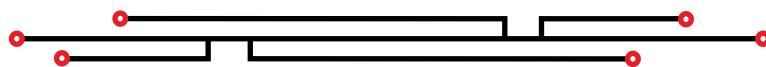




SMALL WONDERS



Beth Alexander, OCT, makes science come alive at an all-girls school, where creativity, curiosity and building confidence are key.

BY STUART FOXMAN

As a group of nine girls surround a work table, science teacher Beth Alexander, OCT, asks each the same question: “What’s your goal for today?”

For the Grade 6 students at The Linden School in Toronto, this class is playtime. The students have created games using circuits. One devised a football trivia game; get enough questions right and a ball will fly over a mini-goalpost. Other students are toying with variations of tabletop hockey (or foosball), where scores light up or buzz.

Over the next hour, the students saw, glue, cut and test batteries, and then work on assembling their inventions. Alexander floats from student to student, answering questions without imposing her thoughts about how the games should work. When one student wonders about the approach she’s taking, Alexander says: “Try your idea — what’s the worst that can happen?”

To Alexander — who teaches JK to 9 — learning is about investigating, experimenting, overcoming obstacles and gaining from these experiences. In that way, *every* subject is like science, she says — it’s the same mental exercise. “Allow space for students to come up with their own questions, then guide them to the process of figuring out the answers,” she says.

Alexander has spent 14 years, her entire teaching career, at The Linden School. The all-girls school has a teaching philosophy that promotes intellectual risk-taking, leadership and social justice to its 111 students; Alexander’s largest class has only 15. As an independent school in Ontario, it operates in accordance with the *Education Act* but receives no financial support from the government.

In some areas, teachers have provided their own support. Alexander designed the science/design technology lab room herself, and there are quirky touches: oval and circular white paper lanterns in a corner, curtains with a cat design, a three-dimensional cardboard unicorn wearing blue sunglasses on the wall (“My junior students are unicorn-obsessed,” she says), and alligator clips used to plan and test electrical circuits dangling from a tennis racket. One poster highlights notable women in computer technology. A chart describes the process of identifying fake news.



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EXCLUSIVE

PHOTOS: MARKIAN LOZOWCHUK



Beth Alexander, OCT, explores electronics with her Grade 9 computer technology students at The Linden School in Toronto.

“Asking questions — that’s where it all starts,” says Alexander. The way we look at science makes a difference; it’s important to separate what you think of as science “the process” from science “the subject.” To many students, Alexander says, science “the subject” is about exams, formulas and stress, which can be especially true as students advance through high school. Teachers and students often view science merely as a body of knowledge to be passed on — here is the information, now retain it.

There’s a place for that, but Alexander says it’s not enough. That’s the subject, and she devotes more space to the process. To someone in kindergarten or the early grades of elementary school, science is touching and playing and wondering what will happen — which students love because it’s fun.

The challenge is to nurture that feeling in every grade. “Science ‘the process’ is so natural. It’s something we love to do because our brains are wired to be curious. You see what works and then you adjust the course,” explains Alexander.

Education should tap into that spirit. “It’s about the love of inquiry. You’re going to solve a problem, so you should care about the question.”

Although her mother and grandmother were teachers, Alexander initially had no interest in the profession. Instead, she began her post-secondary career as a theatre major. Out of interest, she peppered her studies with science courses like biology, astronomy and meteorology. After graduating she became a costume designer, and then a film publicist. That was interesting for a time but Alexander wasn’t sold on the sales aspect.

What to do next? A big influence: Bill Nye the Science Guy, whose PBS show she devoured in her early 20s. “He made it fun. I was attracted to being a science teacher because that’s the purest distillation of how people learn.” So Alexander returned to school to study education.

At The Linden School, she tries to make science hands-on and entertaining, like running a lab on the chemical composition of candy, or transforming the entire classroom into a computer model. “We turned tables into components like a central processing unit, and painted a big green tablecloth to depict the motherboard. Students showed guests an open computer, then pretended to shrink them before leading tours around the ‘computer,’ explaining how each part worked.”

She’s a booster of the citizen science movement, encouraging her students to solve real-world problems. For instance, one Grade 6 class did a traffic study of a nearby street that they felt needed a crosswalk, sharing results with the Toronto city councillor for the school’s ward.

Alexander organizes a yearly Social Justice Data Fair, where students connect math skills with topics traditionally studied in history and geography — like the design of landmine detectors, voting rights or food security. She also co-ordinates an annual Math Mavens and Science Sisters event, where girls and their mothers explore problems together.

When there are educational gaps, Alexander looks to fill them. The Ministry curriculum does not yet include comprehensive coding activities for each grade in elementary. So Alexander researched and wrote one for JK to 8 in her school, which focuses on age-appropriate coding skills. “We review this as a team each year to make revisions and find ways to integrate with Ministry expectations in science/technology, math and language arts.”

To further boost coding skills, Alexander also started a weekly Programming Club for girls as young as five.

All of these achievements were cited when Alexander earned a Certificate of Excellence from the 2017 Prime Minister's Awards for Teaching Excellence.

Janice Gladstone, OCT, principal at The Linden School, says Alexander models what is expected of the students by taking risks herself. One example is the CERES (Coding, Engineering, Robotics, Electronics and Science) lab that she created for the 2017–18 school year.

"She's willing to step outside of what she's used to and try something new," says Gladstone. "It's an integrated lab, where you learn subjects simultaneously, which makes it more authentic because the world is integrated, and learning should mirror that complexity if you're doing it right."

Solving meaningful problems is also paramount. In one class that meant using circuits in textiles to support a UN sustainable development goal. For instance, one student designed a device to alert you if a mosquito net wasn't installed properly. That assignment exemplifies how Alexander makes science come alive. "You feel it serves more of a purpose. It made me more engaged," says Grade 9 student Juliana.

A former student, Maud Munn, says the award-winning teacher builds confidence. Munn, now in her first year studying education at York University, had Alexander in Grades 5 and 6. After Munn discovered that she had a non-verbal learning disorder, Alexander used techniques that allowed learning to happen through displays and visuals, not just words. And she did it for the whole class, never singling Munn out.

"She's flexible with the way you learn. If one method doesn't work, she'll try another and guide you to where you can go," says Munn, who calls Alexander an inspiration for her own career. "I want to do the same things she's doing — changing students' lives, as well as the way they see the world."

Colleague Savannah Barker, OCT, says Alexander has faith in the learner. In the Early Learning program (JK and SK), where complex subjects can be oversimplified, Barker notices how her colleague deliberately uses accurate and challenging language, like elasticity and decibels.

"She respects students and wants to see how far she can push them," says Barker. "She believes everyone can have success no matter their age or ability level." Alexander,

teaching at an all-girls school, is mindful of the under-representation of women in STEM (science, technology, engineering and math). She says there are many ways to foster greater inclusion.

For instance, Alexander says students don't see enough diversity in what a scientist looks like in the media. Inviting guest speakers or choosing videos to highlight greater diversity of experts has an impact.

She reassures students about their skills with supportive feedback and the opportunity to circle back to topics to improve performance. "Many studies show that girls, in particular, begin to disengage from STEM in the face of hyper-competitive practices such as emphasis on speed, on-the-spot performance and evaluation based on rank. I often talk about Maryam Mirzakhani, the first, and only, female Fields Medal winner in mathematics. She considered dropping math until a teacher explained that she didn't need to be fast to be good."

Alexander also nudges students out of "safer" roles and into more active ones. "During collaborative tasks, I assign roles and rotate them, so certain students don't end up being the recorder time after time."

Beyond science knowledge, she wants to nurture a love of perpetual inquiry. One of the most important lessons is resilience in problem-solving.

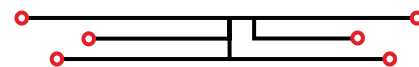
"When I assign a project I ask students to record every time they are surprised, change their minds or make a modification to their work. Part of their mark is this record of these 'mistakes.' I'm a cheerleader for anyone who thought something was scary but did it anyway. I make a fuss about that."

Alexander also wants her students to develop a deep respect for evidence, conveying how that is vital in science and in simply being an informed citizen.

"One study is interesting; 10 are more compelling. How do you know when something is true, how do you trust what you see or believe? These skills are so much more important than knowing the atomic weight of every element." **PS**

The Ontario Certified Teacher featured in this profile has been recognized with a teaching award and exemplifies the high standards of practice to which the College holds the teaching profession.

CULTIVATING CURIOSITY



How can you make STEM engaging for all learners? Award-winning Beth Alexander, OCT, offers these five approaches that work for her:

1 Make it multi-sensory

"As often as possible, STEM lessons should involve the five senses. Break up listening/reading tasks with chances to experience real materials."

2 Set up a "makerspace"

Learn by doing, she says. The space doesn't have to be large; Alexander's first was a repurposed AV cart. "It's amazing what can be done with simple materials like cardboard and masking tape."

3 Let students generate questions

"Kids don't ask, 'Why do we have to learn this?' when they are asking the questions and they are genuinely excited to find answers to interesting problems."

4 Incorporate coding

"Digital skills and computational thinking are more essential than ever, and can be integrated into STEM classes in so many ways." The CS First program (cfirst.withgoogle.com) is an excellent introduction for anyone who wants to teach and learn the Scratch programming language.

5 Try citizen science projects

"These allow students to collect real data that helps to further studies all around the world, from water quality to biodiversity. It also reinforces the idea that more data equals more reliable results." Visit SciStarter (scistarter.com/educators) for a list of suggested projects to join.