Magic

… another short story, once again set in a classroom. All the characters are fictional, including the unnamed teacher who sits at the back of the room.

"We're going outside?? Awesome!"

That was the reaction I was expecting. Kids love activities, especially when they're part of math class.

I'm a student teacher in my first practicum, and while I'm primarily interested in becoming a Sr. High math teacher, my supervisor has let me try a few lessons with his grade six class. They were a fun group.

"What will be doing outside, Mr. Scott?"

"Well, you remember the lesson I taught you yesterday about the diameter and circumference of a circle? You remember how we drew some circles on paper and measured them?"

That had been a challenge. To measure the distance around a circle on paper, the kids had to lay out a piece of thread around the circle, and then measure its length using a ruler. Some of them had had trouble.

"Today you're going to measure some big circles outside!"

I'd been at school since 7 am that morning, drawing various sized circles on the grass out on the field behind the school. I'd used the line painter that the PhysEd teacher used to lay out lanes for racing, a long rope, and a spike. I'd created all sizes of circles; one of them was half the width of the field!

When we got outside, the first thing the kids wanted to know was voiced by Joanne.

"Mr. Scott … do we have enough thread to go all around those big circles?"

"No, Joanne. I have something else instead."

I showed them the 'trundle wheel', a wheel on a stick that rolled and clicked once every metre. There were markings on it to measure fractions of a metre too. The kids tried it out, measuring some short distances.

"OK, now find a circle. I marked the centre of every one, so you can measure both the diameter and the distance around." The kids went to work. It took most of the rest of the period, but eventually they had data for all the circles.

"OK, that's all for today. In tomorrow's class I'll show you some magic!"

That was the hook. They'd be wondering what could possibly be magic about circles!.

I've been doing pretty well as a student teacher. I hadn't needed to worry too much about classroom management in the Sr. High classes I'd taught …. this was a small rural school and

the kids were pretty well behaved. But I'd found the grade six class a challenge. They were slow to settle down at the start of a class, and I had to stop often to keep their attention focused.

To get the class started I'd used a trick that one of my instructors in a college course used to get everyone's attention there. When he wanted everyone to be quiet so he could start, he raised his hand. The instructions were that when we saw hands raised, we were to raise our own hands and stop talking. For our class of adult students, it worked like a charm. Surprisingly, my grade six kids took to it too … they had fun waiting for the very last person to notice that everyone else had stopped talking and was waiting for them!

The next day, after getting the class under way, I showed them an empty chart I'd prepared on the Smart Board. I've discovered all sorts of uses for this electronic blackboard … it's amazing! It lets you prepare your boards in advance, even at home. You can use diagrams, charts, photos, and even links to sites on the internet. I like preparing questions, with the answers covered by an electronic 'sticky note'. This lets me face the class when teaching. I'd noticed that whenever I turned my back on some of these kids, a few of them tended to misbehave. But they were good when I could keep my eye on them.

I asked some students to put their data on the board for the circles they'd measured on paper, and the ones they'd measured outdoors. This took a while, but it got everyone involved in the lesson.

"Mr. Scott, can we use different colours?"

That was always the first question whenever the grade sixes used the Smart Board. Of course I said yes … although the colour combinations some of them chose were a little hard on the eyes …

For each circle, the chart recoded the circumference and diameter. I asked everyone to copy the chart into their notes, and then get out their calculators.

I had a little trouble with Peter … as usual. He didn't seem to be doing anything. I made eye contact with him and asked him once again to copy the chart into his notebook. Still he sat there. So I did was I was supposed to do … I knelt down beside him and gave him a choice … he could either open his book and do it now, or he could stay in the room at break and do it with me then. He made the right choice … as I'd known he would. That usually works.

The use of calculators in math has always been controversial. I'd had a long talk with my supervising teacher, and he'd confirmed what the instructor in my college math course had said. Calculators allow students to do way more math than they ordinarily could, because they remove the time-consuming paper-and-pencil calculations. In Sr. High math, a calculator's graphing capabilities allow for many more topics to be covered.

The danger is in allowing younger students to use them when they should be practicing math skills, or learning about numbers. There are good places to use a calculator, and times where we put them away.

For this class, I wanted everyone to divide the circumference by the diameter for each circle. This wasn't about practicing long division; if we'd done that, the calculations would have taken a whole class. It was the *results* that were important.

"Divide each circumference by each diameter, and round your answers to one decimal place." The kids had learned about rounding decimals in the previous unit.

That's one thing I'd discovered that teachers need to do, especially in math. Teachers need to know the *whole curriculum* for the grade they're teaching. When they create their unit and year plans, they need to make sure that some topics are covered before others. The textbooks usually do a good job of this … but not always.

"Mr.Scott. I must be doing something wrong! My answers are turning out all the same!"

"What answer are you getting, Julie?"

"They're all 3.1! How can that happen? All the circles were different sizes!"

I asked a few other students to report on their own answers. All agreed that the answers were always 3.1. Except for Mike, who'd divided the numbers backwards. But he figured out his mistake all by himself.

"OK, how about we try some more circles. The earth is round, right? I wonder where we could get the circumference and diameter from?"

"You could probably look it up on the internet, Mr. Scott!"

"OK, Joey, go ahead."

We'd used the Smart Board as a giant touch computer screen before. Joey went to Google and within sixty seconds he had the data. We copied and pasted each number into the chart.

While Joey was doing that, we had a side discussion about which numbers to use. The numbers on this site were given in miles. That was OK. But what was even more confusing was the fact that there seemed to be two of each, depending whether you measured at the equator or the poles. The numbers were different.

"Mr. Scott … does that mean the earth isn't really a circle?"

"The correct word is 'sphere', Matthew. And no, it's not perfectly spherical. I wonder why?"

No-one knew the answer, but they all seemed curious. I asked them to think about it, and promised them we'd talk about it tomorrow.

I know that some teachers would have gone off on a tangent here, and pursued this question because the kids were interested. But as a student teacher … with my supervisor sitting at the back of the room busily writing notes … I wanted to finish the lesson the way I'd planned it.

My supervisor had insisted that all my lessons have thorough plans, including all the questions I planned to ask. At first I'd thought that all that work wasn't really necessary … especially since *he* didn't always do it. But I discovered pretty quickly that thoroughly planning a lesson and the questions in advance made the teaching much easier … especially if I rehearsed everything in front of a mirror first. I also made point-form notes on cards, to carry around with me as I taught. That really helped.

"OK, go ahead and divide those numbers. Round this answer to four decimal places. What do you get?"

Joey answered this one too. “I get 3.1416. Is that right?”

“What do you think?”

“Well, if you round it to one decimal place like before, it’s the same as all our other answers.”

“Good. But it might be more accurate, right? Because we used more digits?”

“I guess so …”

I didn’t pursue that. Accuracy in measurements is a topic that wasn’t part of their curriculum in grade six.

“Here’s one more set of numbers. Divide them and see what you get.”

I’d cheated … but I didn’t tell them that. I’d pre-prepared a set of numbers that would give exactly the result I wanted.

“The numbers I gave you this time are much more accurate. Did you get 3.1415926?”

They all agreed. Now it was time to make sure everybody appreciated the magic.

“So tell me what we’ve learned?” I waited a moment. Lots of hands were up. “Megan, what have you learned?”

Megan almost never volunteers answers, so I always made a point of calling on her at least once in every class.

“Every time we divide the circle’s numbers, we always get the same answer. It *is* like magic!”

“Does it matter how big the circle is? Small, medium, large, or super enormous?”

“No, Mr. Scott. Every circle gives you the same answer. About three.”

“Actually about 3.14, right? Where did this number come from?”

They had to think about that for a minute. “You get it by dividing the … circumference by the diameter. But you have to measure them first.” Kenny was always very precise with his answers.

We went on to discuss how that special number was ‘hidden’ in every circle. That was the magic. We gave it a name … ‘pi’ … and they recorded it in their notebooks. Tomorrow we’d talk about how it was a number whose decimal values continued forever without ever repeating. We’d have some fun looking for patterns that weren’t there; this was beyond the scope of grade six math, but sometimes you do a little extra to stretch the kids’ brains.

“Mr. Scott …” Jenny looked at me, holding up a finger with a ring on it. “That means I’m carrying pi around with me everywhere I go, doesn’t it!? It’s in my ring … it’s a circle!”

I love that feeling when the kids learn something new, and are excited by it. It's why I want to become a teacher.

But I still have a long way to go.

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This is a lesson I've taught more than once. Some kids appreciate the awesomeness of pi being hidden in every circle, while others don't. Even more awesome is the fact that, as an infinite decimal that never repeats, every possible combination of digits will show up somewhere within it … including the phone number of everyone in Worsley!

For those of you whp are curious, here is the value of pi to 690 decimal places, in case you ever need it …

3.1415926535 8979323846 2643383279 5028841971 6939937510 5820974944 5923078164 0628620899 8628034825 3421170679 8214808651 3282306647 0938446095 5058223172 5359408128 4811174502 8410270193 8521105559 6446229489 5493038196 4428810975 6659334461 2847564823 3786783165 27120190914564856692 3460348610 4543266482 1339360726 024914127372458700 66 0631558817 4881520920 9628292540 9171536436 7892590360 0113305305 4882046652 1384146951 9415116094 3305727036 5759591953 0921861173 8193261179 3105118548 0744623799 6274956735 1885752724 8912279381 8301194912 9833673362 4406566430 8602139494 6395224737 1907021798 6094370277 0539217176 2931767523 8467481846 7669405132 0005681271 4526356082 7785771342 7577896091 73637178721468440901 2249534301 4654958537 1050792279

You can find pi to 4000 d.p. here:
http://www.worsleyschool.net/science/files/pi/pi.html