized mathematical concepts
 5. New applications to mathematics
- Write a one-page synopsis of “the story”;
- Get the MNS design principles document;
- Create a (short, stand-alone) PPT presentation, accessible and catchy for HS students (and teachers);
- MNS update and revision (regular feedback).

Issues for Consideration

- MNSs development issues:
 - Making a choice
 - Team work
- Dissemination issues:
 - Teacher preparation?
- Implementation issues:
 - Which MNS?
 - When to show it?
 - To whom?
 - Technical issues;
 - Duration;
 - Frequency;
- Pedagogical issues:
 - Activating the students?
 - Student evaluation?
- Follow-up issues:
 - Action research;
 - Clinical study;
 - Scalability;
 - Quantitative/qualitative data collection;
 - Controlled experiment;
 - Short/Long-term impact;

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Accompanying studies

- 2008-2011 Action research
(Amit, 2011, PhD dissertation)
- 2011-2015 Upscaling feasibility study
(Israel Science Foundation grant)
 - ✓ Phase 1: Clinical trial
 - ✓ Phase 2: System-wide trial run
(Online PD and classroom integration)
- 2016-2019 Longitudinal study
(Funded by the Israeli Ministry of Science and Technology)

Longitudinal Studies

Two ongoing studies:

- A. What is the contribution of the MNS project to shaping students' perceptions of mathematics?
How do students perceive mathematics...
 1. ... as a discipline?
 2. ... as a profession?
- B. What is the contribution of integrating MNS in High School classrooms to teachers' PD?

Study A – preliminary findings

- Increased appreciation for the home teacher
- Increased interest in math history and applications
- Better understanding of the dynamic nature of math
 - ✓ Gender contributes very little to differences
 - ✓ Greater effect size at higher levels of study

Study A – Student responses

“To make history you need to know the history”

Maor, 10th grade

“The Snapshots made me examine every topic thoroughly, so maybe I will find something I like and intriguing, and all that will lead me to a new result that will be satisfactory. Personally, even if something seems unsolvable – always keep trying.”

Reut, 9th grade

Study A – Teacher responses

“I found out that I can, and sometimes should, bring to class advanced topics – even if I don’t fully understand them.”

M., teaches Grades 10-12

“The Snapshots enrich the students’ experience and the general perception of math, and are welcomed with great joy by everybody.”

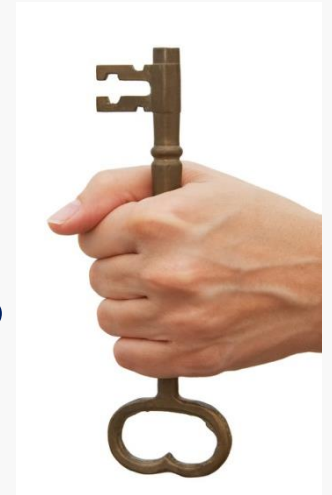
R., teaches Grades 10-11

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An invitation

- This workshop provided a glance at our ongoing initiative to give all high-school students a taste of contemporary mathematics.
- Intrigued? Interested in learning more?
- Want to integrate **MNSs** at your school?
- please contact us!



The road ahead is long...

Thanks for taking part in this workshop
Thanks SIGMAA TASHM & MCST for their sponsorship

Please follow www.mns.co.il for updates
and contact us at: Math.News.Snapshots@gmail.com

