# If I won the lottery, I would…

## Si ganase la lotería, yo…

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## Abstract

This article is an exploration of the work-related consequences of me winning the lottery. As detailed, depending on which lottery I hypothetically won would dictate whether or not I quit my job. In the one scenario where I do quite my day job, I imagine a scenario where I look back at an interrupted career in probability (and statistics) education. Topics pondered include: gambling education, seminal articles, the changing nature of publication and conference travel, the old guard of stochastics education, missed opportunities (e.g., sports analytics education and consequential probability) and the grand narrative of school mathematics.

**Keywords**: gambling; conference travel; consequential probability; The Math Myth; sports analytics education.

## Resumen

Este artículo explora las consecuencias relativas al trabajo si ganase la lotería. Como se detalla, dependiendo de qué lotería gane hipotéticamente, dependerá de si dejo o no mi trabajo. En un escenario en que deje mi trabajo diario, imagino un escenario en que miro una carrera ininterrumpida en educación en probabilidad (y estadística). Los temas posibles incluyen: educación para el juego, artículos seminales, naturaleza cambiante de las publicación y viaje a conferencias, la vieja guardia de la educación estocástica, oportunidades perdidas (e.g., educación analítica deportiva y probabilidades consecuentes) y la gran narrativa de la matemática escolar.

**Palabras clave**: juego, viaje a conferencias, probabilidad consecuente, el mito matemático, educación analítica deportiva.

## 1. Introducción

This paper is a thought experiment, based on a simple question: "If I won the lottery, I would…" For those of you not familiar with the Canadian lottery landscape, there are three main lotteries. Of the big three, that is, Lotto 6/49, the provincial versions of Lotto 6/49 (e.g., BC 49, Western 6/49, Atlantic 49 and others) and Lotto Max (Akin to the provincial versions of Lotto 6/49, there are two provincial versions of Lotto Max, known as Québec Max and Western Max). Lotto Max is the lottery with the largest jackpot. Held every Friday, for a mere $5, Canadians have the opportunity to win, at a minimum, $10 million, and, at a maximum, $60 million. On a related note, the odds of winning the Lotto Max Main Jackpot are not great. Those who buy a ticket must choose seven numbers from a field of 49; and, as such, the odds of winning Lotto Max are 1:85900584. The focus, here, on Lotto Max is purposeful because it is integral to the thought experiment.

Please don't get me wrong, yes, it would be nice to win any of the big three Canadian lotteries. Take Lotto 6/49, for example: the odds of winning, at 1:13983816, are much better than Lotto Max; there are two draws per week for Lotto 6/49, as opposed to once a week for Lotto Max; and, it only cost $3 to play. And while, yes, the largest single

jackpot in Canadian lottery history was a Lotto 6/49 jackpot of approximately $64 million, the average jackpot is just shy of only $10 million and the minimum jackpot is a paltry $5 million. Initially, it might sound absurd for me to using words like "only" and "paltry" when discussing $10 and $5 million. But, to be honest, I am not going to quit my job if I won $5 million playing Lotto 6/49, which brings me back to the thought experiment.

**Lotto 6/49**

If I won the lottery, I would… If I won the minimum Lotto 6/49 jackpot, recall: $5 million, *I would* probably put the money into some high interest savings account and, yes, live extremely comfortably for the rest of my days. Sure, I would quickly pay off the mortgage I have on my house. I would get Kristen (my wife) to retire as soon as possible, of course. I'd probably buy a new car; nothing fancy, just new (e.g., a 2019 Subaru Forester). Make sizeable donations to amazing animal charities (e.g., The David Sheldrick Wildlife Trust). And, I would have all the latest and greatest expensive technology (e.g., iPad Pro, etc.). *I would not*, however, quit my job here at the University of Saskatchewan. Sure, I would probably look into whether or not I could buy myself out of my teaching duties — this way I could focus all of my time and efforts on reading and writing about the teaching and learning of probability. If this wasn't possible then I would look into whether or not I could fund my own endowed chair or professorship. This would run, I'm assuming, into some ethical issues. Deterred, I would probably just accept my regular assignment to duties and my day to day activities wouldn't look all that different from what they look like today. In this particular scenario, I see myself continuing to conduct research in the field of probability education. (I think you see where this is going.)

**Lotto Max**

If I won the lottery, I would… Let's say, rather than winning the jackpot minimum for Lotto 6/49, that I win the Lotto Max maximum jackpot, that is, $60000000. Sixty million dollars! Sure, the bulk of the money would still go into savings and investments. We would make even more sizeable donations to amazing animal charities. I would get Kristen to retire the very next day. We'd probably have a super-fancy car (like a Volvo or a Lexus). And, of course, we would buy one of those oceanfront houses just below the endowment lands of the University of British Columbia in Vancouver, British Columbia. We would also have an oceanfront cabin on one of the Gulf Islands that we would visit frequently. Setting our life back up on the West Coast of Canada would be possible because, of course, I too have retired in this scenario. Not only am I no longer working at the University of Saskatchewan, upon winning $60 million, but I would also be done with any and all current or future investigations in the field of probability education. Done!

## 2. Saying goodbye to probability (and statistics) education

I understand that the passage from researcher in the field of probability education to lottery winner would not take place overnight. There would be a number of loose ends that would need to be dealt with. Case in point, I have a few conferences already on the books for this year and next. I am reviewing a number of manuscripts for various mathematics education journals. And let's not forget about all the emails that keep

incessantly showing up in my inbox. Slowly, though, over time, my connection to the world of probability education would slip into the background. I like to tell myself that I would definitely keep up with new articles as they were published. (Although I would have given up my university access to the articles, my new found wealth would probably allow me to pay the exorbitant prices to access the articles stuck behind paywalls.) It is more likely, though, that I would deep dive into new passion projects that arose from my new station in life. I'm not sure exactly how long it would take, but I do see a lottery based scenario where I am became completely cut off from the world of probability education for decades.

There's this image that is burned into my brain. After all, even with $60 million burning a hole in my pocket, I won't be able to avoid Mother Nature and Father Time. I picture myself much, much older than I am today. My hair has turned completely white, I've keep most of it, and even shed a few pounds. I see myself sitting in a nice wooden rocking chair with a red, plaid blanket over my lap. I'm not reading. I'm not listening to the radio or a podcast. I just am looking out at the ocean from the top floor of my home. The wood that surrounds me is lit by sunlight. It's just me and my dog. And, as I'm sitting there, I'm thinking. More accurately, I'm thinking back. Having shut down a career in probability education at a relatively young age, it's conceivable that one would start wondering about what might have been. After all, some have argued that the field was just coming into its own. There would probably be time spent projecting how many articles in refereed journals would have published if it weren't for winning the lottery. There would also be thoughts about whether or not the career path given up would have ever led to a keynotes presentation at a major mathematics education conference. Thankfully, these vain initial thoughts about life in the field would give way, eventually, to thoughts about the field, that is, thoughts about research in the field of probability education.

The remainder of this article, then, is the wonderings of an imagined, future version of myself. An older me who is looking back on the field of probability education research, the field that I completely abandoned for decades, because I had won the lottery. Stated in more confusing terms, in what follows, I present a personal look back at a quizzical look forward at the field of probability and statistics (mostly probability) education. Given that prominent researchers, especially in publications important to the field (as I best remember it), utilized (wish) lists, I too have made a list, albeit in no particular order. Let's begin.

## 3. Gambling education

Based on my unique circumstances — having won the lottery, that is — one my first thoughts will lean towards the connection between the lottery and probability education. I'll have a quick thought reminding myself to finally read *The Improbability Principle* and then I'll begin by wondering what would have happened had I won the lottery but not quit my job as an Associate Professor at the University of Saskatchewan. Obviously, my lesson for future math teachers on winning the lottery would need to be rewritten.

At the time I left, I began my lesson telling my students that I have a full proof plan for us, as a class, to win the next drawing of the Lotto Max. I proceed to tell them that we begin by pooling all our money together so that we can buy as many tickets as possible. I tell them that we can take out loans, sell cars, etc. so that we can amass the most amount of money that we can. Pull out all the stops! In a room of 80 people, after all, we should be able to put enough cash together. After we work out the Lottery

calculation we find, surprisingly, that we are approximately $85900584 short. Currently, the lesson gets a decent laugh and, I believe, the odds of winning the lottery hit home for some students. However, if I'm standing at the front of the room with $60 million hanging out of my pockets, the laugh just wouldn't be the same. Thinking about the lottery in this manner, my next thoughts would lead to gambling, in general.

Even before I left the game, I've always been perplexed about the lack of gambling education that was provided in schools here in Canada. We go to extreme lengths to teach future citizens about a number of different subjects, including health and physical fitness, history (Canadian and otherwise), literacy and many more, to better inform their future life. However, we do not dig into the perils of gambling. Instead, Canadians have to find out about gambling the hard way through the school of hard knocks. Perhaps playing the lottery could act as a gateway investigation into gambling education. Speaking of gateways, I would wonder as to whether there were pious reasons for not teaching gambling in school and how much society had or has not changed around gambling. Thoughts, though, would lead back to probability education.

As I'm sitting in my room, looking out over the ocean, I would rack my brain trying to figure out who from the field of probability education would be best equipped to have had a good run of research and become the face of gambling education. First off, this person would have to be familiar with much of the research in the field of probability education. They would also have to be extremely well versed in psychological research, as well. These two key factors would provide me with an aside where I wonder about whether the connection between psychology and probability education has strengthened or waned since I left the profession. After that brief aside, I would, once again, wonder about developments that have taken place in the outside world over the years. Suspecting, here and now, that the lottery and gambling and related activities have moved almost if not entirely online, I would, when looking back, add a third factor about the researcher being well versed in the role of technology in teaching and learning probability and statistics and well as in gambling. After going through a list of the usual suspects, my thoughts about the lottery, which acted as a gateway back into the field of probability education, would move on to other subjects.

## 4. The changing face of publications

I'm not going to deny it, I will definitely spend some of my time thinking about certain projects that I did complete before winning the lottery. Sure, there will be some time spent wondering which and to what extent certain publications were referenced, if at all, during the intervening years. Knowing full well that if something I did had become referenced all the time that I would have been contacted by somebody at some point, and having not been contacted by anybody and any point, thoughts would quickly move to the changing face of publications in probability education.

Everything was in transition at the time of my departure. Libraries, yes, still had row after row after row of books. Libraries also had many rows of journals. At the same time, though, the majority of the students were accessing these materials with the electronic devices that they carried around with them all the time. Should option number one be: First, get to the library; second, find the location of the material that you are looking for with a reference device; third, sojourn the library looking for the material; find the material; make sure that you are interested in the material by reading some or all of it; lastly, capture the material for use at a later date. And should option number two be: an article just appeared on my device in my hands. There is no doubt that people

will opt for option number two. Also at the time of my departure, a weird shift was taking place: ease of access was starting to dictate the publications success.

As mentioned, I had noticed a shift when I was leaving. The references that I was finding at the end of their papers had begun to change. The bulk of the references were no longer to articles that were found in paywalled journals from long ago or those just recently published. Instead, the bulk of the references were to online articles that were freely accessible. Having tested this scenario out, I would go through reference list and, sure enough, they were full of articles that just a few clicks away on my most portable of portable devices. Advances in technology, clearly, had not slowed down in the subsequent years since my testing of the reference shift, which got me thinking back to the physical nature of certain projects that I had completed.

Around the time I left, they said vinyl was dead; they were wrong. They also said that the physical manifestation of the book was on the way out, as well; they, too, were wrong. Years on from when I left now, though, the advances with reading books and articles on digital devices has put to shame the experience that was taking place. Sure, people are still reading books decades later from when I left, but the physical book has become like vinyl, that is, books have become the purview of nostalgic diehards. The book reader became the kind of person you see in a special interest story on the news. The other current trend, the ever surging dominance of audiobooks and podcasts will also have a large impact on who, if anyone, is still holding onto that big, yellow bound, paperweight known as *Probabilistic Thinking: Presenting Plural Perspectives*.

I remember the day when my editor copies of *Probabilistic Thinking* arrived in the mail at my office. People in my office joked about lifting the box with my legs and not my back (it was that heavy). Given a number of copies, they took up a lot of space. And I have to admit, there was something satisfying about the physical nature of the book, especially the thickness. And it made quite a thud when I casually tossed it on my desk after looking it over. I also, that day, got a copy of the .pdf version of my book. It just wasn't the same. There was no sense of thickness to the digital file that sat on my computer desktop. I would have to open the file and scroll and scroll and scroll but even then something was lost in the experience. The digital file, another potential option to measure the book's heft, was also much smaller than expected. In fact, given the email limitations of the day, the book could easily be attached to any email that I wanted to send and, just like that, a copy of the book could be sent to the other side of the world. Getting very nostalgic at this point, I'll probably get up from my chair to go look for my one copy of the big yellow book. Displayed, not necessarily prominently, but definitely where it could be seen, I'll blow off all the dust that has accumulated on the cover before I crack it back open and start to flip through the pages.

## 5. The seminal article

As I flip through the pages of the big yellow book, I'll wonder which article (if any), and to what extent, became most referenced by those in the field of probability education. My thoughts would extend, naturally, to wondering about which article, of *all* the articles, became the seminal article in probability education.

Sure, the seminal article may have been published in the period of time since I left probability education, which would prompt me to look things up and see what the big article that I missed was all about. If the seminal article in probability education was published after I left then I know that I would read and, to the best of my ability, try to

make sense of the new philosophical interpretation that was presented or how quantum computing played a role in the teaching and learning of probability or whatever made it "the" article. Probably not being able to fully comprehend the piece, I would do my best to dip my toe back into the water. However, not wanting to look up all the other, new, unfamiliar references supporting this seminal piece, I would just succumb to not being able to fully comprehend the importance of the work. The other scenario, though, is the one I would be able to sink my teeth into a bit more.

Perhaps the seminal article in probability education had already been published at the time of my lottery-based leaving of the field of mathematics education. Thinking of all the usual suspects would also get me thinking about all of the different ways to identify an article as seminal. Biased because of my work, I would begin by thinking about the beginning, not the beginning-beginning, but to the Tversky and Kahneman's article published in the journal *Science* that had such a large impact on the field of probability education. Seminal, sure, but not really an article in the field of probability education. I would then pour through all the different major contributions housed in articles and wonder whether and to what extent this research permeated not only probability education but also the field of mathematics education. To do this I would start to look up research syntheses.

Engrossed in research syntheses, and recognizing the varied definitions of seminal, I would go through all of the articles that I had read well getting acquainted with the field. In doing so, I would recall Shaughnessy's article in the first handbook of the National Council of Teachers of Mathematics. There is no doubt, the article is well written, well organized and well referenced; however, there is something intangible about the timing of the article, as well. Perhaps related to the age of the field of mathematics, the age of the field of probability education, what was happening in related fields such as psychology, and other factors I would ponder the seminal sense of the article in an Iliad and Odyssey fashion. Digging through these syntheses would draw my attention to the fact that at one point, before my leaving, my name started to pop up in a few handbooks. Not being able to resist, I would start to wonder about what happened to the research I, personally, was focused on just before I left.

## 6. Consequential probability

Looking back on the my writing, right at the time of my lottery win, there was one idea that I was floating around that never came to fruition after the insanity of winning the lottery started to set in. If there was one piece that I didn't finish, one that I wish had, it was the piece on, what I was going to call, Consequential Probability. Not necessarily a theoretical or philosophical interpretation of probability, consequential probability was the type of probability that I wish students were learning in classrooms. Given that it was that this one piece was the one itch that I never got to scratch, I still had a copy of the beginning of the paper with me that sat in my desk for all these years. Here's an excerpt:

> Imagine, if you will, a standard deck of 52 playing cards. Consider, now, the following two scenarios. Scenario one: a card is drawn from the deck; the card is replaced; then a second card is drawn from the deck. What is the probability that the second card drawn is a king? Spoiler alert! The probability, in this particular scenario, scenario one, to nobody's surprise, is 4/52 or, if you like, 1/13. Scenario two: a card is drawn from the deck; the card is not replaced, but, rather, is placed (faced down) beside the deck; then a second card is drawn from the deck. What is the probability that the second card drawn is a king? Well, the probability that the second card drawn is a King, denoted $P(K2)$, is 4/52.

We see, then, that P(K2) is 4/52 in scenario one and P(K2) is also 4/52 in scenario two. In other words, for this particular problem, the probability that the second card drawn is a King is the same whether the first card is replaced, as in scenario one, or not replaced, as in scenario two. We denote this the The Replaced Equals Not Replaced Problem or, more succinctly, the R=NR Problem.

Based on our experiences with the R=NR Problem, to some, the answer is intuitive; but, to others, also known as the vast majority, the answer is counterintuitive. Primarily, the counterintuitive nature of the R=NR Problem stems from the probability being the same whether the card is replaced or not, which is anathema to the secondary intuition that is developed when the teaching and learning of probability hinges largely upon the overarching bifurcation of "with replacement" or "without replacement" leading to different probabilities. Cementing this counterintuitive nature, the answer to the R=NR Problem remains the same as the problem is extended.

We ask that you consider, now, a third scenario to the R=NR Problem. In scenario three: a card is drawn from a standard deck of cards; the card is not replaced, but, rather, is placed faced down beside the deck; a second card is drawn from the deck, which is also not replaced, but, rather, placed face down beside first card that was not replaced; then a third card is drawn from the deck. What is the probability that the third card drawn is a king? That's right, P(K3)=4/52.

Our final extension to the R=NR Problem, which we call scenario four, extends the problem in a similar fashion to the extension from scenario two to scenario three. In scenario four: a card is drawn from a standard deck of cards; the card is not replaced, but, rather, is placed faced down beside the deck; a second card is drawn from the deck, which is also not replaced, but, rather, placed face down beside first card that was not replaced; a third card is drawn from the deck, which, again, is not replaced, but placed face down beside the two cards that were not replaced; then a fourth card is drawn from the deck. What is the probability that the fourth card drawn is a king? Once again, the answer is 4/52, that is, P(K4)=4/52.

As demonstrated, the solution to all four of our scenarios to the R=NR Problem is the same: 4/52. As such, our following general discussion of the solution, while specific to scenario three, applies to both scenario two and scenario four. The probability that the third card drawn is a King, in scenario three, is predicated on the first and second card, the ones that are not replaced, being placed face down. Worthy of note, whether the card was actually placed "beside the deck" is, for all intents and purposes, irrelevant. In other words, the cards that are placed faced down could, if one so chooses, be placed on the floor, on an adjacent table, at the back of the room, in another room, on a wall or wherever one sees fit. Wherever the first and second cards are placed, however, it is crucial that the cards are placed faced down. In addition to the card remaining face down, it is also of vital, vital importance that, in the act of placing the cards face down beside the deck, one does not get a peek at the card…

It's at this point that the article delves into the *Men in Black* movie franchise and what a neuralzyer is and what it does, which is key to erasing the memories of anyone that peeks at any of the cards because, of course, the information obtained changes the probability that the third card drawn is a King from 4/52. Anyways, like I said, interesting idea and it's the one that, had I not won the lottery, I'd have wished got out there for all to read. I am pleased to say though, looking back, I did enjoy chatting about this problem with Sir David Spiegelhalter over beer and chicken wings in Arizona, USA before I left the profession. Speaking of those that might leave the profession, I got to thinking about (and said respectfully) the old guard of stochastics education.

## 7. The old guard

Now old myself, I would definitely spend some time thinking about a unique situation in the field of probability education, and statistics education, for that matter, that was taking place just at the time of my leaving the field. Essentially, and again this is said with all due respect, the majority of the old guard was at or near retirement. All of the

major players in the field, at the time of my leaving, were getting older and contemplating retirement. This would lead me towards two thoughts in particular.

My first thought about the who's who of probability and statistics education all leaving the profession in a rather short time span led me to wonder about the people that replaced them. I would spend time wondering about the next who's who of stochastics education. Interested in their academic lineage, I would look to see if any of the new guard had worked with the old guard. I would also be interested in any new players on the scene who didn't necessarily work with the old guard yet were able to establish themselves in the field. Interest would also lie in the work that they were conducting. Essentially, there would time dedicated in my pondering to who was standing on the shoulders of which giants and whether or not they had personal connections in any manner. Less familiar with the new who's who and more familiar with the old who's who, I would wonder about one other thing.

For a group of people that are well aware of various cognitive biases, I would wonder if the group, as a whole, fell prey to creeping normality and whether they had organized one last hurrah. In other words, time, for me, would be spent looking for that one final collaboration, before the who's who all began to retire. This collaboration that I was seeking would house some work from all the major players in probability and statistics education, before it was too late. Given the timing of everything, I would first begin my search by looking at the different book series in mathematics education. Familiar with the Advance in Mathematics Education Series, I would fist look there to see if, perhaps, a volume where the old guard put together a project that not only helped encapsulate the hard work and efforts of a pivotal generation in the field; but, also if they had maybe looked forward to let the new guard know about the things that interested them even though they would not necessarily be the ones conducting the investigations. If not found in that particular series, I would to The Mathematics Education Library series to see if the material was housed there. If I did not see the project in either of those series I would, I think, honestly get a tad excited because that meant that, perhaps, something I've been advocating for some time had perhaps come to fruition.

Excitedly, I'd start telling my computer to look for and report back on any and all ICMI Study Series that had been conducted since my big lottery win. As I listened and watched my computer show me all the different books that resulted, I would hold out hope that the band got together one last time and produced an ICMI Study on probability education. Yes, in 2011, a statistics education study was completed, but I would still be holding out hope for a probability education analog. Given the timing that was discussed, that is, the leaving of all the members of the old guard, it would seem like a perfect venue for one last hurrah. Thinking even bigger, my thoughts would then tend to an ICMI Study on Stochastics where not only the who's who of probability education but also the who's who of statistics education all got together, including some of the  newer generation, to put together a seminal book that would, generations and generations from now, be referenced over and over. Not finding the book, would lead to thoughts about whether such a project was proposed, who was in the running for editing such a project, and the reasons as to why such a project never really came to fruition. The timing was perfect! Alas, my disappointment would not last too, too long because, after all, there were many other topics that garnered my attention — like conferences.

## 8. Conference activity

As I looked back to my time in the game, I know that I would fondly remember my memories from various mathematics education conferences. These memories, of course, are lovely mixture of both personal and professional experiences. My very first major conference was important for my career, and as a kind who grew in the smallish town of Kamloops, British Columbia, seeing Prague was a big moment, personally. I do remember, however, the lack of talks dedicated to probability and statistics education in Prague. Similar memories existed for certain North American conferences. Sure, there was a dedicated group discussing probability and statistics education at the North American Chapter of the International Group for the Psychology of Mathematics Education, but as that group fizzled out so did my attendance at those conferences. At the same time, though, I was making my way to and getting involved in the dedicated Topic Study Groups of the International Congress on Mathematical Education and Topics at the International Conference on Teaching Statistics. These conferences were different.

Fondly looking back at the conferences, recalling memories of meeting major names in the fields of probability and statistics education (and just how polite everyone was), me and the computer would spend timing sifting through all the subsequent conferences that I had missed. All the great places that I did not get to travel. I mean, sure, with my lottery winnings I had the ability and did travel rather extensively once away from the field. But, the fun part of attending conferences, is attending places that you may not have on your list but went to anyways. Sure, for example, I had spent some time in Phoenix during the cold Canadian winters but heading over to Flagstaff was a direct result of a conference. Scrolling through all the conference proceedings, particularly checking out the names and the titles of the keynotes for these big conferences, I would start to ponder about how the conference scene had changed during my time away from the field.

As a person concerned about what is happening to the planet, I am in the unique position of being able to afford to offset all my jet setting around the world. But, I'm lucky, I won the lottery. I wonder how the rest of society saw the continuous flying of researchers to different corners of the world to talk, time and again, to the same handful of individuals who were in the same room from all over the globe. Naturally, this view point is not just restricted to those in probability and statistics education, all academics would fall under this criticism. I suppose the viewpoint of everyone's respective university would dictate to what extent travel was either supported or not supported. There is also the individual, though.

Intrigued by the possibility, I would begin looking for a person, anyone, who had eschewed the traditional conference scene for environmental reasons. Whether or not I found such a person, I would be interested in how their curriculum vitae might differ from others. While suspecting that they chose to just write more articles in refereed journals, maybe not being part of the scene would impact their impact their vitae in ways I had not imagined. If and how such a person did "attend" conferences would also be of great interest.

The technology, at the time of my leaving, was there for conferencing without travel. Look, the technology at the time was not great. Arguably, the technology was in its infancy. Certain programs, for example, Zoom, were much better than the more mainstream programs at the time, such as Skype and FaceTime, but they were also

victims of their time. No matter how good the programs would get, people would still default to the notion that while the programs were good they just weren't as good as if you were there. It should be pointed out, though, people were able to say that it wasn't as good as being there because they actually had, as an option, the ability to be there. Fondly remembering conference travel would lead, for a least a little while, to a deep dive into what conferences were still around, which conferences people were still attending and which, if any or all, became relegated to conferring digitally. Who knows, perhaps I could even jump into some sort of online conference taking place right then and there based on the new advances in technology that had taken place over the years. It would, at least, be worth looking around for a bit. Who knows who I might run into at such a conference. I already had a plan should a person I ran into asked me what I thought I would be working these days had I hung around.

## 9. Sports analytics education

Obviously, when looking back on what might have been, one starts to play the game of "What if…" to varying degrees. Having pondered about a variety of things, having pondered about a number of things that could have been answered by looking things up on the Internet and through other means, left just enough time to think about missed opportunities. Which brings us to the notion of sports analytics education — my white whale.

At the time of my lottery win, to be honest, my interested in probability education had begun to wane. I'm not sure, entirely, why that was. With hindsight being 20/20, I attribute to this new lack of interest as some combination of life stage, career stage, and audience. As is evidenced in my other work related writings from the time, I started to focus my attention on writing for a more popular audience (see, for example, my Math Ed Matters by MatthewMaddux column). Recognizing the success of those individuals who had made efforts to popularize mathematics (e.g., Devlin, Paulos, Stewart and many others), conducting research in the field of probability education began to take a back seat to my efforts to popularize the teaching and learning of mathematics.

Albeit to very little fan fare at the beginning, I could see that my this was the direction that I would have continued had I not won the lottery. Efforts to become a chaired professor for the public understanding of the teaching and learning of mathematics, I firmly believe would have been the new direction that I would have taken had I stayed at the University of Saskatchewan. With that all said, there was one area that I believe could have kept me in the probability education field: sports analytics education. Although probably a little too ahead of the game at the time of my lottery win, I firmly believed that one of the next big areas in probability and statistics education could be sports analytics education. All the markers were there.

Circa the 2020s, sports analytics became a part of popular culture. Paving the way, years earlier, were movies like *Moneyball*. The website 538 was also a big contributor to the phenomenon. And, to be clear, this entry to main stream culture did not happen overnight. There was much resistance. Sticking with baseball for a moment, sabermetrics had always had its place in baseball. There was no doubt that statistics was important to the sport. The numbers of hits, the number of runs, and some percentages and ratios, the sort of thing that one would find on the back of a trading card, is what "baseball statistics" was for quite some time. Then, though, baseball statistics got complicated. All of these new statistics started to make their way into the lexicon.

These new stats would meet tremendous resistance, especially from those involved or previously involved in the game professionaly. You could hear the derision in the voice of the colour analysts who would scoff at Weighted On-Base Averages or On-Base Plus Slugging Plus. After their quick dismals of the advanced analytics, the former jock would then explain that unless you've played the game at the highest level then you'll never understand, never have a true feel for what is going on, no matter how many advanced statistics you have calculated. As a Canadian, I can tell you without a doubt that skepticism about advanced statistics and analytics met a tremendous amount of resistance in the game of hockey.

I can picture it to this day, the day that I realized the true direction my probability education career should have or could have gone. (Damn lottery win!) It was an intermission between the first and second period of a game of the Stanley Cup Final. One of the pundits, a former player — sitting there with his expensive watch and his huge ring that he got for when, back in the day, he and his team had won a Stanley Cup — was asked about Corsi and Fenwick. His response, which was much like the responses of other former players and colour commentators, was to make fun of the advanced stats. This was done though purposefully mispronouncing the terms Corsi and Fenwick, explaining that even though he knew what they meant (he did not, by the way) that they did not matter because, and pulling out a famous quote from boxer Mike Tyson, "Everybody has a plan until you get punched in the face." This was it. This was the moment that I knew, had I applied myself at the right time, I could have ridden out the rest of my career investigating sports analytics education. The timing was perfect.

The old saying that the meek shall inherit the earth changed around the time of my lottery wins. Meek was replaced with nerd. In other words, the nerds shall inherit the earth. Circa 2020, this was especially the case. Sure, the nerds had Hollywood. The nerds had Silicon Valley. Those were givens. What people were not expecting, though, was for nerds to infiltrate the world of professional sports. After all, jocks and nerds, as history tells us, just don't mix. However, in professional sports, the adage never changes, the most important thing is to win. Slowly but surely, professional sports teams started to realize that deep diving into data, statistics, and utilizing analytics was almost as important for the team and the athletes practicing and making sure not to disrupt their circadian rhythms when travelling.

Although it happened in the background for most teams, evidence of the importance of sports analytics would eventually be made for all to see when nearly every professional sports team added an analytics position to the team. Wedged in there with the owner, president, manager, coach, players and support staff was a statistics person. In some instances, the statistics person began to play even more prominent roles for the team. Case in point, general managers used to be hired because they were ex-professionals in the sport and knew the game. General managers, in this new world of professional sports, were being hired for their ability to dig into the numbers and see what nobody else could see. Soon, the big brawny ex-jocks that filled many of the major roles in professional sports organizations were being replaced by individuals wearing dark, thick rimmed glasses. Like I said, the timing was perfect for sports analytics education to enter the scene, were it not for the lottery.

If not for the lottery win, I had it all mapped out, my attempt at coin a new area of research, sports analytics education, within probability and statistics education. The path was not going to be easy but I had already had the path planned out. And, if executed properly, research efforts in this area could have occupied the next 25 to 30 years of my

career. I would, first, have to start with a theoretical piece that would establish the notion of sports analytics education.

Having never done it, there were a few particular directions that I was looking to take. One way, would have been to write a purely theoretical, almost philosophical, piece that explain how this new area of research in probability and statistics education, which is part of the field of mathematics education, would borrow from other related fields. Through this approach, many examples would be utilized to make the case. After all, the heuristics and biases research that dominated probability education for years came from the field of (cognitive) psychology. Similarly, semiotics does not have its roots in the field of mathematics education; however, semiotics is a major area of research in mathematics education. The numerous examples would then be followed with references to research, data and logical argumentation in order to put together that one article that would get referenced over and over and over anytime that someone would conduct work in the field of sports analytics education. There would have been other roots to go, of course.

Instead of writing an article with the explicit purpose of defining a new domain of research within a field, the other option would be to just write a sports analytics education article. Through this approach, albeit different, the result would be the same. References made to this particular article would reference, time and again, the first of the articles about sports analytics education. This approach, which is a tad trickier because people would get to read into the article with their own thoughts and opinions, would not be an easy task. My thoughts at this point would lead to wondering how does one write an article about a topic that is yet to exist in a field. Channelling back to thoughts that I had at the time of the lottery win, coupled with years away from my initial thoughts on the matter, I see this particular topic taking up more time as I sat in my rocking chair in my house overlooking the ocean. With professional sports as the last bastion of reality television and with all the metrics showing up on television, e.g., win probabilities, etc., there would be no doubt that this was one of if not the direction my career would have gone had it not been for the lottery win. With my dog now ready to go for a walk, my wondering window was closing, but I did have one last area to ponder as we made our way for our walk.

## 10. The math myth

In addition to books and articles that were explicitly related to the teaching and learning of probability and statistics, my time spent reminiscing would also venture into thoughts about books and articles that were tangentially or implicitly related to probability and statistics education. Of all the books that I had encountered during my time, there is one book, in particular, that I would be thinking about and would definitely seek out to see how it was received.

Political scientist, Andrew Hacker, a few years before I left the profession, wrote an article for *The New York Times*. Under a very simple heading, that is, 'Is Algebra Necessary?', he questioned whether teaching algebra should be as sacrosanct as it is currently treated in the USA. To say the least, he ruffled the feathers of many, many different people. Mathematicians, especially, were bent out of shape. After all, who, if anybody, attacks mathematicians. They are, well, mathematicians. The fall out from the Hacker resulted in a number of responses from mathematicians who tried to explain how important algebra is to everybody (e.g., Edward Frenkel). Around the same time, however, other articles examined the same question (e.g., Nicholson Baker in *Harper's*

*Magazine*), and certain scientists (e.g., biologist E.O. Wilson) decreed that you did not necessarily have to be good at mathematics in order to be a great scientist. What happened next, I found fascinating.

Given the tremendous response to Hacker's article, a book, entitled *The Math Myth*, was published a few years later. This is not the fascinating part. What was fascinating, for me, was the tepid response that the book received from the mathematics education community, in general, and the probability and statistics education community, in specific. Let me explain.

Look, I understood that writing a book denouncing the very subject that people have dedicated their careers to might not be discussed at length. But not at all?! Around the time I left my profession, I had checked the reading lists for various graduate studies programs and various universities here in North America. However, not one had *The Math Myth* as required reading. I found the reception of *The Math Myth* by the mathematics education community rather perplexing. I would talk to colleagues at conferences and in other casual situations and they would say that they had heard of the book but hadn't read it. Hadn't read it?! Hadn't read a book that questioned whether or not we should be teaching mathematics in school seems like the type of book that a mathematics education professor should make the time to read. Ok, to be fair, the book is focused on questioning the teaching and learning of algebra, in specific, and not mathematics, in general, which brings me to my surprise associated with the probability and statistics education community.

For as long as I can remember, the grand narrative of school mathematics did not change. Being good at school math meant that you were good at algebra, excelled at pre-calculus and then were successful in calculus when you went to university. If you were very good at school math then you would take calculus early, while still in high school, and start on the second semester of calculus in the first semester. The funny thing about grand narratives, they hardly get questioned.

On more than a number of occasions, I tried to question the grand narrative of school mathematics. Perhaps attending at colloquium talk in the Department of Mathematics and Statistics, or some other event where a bunch of mathematicians would gather, I would ask them whether they saw a day in their future where the trajectory of a student in school mathematics resulted in taking a subject other than calculus. Whether I asked that question, or whether I asked whether there was some other area of mathematics that all students should taking in school so that they are the best informed citizens they can be when they graduate, I was met with the same question asked back of me: "And what do you suggest?" Not one to shy away from the question back to me, my answer was always the same: "Probability and statistics, of course." Just so we're clear here, the mathematicians were not scoffing at me when I gave my response, they were scoffing at my response. After the mixture of laughter and derision subsided, I would let them know that I wasn't alone in my thoughts. For example, Arthur Benjamin, mathematical magician from the USA had been advocating for people to take probability and statistics as *the* course that people should learning about in schools. The response, again, was the same. The notion was not even entertained. Then, though, along came Hacker's book.

Maybe I was too close to the subject that I was studying when I won the lottery, but I thought that probability and statistics was the one course that should replace calculus in the grand narrative of school mathematics. Sure, those students that showed promise in school mathematics, or those that decided to go into careers, like Engineering, where

calculus was  important would still study the subject. But, for the others, for the vast majority of people, the path of school mathematics should lead to being able to navigate, adeptly, the data deluge that is showing no signs of slowing. Given the advances in technology, given the vast amount of data to navigate, risk assessment, given all the research on heuristics and biases, given the need to accurately assess information all signs seemed to be pointing in this direction. *The Math Myth*, then, was an opportunity for researchers in the field of probability and statistics education to support the argument that, perhaps, algebra has had its day in the world of school mathematics and it was time to move to better reflect the needs of students who were no longer coming to school after their farming duties were finished for the season.

Perhaps some other books or series of articles had come along in the time that had lapsed since I had left the profession and, if so, I would probably even dedicate some of my time to digging into those pieces to see how the argument was laid out to support the importance or probability and statistics in schools. I would also be interested in reading about the major stumbling blocks that took place — other than the mathematicians who do not like what they do for their careers getting questioned — and the time frame that it took for the change, if any, to take place. Sure, I would also be looking for any references to Hacker's work that may be out there, but the way things were at the time of lottery win did not bode well for finding to book referenced too many times. Then again, you can't use the past to predict the future.

Just as we (my wife, my dog and I) were heading out the door, my last thoughts would have turned to how computer coding, which I assumed had come to dominate math classes all over the world, was impacting the teaching and learning of probability education. Before I could head down that rabbit hole, though, my wife would ask, "What have you been doing up there all afternoon, Egan?"

## 11.  Final thoughts

Without getting into too specific, I will tell my Kristen that I've spent the better part of an afternoon thinking about what might have been had we not won the lottery all those years ago. I might even delve a bit into each of the topics that I had been thinking about as we strolled along the beach picking up little pieces of plastic whenever we could. Having heard my list, she would then ask, "Wait, you didn't think about luck at all?! You won the lottery!" Caught off guard for a moment, she'd follow up the silence with "Don't you think you were lucky to have won the lottery?!" Trying to put absolutely everything into perspective, as best I could at that specific moment, I reply, "I guess so…"