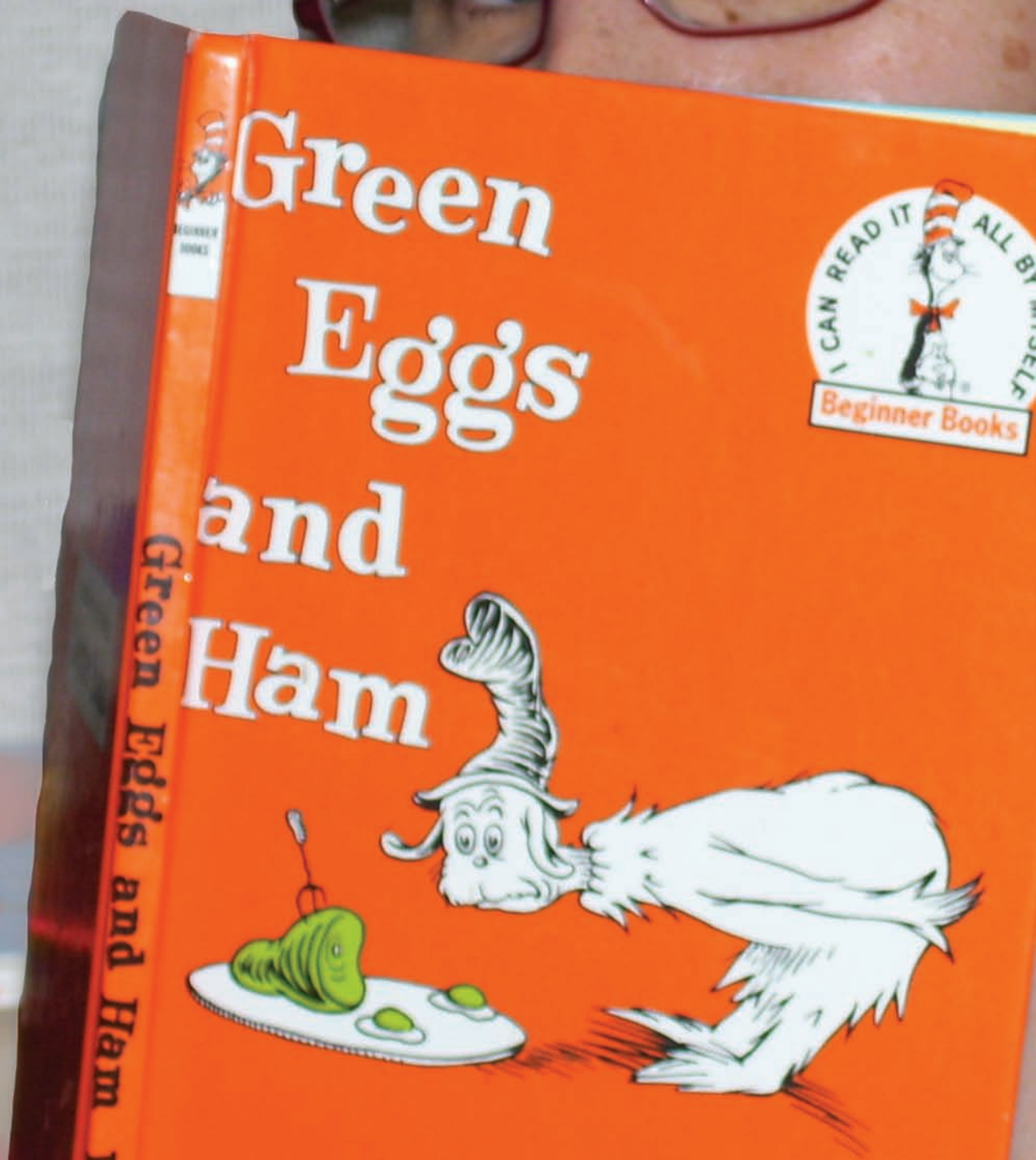



Making Science A Class Act





I had the privilege of teaching this quixotic mix a science class called “Matter and Energy.” The subtitle could have read “Not Smart Enough to Get Into Chemistry.”

By Pam Westfall

After roll call, I stepped out from behind the desk and walked to the center of the room. “Hello,” I said, as voices began to hush. The classroom fell silent, and all 28 pairs of eyes fixed on me.

“My name is MZZZZZZ Westfall. You see, I am married, but I didn’t change my name. I’m not a miss, because that was my title when I wasn’t married. I’m not Mrs. Westfall, because that is my mother. By convention, I am a miscellaneous, and it is pronounced MZZZZZZZZ. Why don’t we practice that?”

I counted to three, and in unison they drew out the MZZZZZZ part. So far, so good.

I was told not to expect too much from them, that they were low-level learners. As a former science researcher, I needed to do my own investigation on the group.

I scanned their academic records, realizing that I did not have future Fulbrights. Their grade point averages varied, but none was higher than a 3.5 (C+) and the lowest was a 0.6 on a 5.0 scale. Five had special education services, but the rest did not.

As I saw it, they held promise. They had mastered my name! I hoped they could master more.

I told them I had two rules: no talking while I’m talking and raise your hand if you have something you want to say.

My class roster could have doubled as a roll call for a mini-United Nations meeting, and typical of a Chicago high school. Yet this was suburban Plainfield.

I saw African Americans gathered front and center, the boys wearing low-slung jeans, the girls sporting “good hair” that has been straightened and made fuller by extensions. Their loud conversations made my roll call barely audible.

Off to one side sat some Hispanics with gold necklaces shimmering.

Assembling themselves in the back, the Middle Easterners and the Indians clumped loosely together, the young ladies modestly dressed and the young men leading quiet discussions.

White students filled the remaining roster and seats, some clumped together, others mixing in where they saw fit.

I had the privilege of teaching this quixotic mix a science class called, “Matter and Energy.” The subtitle could have read “Not Smart enough to Get Into Chemistry.” It was filled with mostly sophomores who needed the science credit to graduate.

Within the first week, I realized that I had quite a cast of characters whose personalities were difficult to manage. Three emerged as the main players.

I affectionately called one “Mr. Rapper.” His raps were interrupted only to clear his throat from time to time. His purpose in my class was not to learn science, but to perfect his art.

A lovely Hispanic girl, whom I referred to as “La Princesa” would spin incredulous stories about her drug-dealing incarcerated boyfriend. She contemplated whether she should be there for him when he was released.

When not preoccupied by her boyfriend

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dilemma, she would pick fights – cat fights interrupting lectures – with other females in the class, .

Rounding out the list was Pedro, a Polish boy whom the class had decided to give a Spanish name. Whenever I had a sub, Pedro would try to emulate a Spanish accent and refuse to speak to the sub unless she called him Pedro.

After two weeks, my gang of talkative three infected the rest, and morphed the class into total chaos. They ignored me when I talked, moved around whenever they pleased, didn’t do their assignments, and bombed tests.

I finally had had enough and I requested a meeting with administrators.

“I know what they need,” I said to them, “they need movement, music, and they need to construct their own lectures. That would keep them in order, but I just don’t know how to do that.”

While one of the administrators agreed with me, the other held a different view.

“No way,” she said, “you need to have them absolutely quiet from the beginning. You give them too much energy. You need to focus on the good ones, and ignore the bad. And no lectures. They just don’t have the attention span.”

Devastated, I had to regroup. I could not bear the thought of keeping them on a lockdown, forcing knowledge into their heads.

In reflecting on my own science education, I realized that I had taught myself a lot of what I know.

I learned physics in ballet class, got inspired to cook by extracting DNA, and understood entropy as the reason I resisted cleaning my room.

Along the way, I made strange yet meaningful connections, and that is why I learned science. I was going to teach them science my way.

First, I instituted a new seating chart, compactly configured, for easier class control. Instigators were dealt with swiftly, and I responded differently to their bad behavior.

If I caught students throwing things in the air, they stayed after class to explain why they decided to study projectile motion, a physics topic, instead of chemistry. The projectiles stopped.

If they used bad language, or were overly disruptive, they received a writing assignment from the

“Book of Consequences,” a confessional that documented their actions.

The deans loved it because it documented a student’s confession of wrongdoing. Using the one-two punch seemed to work, but it was more like turning the volume down from a 10 to an 8. They still were too loud and unfocused.

I gave them “bell work,” a simple problem to solve or a concept to expand on. I gave it the title of “ME pod,” short for Matter and Energy Problem of the Day.

After the bell rang, I turned on the overhead with the ME pod on a transparency, flicked off the lights, and began class. Settling into silence, the darkness of the room and hypnotic glow of the overhead mesmerized them temporarily.

As a simple way to check for understanding, and keep them thinking about science, I told science jokes after the lights came on.

Pedro secretly looked forward to the jokes, and called them affectionately “The Junk of the Day.” If I forgot about it, he’d remind me, and demand two. They rarely got the punch lines, but I never stopped telling them.

“Along the way, I made strange yet meaningful connections, and that is why I learned science. I was going to teach them science my way.”

Solids, liquids, gases.

We studied the differences, and the kinetic theory that goes along with it. While it was a boring topic, it was important nonetheless. I went through my usual demonstrations, labs and requisite worksheets. Yet I felt I could do something more.

While the class completed daily obligatory worksheets, my Hispanic students were their usual rowdy selves. I decided not to give them the standard lecture.

“So, what do you think of solids, liquids and gases?” I tentatively asked.

“Truthfully, Westfall, they suck. This stuff sucks. It’s so boring,” replied La Princesa.

A flood of empathy filled my mind. I knew it was boring, but my creativity had collided into a brick wall.

“Okay, it can be boring,” I admitted, “So, what isn’t?”

“Dancing, man. I can do it all night.”

Hmm. I bet she could. I had seen her in action in my class. Often, it would start as a piece of paper



tossed in the direction of her latest victim, and end in a catfight where I'd have to wedge myself between to keep fists from flying.

A million light bulbs went off. Dancing was based on movement. The molecules in solids, liquids and gases are in constant motion. I also realized that it was Hispanic Heritage Month. The administration was always encouraging us to connect students to the diversity of other cultures.

"Okay. You win," I said with some resignation, imagining what damage she could do.

"Here's what I want you to prepare for Thursday. You need to demonstrate three different dances that represent the three states of matter, and I want you to use Latin dance. Let's talk about that."

Her excitement electrified the air. She literally jumped out of her seat and declared, "Oh, I can do that!"

I had never seen this bold young lady get so excited in my class. I smiled like the Cheshire Cat, yet reservations preoccupied my thoughts.

"Great, but it has to be a surprise, so tell no one. We can talk during class tomorrow, after you've had some time to think about it."

Since the age of three, I had studied dance. By now, I had accumulated 37 years of experience. I could feel the motion of the molecules in their various states, but had no idea how to convey this to the students. Thanks to La Princesa, I could finally do it.

Armed with iPods, we brainstormed with determination. Acting more like an executive than a troubled teen, La Princesa ran the meeting, and I was satisfied that she understood the material well enough to execute the dance demonstration.

In class, I mentioned that the surprise was a reward for good behavior. The class settled down. Two days later, La Princesa and crew swirled and shook, cha-cha'd and tangoed to show molecular motions.

They became solids, then liquids, and finally gases. Their prior knowledge of dance finally linked to science.

As an informal dance party broke out, and the class once again bordered on anarchy. I turned down the heat by lowering the volume. They eventually settled back into their seats, and we ended with a scholarly recap of the activities.

The results of Friday's quiz were mixed, but I could tell that the real victory was that I was winning them over.

The class progressed to more complicated material, and at every step of the way I tried to incorporate some unusual activity, like the dance demonstration.

In a flash of inspiration, I thought up a fairy tale

about a 19th century scientist, Count Avogadro. He had championed a complicated idea that my students were struggling with.

"Once upon a time there was a knowledgeable count that lived in a castle nestled in the beautiful Italian countryside. He loved science so much, that he used to sit in his castle all day and think about it.

One day, he discovered the concept of how much stuff was in matter. He was so happy about his discovery, that he rejoiced and went to a ball. There he met a beautiful young woman named Felicita Mazzé. They fell madly in love, and eventually had six beautiful children. Fifty years later, someone came up with the exact number, and called it Avogadro's number, in honor of the count."

Perhaps my flowery language had conjured up images of a 19th century scientific Fabio because when I finally showed the students a picture of him they erupted in laughter. They couldn't believe how ugly he was. From then on, it was "That ugly dude's idea."

Building on that, we learned about the Dead Dudes Club. The theme: four men who had all discovered various principles about the behavior of gases and they were all dead. My students had to learn a little bit about their theories, and something about their private lives.

If I could find a juicy tidbit, such as flunking school, I would share. Making science personal made it come alive.

In a moment of inspiration, Mr. Rapper devised a little ditty on the fab four of gas laws. The ending was priceless,

"... I need this rhyme
to pass this class
or else these dead dudes
will kick my ass!"

The class howled with laughter, and he beamed at the attention. I was glad to see him smile. Earlier in the day I had discovered that his father had just been convicted of dealing drugs, and was awaiting sen-



Pam Westfall

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tencing.

While my class was beginning to understand science concepts, they stumbled over vocabulary. Their tests showed a weak link between their language and science talk. As they worked on a vocabulary exercise, Pedro became frustrated.

"I hate this stuff. This stuff is useless!"

I walked over to him.

"Pedro, settle down. You need to get your work done. I can help you with it."

His response was succinct.

"I'm not doing this shit!"

With dramatic flare, he threw his book on the floor. I picked it up.

"Pedro, you have a choice. You either settle down and stay by your friends, or you have to move by me."

His only response was an icy stare. I held mine just long enough to make him feel uncomfortable. I then moved back to my desk. He knew that a move meant staying after class, and possibly missing his bus. He had no other way home.

"Someday, someone's gonna fuckin' bash in her head," he informed his friends.

"Pedro," I mustered in my nicest voice, "is there a problem?"

"No. None here."

"Good."

He got a two-day suspension for that comment, and I got a reality check. They all felt frustrated with science vocabulary. Pedro simply voiced it. It bothered them, and I had been too lax in addressing it. I also knew I didn't want any more meltdowns.

The next day, sans Pedro, I surveyed the class about a solution.

"What can we do about the vocab?"

"Yo, Westfall, we can like not do it, man. It's a waste of time!" Mr. Rapper declared.

"Really? But you like words, Mr. Rapper. Perhaps we need to make a rap about them."

"Too hard."

We brainstormed, and one idea stuck: I Got Your Back. The game was simple. A guesser had her back to the whiteboard, and a writer put a vocabulary word on it. One person was the "dictionary" and had the job of reading the actual definition the book gave.

The guesser had to figure it out based on the book definition. If she couldn't get it, then the floor was opened up to everyone in the class. The students could use anything to describe the word, and even break it up into parts. Once the guesser had the right word, I put the formal scientific spin on it. They now had a link between their world, and one of scientists.

I Got Your Back became a classroom favorite. It allowed students to be loud, move around, and learn more naturally.

One day, while playing the game, someone started clapping out the theme to "Car Wash." They all joined in, and it became the cue to change guessers. Bingo! Now they had their music, their movement, and they were constructing their own lectures. I was amazed at how happy they were.

Happiness diminished as first semester finals loomed. During a discussion about the review packet, frustration resurfaced. This time, they protested that I had not taught them about particles in an atom. Surveying the scenario, I intervened before chaos erupted.

"Wow, we are working so hard right now that I think we need a break."

No one disagreed.

"Well, why don't I tell a joke?"

Groans circled around the room. I pulled up a classic.

"So, a neutron walked into a restaurant, and ordered two colas"

More groans.

"Yo, Westfall, we've heard this one before. Man, give us a new one!"

"Wow, you've heard this one before? Great! It gets even better the second time around, I promise. So, a neutron walked into a restaurant, and ordered two colas. The waiter brought them, and the neutron asked, 'How much?,' the waiter responded, 'For you, no charge.'"

The room erupted in laughter. Pedro felt cheated.

"Oh man, Westfall, you didn't tell us those bad jokes were educational."

With that, everyone laughed even harder. I chuckled, too.

"Well, you better know the charge of a neutron now!"

In the end, 8 out of 28 flunked the class, but all knew the charge of a neutron.

When we finished the chemistry part, we moved onto physics. I brought in toys to touch and play. A pink Barbie Jeep and a Mr. Incredible doll introduced the concept of inertia. I plopped Mr. Incredible on the hood of the Jeep, and gave it a push so hard it crashed into a block I had placed on the teacher's desk. They howled with laughter when he went flying off, his inertia keeping him in motion.

As the class progressed, I continued to give them opportunities to discover science for themselves. From NASA's Web site, I found a computer program to build planets. We studied trajectory motion; they shot small cannonballs out of miniature cannons. For potential and kinetic energy, students created pipe foam roller



coasters for marbles.

My students had personal lives that were rough, raw, and rainy. Many were being raised by single moms. Some had stepfathers whom they enjoyed as much as a root canal. Others lived with relatives, their relationships stormy at best.

After careful consideration, I decided to highlight the personal life of the biggest rock star of the physics world: Isaac Newton known as the man who had an apple fall on his head.

As I revealed his life, they found many parallels with theirs: his father died before he was born, he didn't get along with his stepfather, and he even flunked out of school, the first time around. The more information I gave about him, the more interested they got.

One fact stood out from the rest, and they would often echo it with such enthusiasm I had to check my ears to make sure I heard them right: that he had flunked out of school, and yet managed to have a second chance to show his brilliance.

It seemed as though they had hoped for a second chance, too: a chance to show that they were smart, that they could succeed. I was giving them another chance.

As time went on, I began to use children's books to help illustrate the complex science principles. I found that not only did they love to hear the story, they also seem to connect to the material better.

One day, I brought in a classic, "Green Eggs and Ham." I asked Mr. Rapper to read it.

"I am Sam," he began,

"I am Sam.

Sam I am."

His voice was loud, booming, and expressive. As he read, Dr. Seuss' rhythm sounded so fresh and new, like it was really a rap song.

"That Sam-I-Am! That Sam-I-Am! I do not like that Sam-I-Am."

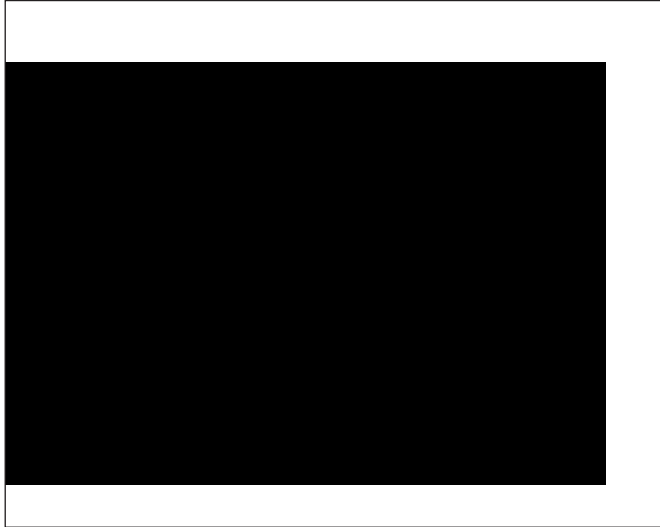
We sat and listened like kids waiting at the ice cream truck for our own treat.

We all had our favorite lines in the book, and we wanted to hear the Rapper say them. He did not disappoint. At the end of the story, he took some artis-

tic liberties, and the whole class howled with laughter. We gave him a standing ovation.

Once the crowd died down, I made the comment, "Wow – how can I top that?"

With the crowd subdued, I used illustrations from the book to show how characters had potential energy in one picture, and kinetic in another. They listened thoughtfully.



Pam Westfall used the Mr. Incredible doll and the Barbie Jeep to show her students physics demonstrations.

Some of them were still lost, but the classroom had transformed radically.

It had gone from out of control and rowdy, to a group of interested learners.

Only one student failed this term. The rest passed.

On the last day of school, La Princesa stopped by my room to say goodbye.

"Ms. Westfall, you are my favorite teacher." I smiled and thanked her.

She handed me a note. "I'm looking for-

ward to seeing you again next year," she added. I took the note and opened it.

Colorful smiley faces and hearts leapt off the page, and in a curlicue style, it read:

"Ms. Westfall, I am sorry for being such a pain. Thanks for putting up with me. You are my favorite teacher. La Princesa."

I learned many lessons that year. My students were difficult to teach. They had limited skills and minimal interest. I discovered how to make it real for them – by any means.

If that meant crashing Mr. Incredible in a Barbie Jeep, then I let them do it.

If it meant finding out that Sir Isaac Newton never knew his real father, then I told them.

And if they needed to dance, they did.