Thoughts and Q/A on math olympiad coaching

https://web.evanchen.cc/coaches.html

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4 November 2023

About this sphere

Bad news

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Examples of *oral traditions*:

- No official syllabus of IMO topics exists (unlike IOI).
- Haphazard voting process for problem selection.
- How IMO coordination works (e.g. past rubrics).
- What the IMO Shortlist is and how to use it.
- https://aops.com/community/c13

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Good news

Most coaches are really nice and you should talk to them.

Two key ingredients

I would say the two most important things are:

- Excellent problems and solutions on national competitions (at all levels).
- Building and nurturing a community of students and trainers.

Problems and solutions

These are the raw materials used by students

- Quality of MO's sets it apart from other extracurriculars.
  - Why MO medalists are heavily recruited.
- Good authors and editors are so valuable that money can't buy them.
- For full pyramid, not just the final round.
  - Develops a talent base, not just top-6 IMO squad.

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Example: USA problem process

- https://web.evanchen.cc/problems.html
- Each TST had 6-month selection and review.
- The earlier round AMC/AIME has 2-year review.

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- Security issue, but best-written solutions in town.

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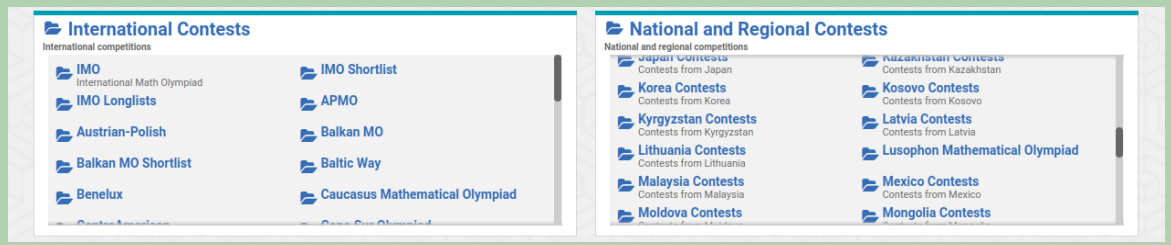

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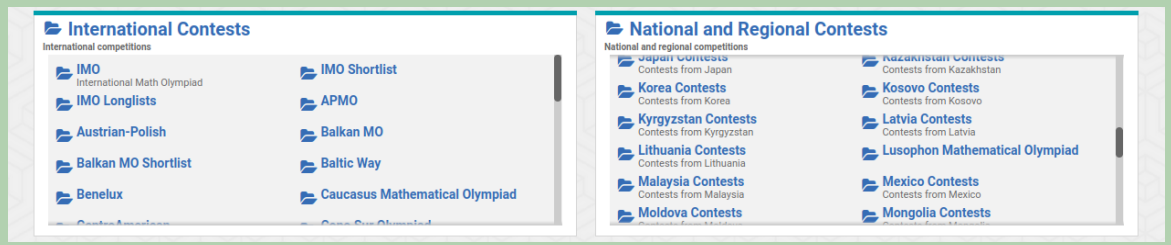

Collaboration

Example: mirrored contests (e.g. RMM, APMO).

Community

Building a community out of common interests at all levels is super important for talent base.

Goals of the human component

- Peers to be role models and friends with.
- Space to ask questions, talk about problems, etc.
- Feedback cycle where top students return as trainers and problem proposers (reaching escape velocity).

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Figure out what students already use and connect them

So far...

Two stated end-goals

- Great problems at all levels build a deep talent base.
- Foster active community based on shared interests.

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Spoiler

- It's really hard! (That's why it's interesting.)
- Probably no "magic bullet" or one-size-fits-all answer.
- Rather than try to describe a recipe, some general advice by showing examples of mistakes I've made.

Process

The most competent people, with weak processes, will screw up.

— Chris Peterson

Theory and practice sometimes clash. And when that happens, theory loses. Every single time.

— Linus Torvalds

- For both goals, pay attention to infrastructure/process.
- Processes must work well in practice, not just in theory.

Example #1: college homework model

Failure mode

- Used to just send students a PDF of 7 problems, ask to solve all of them, and email whenever stuck.
- Led to **enormous friction** whenever student couldn't solve a problem (often).
  - Would often give up on problem or feel discouraged
  - Unrealistic **in practice** to expect someone to email Evan every single time they can't solve a problem, even if it's possible **in theory**.

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Resolution

- Point-based problem sets, solve any $\binom{n}{7}$ or so.
- Large Discord community of peers for discussion.
- Automated pre-written hint system.

Example #2: USA TST 2014-2017

Failure mode

- Haphazard email thread for both proposals and rating, with no solutions at all.
- No process to get consensus or organize feedback.
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Resolution

- Created mailing list with clear schedule ahead of time (submit problems by X, ratings by Y, test chosen by Z).
- Proposals collated in packet with full solutions.
- Google form to aggregate all ratings and feedback.

Closing

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Most important part of this talk

Q/A