Everything Else I Know About Lean I Learned in 8th Grade Science

By Robert Martichenko

It’s been four years now since I spent that fateful day with my daughter Abbey in her first grade classroom. The result of my day with Abbey was my writing the book *Everything I Know about Lean I Learned in First Grade*. I am very proud of the book as it was a labor of love, and I am equally as proud that several thousand copies of the book have found themselves into the hands of eager lean readers.

However, just like all things in life, most good things that happen have some element of an *unintended consequence*. In the case of the Lean in First Grade book, the unintended consequence was that my oldest daughter Emilee, was quite put out about all the attention Abbey received with respect to the book. While they are very loving sisters, a dad should never underestimate the “hey, don’t you love me too?” syndrome. And so, in my endless pursuit to be a good dad, I promised Emilee the follow up book would pay attention to her and level the *dad attention* playing field.

The challenge was how to do this? The reality is, I never intended on writing the *Everything I Know About Lean I Learned in First Grade*. It truly originated from me simply trying to spend time with Abbey due to a busy work and travel schedule. So I talked to Emilee about coming to her 8th grade class. However, I was then educated about how 8th grade does not work the same way as 1st grade and therefore a “day” with Emilee was, according to her, not practical for many reasons. Then, one evening I noticed Emilee working on a project that included building a vehicle or sorts and attaching a balloon to the vehicle in order to propel the vehicle across the floor.

“What are you doing, Emilee?” I asked.

“Nothing” was the response from my newly-teenage daughter.

“Looks like something to me?” I replied.

After a few rounds of what may be construed as dialogue, I determined Emilee was in fact building a car that she intended to test and compete with the following day in science class.

“It’s settled then,” I said. “I’ll join you tomorrow for your science project and watch you race the cars!”

I was pleasantly surprised when Emilee agreed and was eager for me to join her the next day. After a couple of emails, I arranged to be a spectator the next day in 8th grade science class.
The next day was filled with fun. Emilee’s teacher brought the class and I to the cafeteria and we launched our cars. To say that we had high variability in product design would be like saying Niagara Falls has a little bit of water flow. Alfred Sloan and Lee Iacocca combined could not have come up with so many random automobile designs. Each student came up to the starting line, attached their balloon, and hoped for the longest ride across the cafeteria floor. To say that we had high variability in results (as measured in linear feet) would be like saying the Grand Canyon has a bit of a drop-off. The high score was well over 40 feet and the low was in fact a negative value where the balloon shot off the car and twisted the car in such a way that it propelled backwards. (The improbable physics of this particular test run still puzzle me today.)

In the end, it was an amazingly fun morning. Emilee and I and her classmates shared some laughs and conversations about how we could make a better balloon-propelled vehicle.

However, in that one morning, I did not gain enough insight to make good on my promise to Emilee to write the follow-up book to Lean in First Grade. What was a dad to do? That evening I interrupted Emilee while she was doing her homework to discuss my predicament. She was actually doing her science homework and I noticed her text book was very colorful and alive with pictures and tables and all sorts of images and figures that made the text book itself appealing to look over.

“Wow, text books have come a long way,” I said in a “you should have seen what it was like in my day” tone of voice.

“I wouldn’t know” was Emilee’s reply in a tone of voice that only a 13 year-old can perfect.

Over the next few hours I read through Emilee’s 8th grade science textbook. Similar to my experience while sitting in Abbey’s 1st Grade classroom four years ago, I had a sudden revelation: it’s all here.

The fact is, lean thinking and lean principles should not be thought of as anything new or innovative. The complexity of creating a lean business is in its simplicity. We have the answers to many of our challenges; they have been around for centuries. Why is it that collectively we cannot simply get back to basics, get back to theories and models that have created all of the positive advancements we know in the world today? Arguing against lean principles should be no different than arguing against the laws of aerodynamics or penicillin fighting infection. Not much argument about the latter two.

My commitment to Emilee was that I would write a follow up to Lean in First Grade where she would be the lead protagonist. Holding true to my commitments is very important to me, not only as a business leader, but in this case as a parent. How can I preach the wisdom of walking the talk if I don’t practice it myself? Yet, life is busy. The new normal work week is almost abnormal. So I decided I needed to talk to Emilee and confess that I was unsure of my ability to complete my end of the bargain.

This is how the talk went. Picture my family of four around the dinner table:

“Emilee, I think I will need at least twelve weeks of full time attention to our project if I have any chance of completing the book. And honey, I’m just not sure I can commit to that right now as work and travel make it very difficult to find that much time to focus on one thing.”
“Ok, Dad, no problem. Why don’t we just do a little bit a time? We can spread it over what time we have available to us.”

What came next was silence on my part and full recognition that once again, even with all my training, education and real world experience in lean, I missed to see the obvious solution to the problem. Why did I feel the writing of the second book needed to be a batch process?

“You’re absolutely right Em,” I responded. “Let’s just do a little each day and before you know it, a job that seems larger than life will get done – done in an efficient and effective way. That is, by doing the right things a little each day, we will complete a great book in the end.”

The good news: in the spirit of small lot size and high delivery frequency, we can share the updates of this second book with our readers as it progresses one chapter at a time. I’m very excited about this second book and look forward to sharing it and hearing comments from our readers.

“A journey of one thousand miles” begins with a single step, or in this case, chapter 1. Please join myself, Emilee and her classmates, and of course Orloe the Wise Owl next month in the LeanCor newsletter as we introduce Everything Else I Know About Lean I Learned in 8th Grade Science.

Pt 2: Day 1 – Science and Scientific Method

I always enjoy the first day of any learning event. There’s a positive energy that comes along with learning. Learning is good for the soul. Sitting in my daughter Emilee’s 8th grade classroom, I asked Emilee what she thought, but apparently a little too loudly.

“Alright Emilee, the first day of eighth grade science! Don’t you just love to learn?”

“Ah, I guess Dad, but could you talk a little quieter? My friends might hear you.”

“Oh, sorry honey.”

Emilee’s eighth grade science teacher entered the class with a packsack over his shoulder, bike helmet, and water bottle in his hands. He looked to be about fifteen years old. Although I know it’s just the fact that I’m getting older and younger people seem ultra young as the years go by.

“OK class, let’s come to attention. We need to get this show on the road!”

After the class went into listening mode, the teacher began.

“Nice to meet you all, my name is Sammy Magee. You can call me Teacher Sam. Ok, let’s get started. Who can tell me the definition of science?”

At this point the class of 20 students sat in silence staring at Teacher Sam, undoubtedly in thought about their summer vacation that was now officially over.

“Nobody?” he asked. “Well what are you waiting for? Get out your smart phones and figure it out!”
At this point Emilee just stared at me and with her eyes communicated that phones were not allowed in class.

Sam broke the silence of hesitation among the students.

“This is science class people, this is about experiments. This is about questioning everything. Live on the edge people, use your phone and find me a definition of science!”

Clint Eastwood and John Wayne combined at their peak would have been challenged with the speed of phones being drawn from their holsters. Fingers started pecking, and within thirty seconds the first answer was shouted to the class.

One high-energy eighth grader shouted, “According to Wikipedia, science (from Latin scientia, meaning "knowledge") is ‘a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe!’

Another shouted out “According to Dictionary.com, science is ‘a systematic knowledge of the physical or material world gained through observation and experimentation!’

Yet another shouted “According to Webster’s New Collegiate Dictionary, the definition of science is ‘knowledge attained through study or practice, or knowledge covering general truths of the operation of general laws, as obtained and tested through scientific method and concerned with the physical world.’

Another student started to shout out another internet-generated definition when Teacher Sam interrupted the group and said, “Ok class, holster the phones!”

Teacher Sam continued, “What is the foundational approach and tool used for scientific discovery?”

Unbelievably (or in hindsight maybe it wasn’t so unbelievable), no less than four students yelled out “Facebook!”

The look of disgust on Teacher Sam’s face said it all. “Well now, I can see how you would think the answer is Facebook or maybe Twitter or maybe some other application that takes mysteries of the world and turns them into a game where you can smash walls with birds. For now, in the absence of my own knowledge of such an application, can anybody tell me the known approach to scientific discovery that has been around for a while, like a few hundred years?”

I was very proud of my Emilee when she raised her hand and responded, “The Scientific Method?”

“That’s right Emilee,” Teacher Sam said. “Great job. Can anyone remember the main points of the Scientific Method?”

I guess the summer hadn’t completely voided all the young minds as they went into their memory banks and drew out what they learned the year before. The responses were random but Teacher Sam caught them all and wrote them on the board in the correct order.

**The Scientific Method**
1. Ask a question.
2. Define the problem.
3. Make observations, gather information and data.
4. Form an explanatory hypothesis.
5. Test the hypothesis by performing an experiment.
6. Make new observations and new information and data.
7. Analyze the data and draw preliminary conclusions.
8. Publish results and share the learning.
9. Re-run the experiment as many times as required to solve the problem.

“Very good people,” Teacher Sam told the class. “Now, this is the approach we will use this year as we become scientists and learn about our world and how it works. It’s nothing complicated, just a simple proven model that scientists over centuries have used successfully to ask good questions, uncover answers, and solve problems - both big and small.”

Orloe the Owl on Lean and Science

Lean thinking is very similar to science as lean is about observation, questioning the current state of operations, and conducting experiments in order to uncover the truths behind processes in order to improve the current state of the processes.

The scientific method is a proven approach to problem solving that has been around for centuries. Once again, this is nothing new under the sun. Many problem solving models have been advocated over the years; Plan-Do-Check-Act (PDCA) from Dr. Deming, Define – Measure – Analyze – Improve – Control (DMAIC) from the six sigma movement….and there are others. However, at the heart of any problem solving model is the structure of the scientific method.

As lean practitioners and operational leaders we need to think of ourselves as scientists looking to make important discoveries. Our job is to observe and uncover the truths and mysteries of the processes that make up the value stream and value proposition to our customers. The challenge is not what problem solving model to use, but rather to ensure that you have a model in place. Far too many organizations espouse continuous improvement, yet they do not have a formal approach to solving problems! This is a major disconnect. A problem solving model is simply a language, a standard way in which all people inside an organization will approach solving problems. I would advocate that if you do not have a standard problem solving model in place then you do not have a culture of continuous improvement.
The Orloe Problem Solving Model

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<th>Operate</th>
<th>Do the Work &amp; Identify the Problem</th>
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<td>Plan &amp; perform the work.</td>
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<td>Identify gap between plan vs. actual condition.</td>
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<th>Review</th>
<th>Define the Problem</th>
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<td>Document &amp; validate current state.</td>
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<td>Develop a clearly defined problem statement.</td>
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<th>Learn</th>
<th>Determine Root Cause</th>
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<td>Identify all possible causes to the problem.</td>
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<td>Isolate critical few root causes to the problem.</td>
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<th>Optimize</th>
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<td>Develop solutions that address the root causes to the problem.</td>
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<td>Ensure the solutions support the entire value-stream.</td>
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<td>Communicate, train, and implement the solution.</td>
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<td>Measure and monitor the impact of the solution.</td>
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Three Lessons on Science and the Scientific Method

1. Science is “knowledge attained through study or practice, or knowledge covering general truths of the operation of general laws, as obtained and tested through scientific method and concerned with the physical world.”

2. As lean practitioners, we need to think of ourselves as scientists. Our goal is to understand the world around us and make it better. At work, this means to understand our processes and to work to make them better.

3. The scientific method has been around for centuries and is a formal approach to solving problems. As leaders inside our organizations, we need to ensure that we have a formal model in place for solving problems.

Pt 3: Horses – Entropy and the Second Law of Thermodynamics
After a full week of school, Saturday morning is always welcomed in the Martichenko household. I read once that people actually prefer Friday over Sunday, even though many work on Fridays. The logic is that some people actually prefer a day of work when they’re anticipating the weekend more than a day of rest when they’re anticipating Monday and a full week of work. Either way, in the Martichenko family, we enjoy Saturdays.

The sport of choice for Emilee and Abbey is horseback riding. They compete in Hunters, Jumpers, and Eventing, which means they like to go over jumps that can exceed 3 feet (generally to the amusement of watching me nearly have a coronary with every jump). While I always enjoy watching them complete a circuit, the end of the circuit is a refreshing part for parents. “Safety first in all operations,” I say to the girls, their mom - Corinne, their trainer, the owner of the barn at which they ride, and anyone else who will lend me an ear.

A typical Saturday involves the girls going out to the barn on Seabrook Island, gathering their horses from the pasture, bringing the horses to their stall where they will be groomed and tacked (the process of putting on the saddle, bridal, and reins). I always like this part of the process and frequently joke with Emilee that we need to better understand Takt time. The reference is lost on Emilee and when I try to explain, she immediately starts to text some unknown person. (Evidence that she has better things to do than listen to another lesson on Lean thinking.)

Horses raise good kids. They teach discipline and hard work. The work required before you ride the horse and the work required afterwards necessitates a real commitment to the sport. It’s very much like Lean thinking wherein you need to prepare properly, you need to practice a lot, and you need to wind down and reflect after each practice.

Today is not a typical Saturday, as today the girls have a horse show. This means that Domino (Emilee’s horse) and Cotton (Abbey’s horse) will be transported to Mullet Hall - a very scenic, yet laid back equestrian centre close to Kiawah and Seabrook Islands on the South Carolina coast. Both Emilee and Abbey will prepare their horses and themselves for the competition by grooming their ponies endlessly and putting on their best show clothes. The set will be completed with a show helmet, an elegant black velvet helmet worn only on show days. “Safety first,” I say. The low utilization rate on the show helmet does not concern me to the point that it requires my intervention.

Although I am not a horse expert, I really like the horse environment. I don’t quite understand the sport in regards to scoring and what actually makes a “winner trip” around the ring. My involvement is more about purchasing the hay and offering encouragement when the girls are not happy with their performance. This unhappiness is typically signified in the form of them leaving the ring and riding straight back to the barn without glancing down at me and my ready camera. (Body language is everything it seems.)
Because I am not heavily involved with the inner workings of the competition, I am left with spare time on my hands that others are using to discuss “how the heck that judge ever got to the point where they felt they were qualified to judge.” As most Lean thinkers do, I use the time to wander around and look for examples where Lean principles can be applied to improve processes. (This is a curse of the trade and I fully recognize I need a support group at this point in my life.)

Horses, horse shows, and horse people are all very interesting. There is an ecosystem around the sport that is highly functional. Just like business, there is a culture, etiquette, politics, and protocols for decision making. I don’t understand any of it. When I’m not wandering around, I spend my time trying to figure out when my girls and their ponies will ride and compete. Horse shows are a “hurry up and wait” event, and when a rider competes, the ride can last no longer than 2 minutes. Thus, if you miss the event time you can miss the 2 valuable minutes and have to wait another 2 hours for the next ride. It’s a classic value stream: 10 hours of total lead time (all day Saturday) for 10 minutes of total value (5 events @ 2 minutes per event). Speaking from direct experience, you do not miss your child’s event.

There are few visual cues at horse shows, no real visual management around the plan or schedule for the day, and no posted current status of whether the show is behind or ahead of plan. It can be very frustrating for a Lean thinker. I tell myself this is not about Lean, and I do what all other people in my “boat of ignorance” do: wait for my children’s trainer to come running frantically saying “get your horses ready, you are on next!”

*I have just experienced this with our trainer as I stand outside the ring waiting for Emilee and Domino to enter for their first competition of the day.*

Emilee and Domino have been riding together for over 6 years. We purchased Domino in Kentucky when we lived in the great horse state. Domino is very popular among other horses in South Carolina because of his home state of Kentucky. I’ve overheard other horses asking him, “What is it like to actually pasture in the rolling hills of Kentucky?” Domino is a laid back *Paint* (black and white) horse and normally just plays it cool and replies “It’s OK, no big deal. The grass is nice, the oats are tasty.” I like Domino, he’s a member of the family. As I said earlier, horses raise good kids and Domino has done a nice job with Emilee.

Emilee and her horse enter the ring. The judge is ready, the rider is ready, and the horse is ready. Emilee gives her pony the first of many cues and they begin the circuit of jumps as a team, working as a unit of one. I immediately become lost. I have no idea what Emilee is doing with her horse, what the judge is looking for or what will produce a successful run. My focus is simply that I want her and Domino to make it over the jumps safely. I do, however, eves drop on Emilee’s trainer, other observing trainers, and other parents, hoping to capture their comments. Using this technique, I decipher that she is having a great ride. She is maneuvering through the circuit of jumps in a serpentine fashion, clearing each jump with relative ease from my perspective. The ride comes to an end and I look for indications of how well she did. People around me are cheering and yelling “Great job Emilee!” and Emilee is bent forward giving Domino and big hug of congratulations. This is great news and I get my camera knowing she will welcome pictures with her on her horse. Pictures are taken and we head back to the stall. Emilee untacks her pony and we sit down. I go into inquiry mode.
“You did great Em,” I say. “Everybody said so!”

“Thanks Dad. It felt like a great ride.”

“What made it a great ride?” I ask, admitting my ignorance.

“Oh Dad, here we go. Let me guess, you want to know the CTQ’s for my ride?” Emilee responds as she rolls her eyes.

My pride in her use of the term “CTQ” would light up the whole state of New York even if Niagara Falls went dry. “Well yes honey,” I say. “I would like to know what the Critical to Quality Checklist is for your great ride.”

“Fine” she says. “But I’m only doing this once, so give me your phone.”

I’m a little puzzled, but I dutifully hand her my smart phone. She opens the Notes application and starts to type the list of CTQ’s from her ride.

### CTQ’s to Have a Successful Circuit

1. Keep eyes looking forward and focused on where you are going
2. Keep your horse at a steady pace
3. Solid contact with reins
4. Sit deep in the saddle and do not get a head of your horse
5. Heels down and firmly in the stirrups
6. Keep your horse moving

After reviewing the list, I ask her, “You are telling me that these are the most important items that you need to get right in order to have a successful ride?”

“It’s a checklist Dad,” she teaches. “I have it on paper but can’t take the paper with me so I also have it in mind. I can see the checklist as I ride and I’m checking each item off in my mind as I complete my event.”

“It’s called practice Dad, lots of practice.” She says in a voice telling me my time with her full attention is running short.

“10,000 hours.” I build on her comment.

“Say what?” She grunts.

“Malcolm Gladwell, Outliers, 10,000 hours of practice. “I respond to the grunt.

She looks at me, turns around without saying a word, and walks away toward the event ring. My time is done, this meeting is over!

Her next event is one hour away – give or take three hours. We sit down at the picnic table and have a great lunch - the pot luck lunch built by no less than eight families. This is a lunch format that cannot be replicated by any restaurant anywhere under any circumstances. Once I have had ample potato and macaroni salad, I go back to quizzing Emilee.

“Ok Emilee,” I start. “I understand you have a physical checklist and that you have memorized it through practice.”

“Yes, Dad,” She responds across the picnic table. Three of her friends come closer to listen to the conversation and Abbey warns them to consider otherwise. Abbey then runs for the hills while the “getting’ is good.”

“Great,” I say, getting my inquiry juices flowing. (I remember from my own lean leadership training that effective inquiry means to ask questions that will allow for deep understanding of the topic at hand.) “So what happens when things don’t go well, what exactly do you do?”

“Well Dad,” Emilee answers politely and engagingly because her friends are listening. “The first thing is to assume everything will go wrong and your job is to keep it from falling apart.”

“You assume everything is going to go wrong?” I ask.

“Yes Dad, it’s all 8th Grade Science, entropy and the second law of thermodynamics.”

“Really?” I respond, maybe a little too enthusiastically, as I can tell Emilee’s friend are wondering where Abbey went and whether they should have joined her. “Tell me what you have learned.”

Emilee begins a short but theatrical soliloquy that would have gained the respect of Shakespeare and Shaw collectively. “The Second Law of Thermodynamics states that in a system, a process that occurs will tend to increase the total entropy of the universe. In other words, the system wants to fall apart by virtue of the entire universe trying to make the process fall part.”

“Entropy…” I am now building on her words. “A measure of the disorder or randomness in a closed system?”

“IKR.” (a.k.a, “I Know Right?”…or in other words, “Yes dad, how do you manage to get through a day on your own?”)
“Ok,” I continue. “So you and Domino go into the ring and every part of the universe is trying to make your ride fall apart?”

“IKR.”

“So what do you do to have a successful ride?”

“I just put more pressure on the process to get it right than the universe is putting on it to make it fall apart. For example, other than the basic CTQ’s, if I know Domino is restless in the morning I will exercise him before my event so he is calm. During the event, if I think he may refuse a jump, I squeeze more with my legs to let him know I am there and ready to guide him over the jump.”

“Emilee, this is Lean thinking!” I say to her and her friends.

“Ugh.” She responds. Without another word she and her friends are off.

Orloe the Wise Owl on Entropy and the Second Law of Thermodynamics

Lean thinkers are process thinkers. We try to create stable processes in order to implement flow across the fulfillment stream. As a mature process thinker the first thing you need to recognize is that processes want to fall apart. In fact, all natural forces in the universe are trying to take your process and make it fall apart. Therefore, we need to put equal and more pressure on the process to keep it together than the universe is putting out to make it fall apart. This is the core purpose of Lean techniques and tools such as Standard Work, Plan Do Check Act (PDCA), and Error Proofing. The goal is to make it easier for people to “get it right” than it is for them to “get it wrong.” As a leader you need to recognize that processes want to fall apart and consequently not be surprised when they do! This is why Lean Leaders ask “why” and not “who.” A Lean Leader recognizes that at times entropy will win over PDCA and other tools. When it does we are eager to understand why. As the saying goes, Lean Leaders are hard on process and easy on people.

A fundamental approach to attack entropy is to identify and create a checklist for the CTQ’s of the process. These are the elements of the process that no matter what, we need to get them right. In other words, if we don’t do these things (CTQ’s) we are virtually guaranteed that the process will fall apart.

Orloe’s Three Steps

1. Isolate and create a checklist for the Critical to Quality (CTQ) elements of the process you are working on.

2. Create standard work around the CTQ’s so you can learn and visualize them while you are doing your work.

3. Put more pressure on the process to keep it together than the universe is putting out naturally to make it fall apart.