

Having Students Write Original Problems

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So You Can Just Listen

At www.vincematsko.com:

- Riga 2010:
 - This slideshow (in .pdf);
 - Examples of student work shown today (in .pdf);
- IMSA → APS: Fall 2009 website, including course syllabus and all original Problem Sets.

IMSA and APS

- Illinois Mathematics and Science Academy
- Advanced Problem Solving

Summary of Course Topics

- Combinatorics
- Probability
- Plane Geometry
- Logic
- Recurrence Relations
- Generating Functions
- Cryptarithms
- Inversive Geometry
- Grammars and Finite-State Automata

Significant Course Components

- Play Days
- Final Project presentations
- Writing original problems
- Complete written solutions to problems

The Problems!

We'll begin with a brief look at some sample student problems.

Problem Writing: PC, BJ

Writing original problems has been one of the hardest things that I've ever had to do academically.

Unlike many of the other assignments as IMSA, I've come to accept that writing truly insightful problems is really something that cannot be done regularly the night before.

Teaching Problem Writing

Some helpful strategies:

- Model by examples.
- Model during class.
- Critique problems in class.
- Have peers critique problems.
- Allow submission of revised problems.
- Liberally comment!

Problem Writing: EL, JP

Overall, I think what helped the most in improving my problem writing were the classes when we made a problem as a class. Through these exercises, I learned that one's own spontaneous thoughts or questions can serve as effective inspiration for a problem because what is novel to one is likely novel to many, if not all.

I think that just showing examples of problems and showing the process of writing problems helps the most.

Problem Writing: RS

When I was starting this class, I was slightly afraid of writing problems. I wasn't quite sure where to start or what to put into a good problem. It really helped when you made us write our own problems. I also think that seeing other students' problems helped me figure out what some major strengths and weaknesses in original problems [are] and consider them when writing my own problems.

Problem Writing: JP

I was very doubtful when I first tried writing a problem. I just didn't know what I needed to do to write a good problem. I wasn't sure what a good problem was and just lacked confidence. As the semester progressed, I was able to get a better idea of what a good problem was....

Through my mistakes and successes, I learned more about how to write problems. The feedback on my problems helped me most in writing problems.

Problem Writing: PY

As I learned throughout the semester, problem writing is a skill, and also one that can be learned through practice and the correct mindset. To me, the most important cognitive skill used in problem writing would be focus.

Reflection: AK

At the beginning of the semester, I thought that writing problems would be very similar to solving problems; since I was pretty proficient at solving problems, I thought that writing problems wouldn't be very hard. But as the semester progressed, I realized that writing problems requires all of the skills necessary to solve problems, and many, many more. While writing a problem, you have to imagine yourself in the position of the solver and go through the steps necessary for the solution. If the problem is too hard or too easy, you have to adjust it to either help or hinder the solver. Solving problems is single-sided, while writing problems is double-sided.

Creativity: SA

To be honest, I thought that the only thing necessary to write problems was being able to manipulate previously written problems enough to form an entirely new one. I really despise basing original problems off of previous problems, because I just don't think my work is authentic in that situation. I didn't know that I could just start drawing a bunch of lines and come up with an interesting problem. This was what was so surprising to me during the semester....I think creativity is key to writing original problems. I now bear witness to its lovely academic benefits.

Creativity: EL

Anyone can write tedious, difficult problems that review core math subjects, but to write problems in a novel, challenging, and refreshing manner, one must be imaginative. I feel that this creative side of math is an often overlooked aspect of the field as many believe math to be an extremely black-and-white, rigid, and boring subject.

Creativity: BJ

Over the course of the semester, I have come to realize the extreme degree of insight and artistic level of creativity needed to write truly good and beautiful problems. The burden of problem writing and solving truly lies more squarely on the shoulder of the writer....

Inspirations for new problems, like creative inspirations for music or art, can strike at any time of the day or night. This artistic creativity along with mathematical insight is the most important instrument in a problem-writer's toolbox.

Advice: AL

One emphasis that should be placed on problem writing is just getting a starting point. Oftentimes a trivial problem can be turned into a very clever one by extending the principles used to solve the trivial problem, or designing a problem which obscures the principles used, so that the non-triviality comes from the problem-solver having to find said principles. Also, in line with previous statements, emphasis should be placed on self-motivated exploration of mathematics...you can't find cool things if you don't look!

Advice: BJ

While a broader knowledge of problem literature can indeed allow for new ideas, these ideas tend to not be truly new, but instead offshoots of the original constructs. Thus, I would recommend that you require students to write some problems in areas they are relatively unfamiliar with.

Advice: PC

The first thing I realized and strongly suggest...is that original problems must be in something you are interested in....

Secondly, it is more important to get something down on paper than nothing at all. Revisions can always be made.

Advice: KZ

My advice for students taking Advanced Problem Solving next year is to not be intimidated by the task of writing original problems. It may be a little difficult at first, but everybody can be a good problem writer; all it takes is experience. In addition, whenever you need a good idea for a problem, do not stress over it, just think about it during the day or while you lie on the bed before going to sleep. For example, many of the problems that I thought of this semester came from me thinking in the shower. As long as you think about original problems, a good idea will come up before the end of the week.