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# Fun, Not Competition: The Story of My Math Club

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## Synopsis

For almost three years, I have spent most of my Sunday afternoons doing math with my daughters and a group of their school friends. Below I detail why and how the math club is run. Unlike my day job, which is full of (statistical) learning objectives for my college students, my math club has only the objective that the kids I work with learn to associate mathematics with having fun. My math club has its challenges, but the motivation comes from love of mathematics, which makes it fun, and worth every minute.

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When she was in the second grade, my oldest daughter (I'll call her Fish) had an amazing teacher. Maestra was loving and kind, and most importantly, she understood and appreciated all the different personalities in her classroom. She knew how to instill a love of learning and a sense of ownership of education in 7 and 8-year-olds. Fish is shy, introverted, and has trouble speaking in front of groups. Maestra celebrated Fish's personality, always pushing her just enough to grow, without going too far.

However, I struggled with how the class was being led mathematically. In January, the second graders were still adding one and two digit numbers. As a quantitative family, we do a lot of math at home, and I knew that Fish had

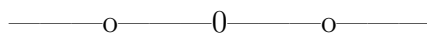
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extremely strong quantitative skills. Yet the classroom environment was not pushing her to go beyond the very basics. And though she liked math and found it easy, she felt no reason to investigate new mathematical concepts. When I'd try to bring up cool math at home, it became a battle. I found myself in a catch 22: if I force her to do math at home, we'll fight and she will hate math. If I don't force her to do math at home, she won't do any math.

At about the same time, I became aware of math circles (some sponsored by the AMS, others regionally affiliated).<sup>2</sup> I even brought Fish to one of our local math circles to see if she would like it. Though she was able to keep up mathematically, the experience was a disaster. First of all, she knew no one—which put her in a tough state of mind. And secondly, the room was filled with kids who love doing math puzzles all day every day. They had to audition for the math circle, and the group of students regularly went to local math competitions. It was not a space where Fish would learn to love math.

Although there are surely differences in rigor and competitiveness across math circles, the general idea of a math circle is to engage students who are looking for new challenges in mathematics. Neither my daughter nor I were looking for new challenges, and after unsuccessfully investigating the local math circles, I found myself struggling again to figure out how to get Fish to WANT to do math beyond what she was already doing in her class. The answer I finally landed on was to create a math club that embodies the way that I love mathematics. I call my group a math club to distinguish it from the problem solving competitive environment often found in traditional math circles.



What follows are my reflections on what has worked for my Math Club. Mine doesn't always run perfectly smoothly, but I hope my guiding principles can help others to work successfully with kids who want to love mathematics.

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<sup>2</sup> EDITOR'S NOTE: This journal has published a previous article about math circles; see White, D. and Ziegelmeier, L. "Reflections on Math Students' Circles: Two Personal Stories from Colorado", *Journal of Humanistic Mathematics*, Volume 5 Issue 2 (July 2015), pages 110–120. Available at <http://scholarship.claremont.edu/jhm/vol5/iss2/10>.

**Principle 1: Mathematics is Fun!**

First of all, mathematics is fun. In our math club, we never do anything rote. Every week is a different challenge that gets the kids into a problem solving mindset instead of a memorization mindset. I take many of my ideas from existing math circles (see resources below), and I pick and choose the ones that I think my kids will truly enjoy and that will challenge them just enough.



Figure 1: The Big Math Club learning that no matter what polygon we use to tile the plane, the angles at a vertex have to add up to  $360^\circ$ .

The problems we work on range the entire spectrum of math & statistics (with a little bit of CS and physics thrown in). In Figure 2 below you can see engaging examples, lots of questions about why, some erasing after figuring out how to do the problem correctly, and a little bit of Fish's doodling and practicing her cursive writing. I love that she answered the perimeter questions with "because I counted". She indicates that the solution is obvious



to her, yet she is being forced to reflect on her response. The reflection gives her the opportunity to recognize that the answer is not obvious to everyone, an empowering realization!

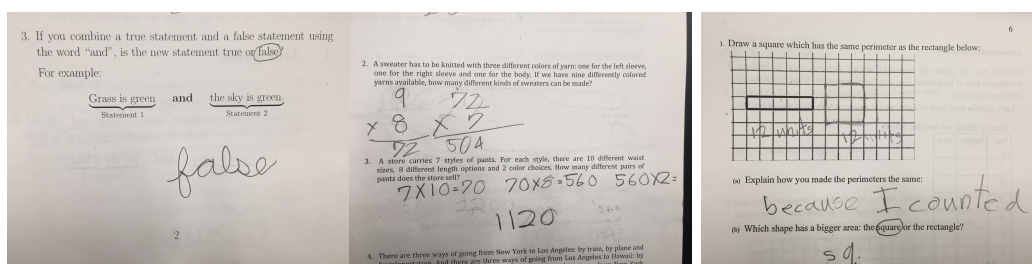


Figure 2: Fish’s worksheets for a selection of problems. The examples are all from the UCLA Math Circle Archive, available at <http://www.math.ucla.edu/~radko/circles/archive.shtml>. In particular the Logic worksheet is from <http://www.math.ucla.edu/~radko/circles/events.shtml?id=1278>, the Combinatorics worksheet is from <http://www.math.ucla.edu/~radko/circles/events.shtml?id=1023>, and the Geometry worksheet is from <http://www.math.ucla.edu/~radko/circles/events.shtml?id=1013>. All links were last accessed on January 22, 2018.

### Principle 2: People are Fun!

Second, people are fun. I consider myself to be an accomplished academic. (I’m a full professor at a top liberal arts institution). Yet, I’ve never written a single-author paper. I love collaborating and discussing mathematics with my friends and colleagues. I love listening to how my collaborators think. I learn a tremendous amount working with other people. My daughter also adores her friends and is incredibly social within her network of classmates. There is no pushback to doing mathematics when it’s done with her friends who are goofy and fun and push her to think just a little bit harder.

In Figure 3, we see Fish’s best friend, Nathalie. Fish’s leapfrog game handout is blank because they used Nathalie’s to play. When we are in Math Club together, there is no question that the kids genuinely enjoy being together and they feel camaraderie around successfully navigating the mathematical challenges together.

### Principle 3: Rewards are Fun!

As any parent knows, rewards are fun. My professional rewards come as lines on my CV — publications, grant funding, and maybe a teaching award here and there. For Fish and her friends, rewards are simple. Every week each

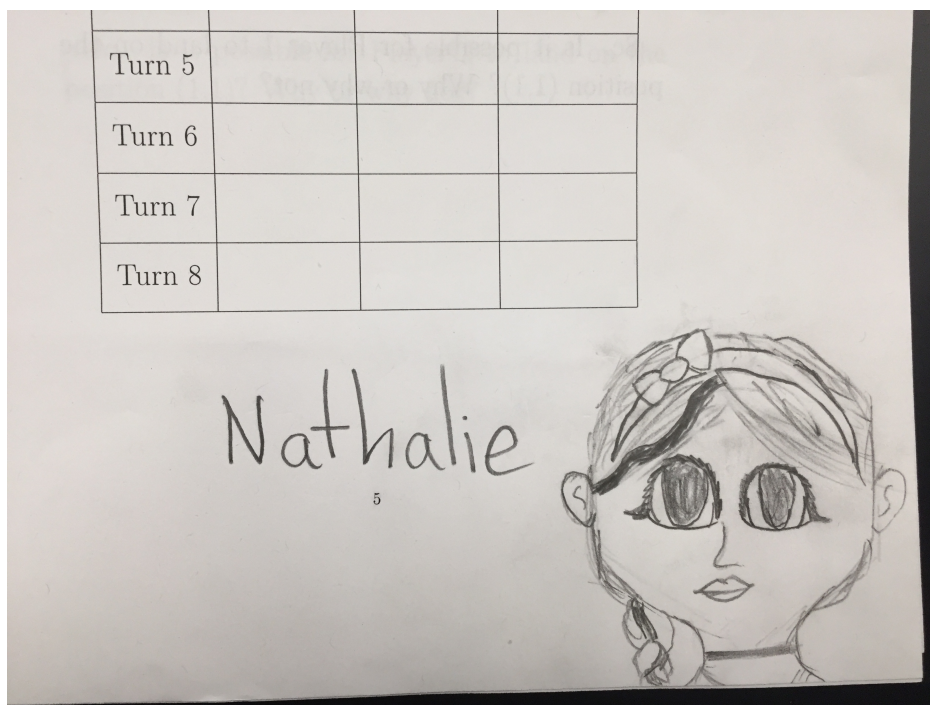


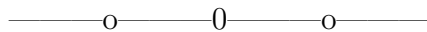
Figure 3: Fish’s Leapfrog worksheet. The example is from the UCLA Math Circle Archive <http://www.math.ucla.edu/~radko/circles/archive.shtml>; the Leapfrog activity is available at <http://www.math.ucla.edu/~radko/circles/events.shtml?id=848>, last accessed on January 22, 2018.

friend gets a lollipop, and they also get up to five points for doing a great job (one point each for staying engaged, helping others, staying in the chair, having a good attitude, and answering one math question at the end of the session). Every four weeks is a “shopping” week when they get to choose things I’ve purchased from the dollar bin at the local store. I have baskets with toys, and each basket is labeled as “20pts”, “40pts”, or “60pts”. The whoopee cushion may have been the biggest hit of all the shopping weeks (40 pts).

It is worth noting that there is some research showing that rewards don’t necessarily link directly to learning [1]. However, I will continue to make the point that the goal of our math club does not center around certain mathematical learning objectives. Indeed, the primary aim is to create an environment where the kids associate mathematics with enjoyment. And rewards do make it more fun.

**Principle 4: Helping is Fun!**

Helping people is fun. I will admit that I spend every Sunday doing math with kids because I want my own children to love math, but there is much more to it. I chose the kids in the math club because I knew they could do the math that we are doing (they do need to have good arithmetic skills!), their parents were committed to bringing their kids every Sunday, and they would create a fun and collaborative environment ripe for experiencing all that mathematics can be. There are a few kids (mostly girls, but not all) who already see (or used to see?) themselves as “not math people”. Those kids struggle with mathematics (generally) and simultaneously recognize that some of the sessions are really fun (and easy) for them. By providing them with alternative definitions of what math is (e.g., ciphers, ZomeTool polygons, logic puzzles), they can see and internalize that there are many different ways to be “good” at math.



Fish is now in fifth grade. Her math club has grown from an original group of four (I started small, I didn't know what I was getting into!) to a group of ten, which became the Big Math Club with the big kids in it. Her little sister (now in third grade) spent last year with her own group of six friends. The Little Math Club will probably grow a little bit. As they get older, a few more voices add texture to the group.

I set up the groups quite deliberately. As I've written above, I want the group to have fun doing math. That means the kids have to enjoy doing math, and they also have to enjoy each other. It also means that their parents have to commit to bringing their kids to Math Club every Sunday. It is important for me to balance the group by gender and by kids who have slightly different mathematical skills and backgrounds (albeit, all kids who can do the math). I also work hard to have kids who want to be there. At this point, personal dynamics (gender or otherwise) have not hindered the math or the fun that we get accomplished. As the kids get older they will be able to do more math and focus for longer periods of time; however, they are also likely to be more focused on their personal relationships, which will add an additional challenge to our weekly meetings.



Figure 4: The Little Math Club working diligently on making three-dimensional solids using ZomeTool.

I write this article to share how I've gotten my small network of kids to love and have fun with math. But I don't pretend that there haven't been challenges, these are kids after all. Sometimes the kids are too rowdy. Sometimes they don't want to be there. Sometimes the idea for the lesson doesn't go over. (I had no idea that fourth graders aren't familiar with the idea of an average!!). Sometimes I'm overwhelmed at work, and the last thing I want to do is prepare handouts for two 90-minute math club sessions (each week I spend two to three hours prepping the materials and then three hours with the kids). But if there weren't challenges, there wouldn't be fun. And really, it's all about the fun.

### **Math Club Logistics**

- We use a classroom in the math department at my college.
- The Big Math Club: 4-5th graders: 10 students (6 girls, 4 boys).

- The Little Math Club: 2-3rd graders: 6 students (4 girls, 2 boys).
- 2/3 are fairly advanced, 1/3 not so.
- I print out worksheets beforehand; students work for approximately 60 minutes on the topic.
- For the last 30 minutes or so, we play games (e.g., Set, Colorku, Zeus on the Loose, Prime Climb, Mobi, etc.)
- At the end (during games), I check in with each one individually and ask them a challenge question (at their level of challenge) on the topic we covered that day.
- I cancel Math Club when I am traveling or have family obligations, but we meet almost every Sunday from September through June.
- The Big Math Club works in smaller groups of 2-3 students, the Little Math Club works as one entire group (sometimes separating into pairs).

### Math Club Resources

UCLA Math Circle archives: <http://www.math.ucla.edu/~radko/circles/archive.shtml?year=2016>

I particularly LOVE the worksheet on function machines (for almost any age): <http://www.math.ucla.edu/~radko/circles/events.shtml?id=757>

Fun and interactive projects in statistics: <http://www.amstat.org/ASA/Education/STEW/home.aspx>

Mudd Math Fun Facts <https://www.math.hmc.edu/funfacts/>

Tessellations are fun to do with pattern blocks ([https://en.wikipedia.org/wiki/Pattern\\_block](https://en.wikipedia.org/wiki/Pattern_block)) <http://www.math.ucla.edu/~radko/circles/lib/data/Handout-688-798.pdf>

Cipher Math Murder Mystery: [http://crypto.interactive-maths.com/uploads/1/1/3/4/11345755/murder\\_in\\_the\\_mathematics\\_department\\_codebreaker.pdf](http://crypto.interactive-maths.com/uploads/1/1/3/4/11345755/murder_in_the_mathematics_department_codebreaker.pdf)

ZomeTool: <http://www.zometool.com/>

Prime Climb (you won't believe how much your kids will love this relatively new board game!): <http://mathforlove.com/games/>

**References**

- [1] Gneezy, U., Meier, S., and Rey-Biel, P., “When and why incentives (don’t) work to modify behavior”, *Journal of Economic Perspectives*, Volume **25** Issue 4 (2011), pages 191–210.