USING COCHRANE TO TEACH HIGH SCHOOL STUDENTS HOW TO SPOT JUNK SCIENCE

This is a story of how: I stumbled upon the principles of evidence based decision making and the Cochrane Collaboration. How these principles subsequently destabilized all of the things that I thought I knew and how I had to take responsibility for learning the skills required to rebound from that destabilization. It is a story about many of the challenges and solutions that I've encountered along the way to developing, what I now feel, is one of the best high school curriculum solutions for the problem of: How do we build students who are able to debunk the relentless volume of fake news, pseudo-science and contradictory health information that we all have to deal with in today's information age?

…and I'll change my mind if presented with better evidence.

By: Ray Gowlett

HOW IT BEGAN

I'm a physical education teacher at a high school outside of my small hometown of Richards Landing, Ontario. This project started about three years ago when I was deciding how to tackle the nutrition portion of our province's health and physical education curriculum. The standard practice up until this point was teaching the latest version of the Canadian Food Guide. As you can imagine, when trying to foster an environment of free inquiry, the questions about other ways of tackling the problem of proper nutrition were almost overwhelming. Many students would make claims of 'research says this', and 'research says that'. I didn't know how to answer those questions properly.

That was when I made the decision that the only way I was going to be comfortable teaching students about nutrition wasn't to teach them about 'the facts of nutrition', but rather, to teach them the process in which the 'facts' themselves were being generated. I had to teach them how to analyze the primary research that lead to the recommendations in the first place. They had to be taught to think critically and evaluate evidence for themselves. They needed to learn the concepts and terminology required to provide an accurate rationale for ignoring click bait editors who misinterpret results and sensationalize headlines.

I tried to accomplish this undertaking myself, but quickly realized that my training to become a physical educator had left me completely unprepared and ill equipped for this task. I had to find some way to do this, and more importantly, a way to teach students to do the same.

MEET YOUR NEW MENTOR AND THE COCHRANE COLLABORATION

At the time, to the best of my knowledge, there were no educators at the high school level who could help me in analyzing primary research and getting to the bottom of the results (clinical

relevance). Big questions kept popping up. What's a systematic review? What are the differences between a surrogate measure and a meaningful outcome? How do you make the distinction between correlation and causation? Why is it important to differentiate between relative risk reductions and absolute risk reductions? At one point, I went to a PE training session put on by one of Canada's leading PE educators. During the presentation, the speaker had used 'evidence' to support a particular training program that he was endorsing. After asking a few specific questions about the evidence that was presented, he revealed that even he didn't have the skill set to critically analyze primary research.

In order to learn about how to read and understand evidence, I had to go outside of the world of education. As luck would have it, I ran into a retired emergency medicine doctor, Dr. Roedde, who had taught evidence based medicine using the principles of the Cochrane Collaboration. We quickly hit it off, and he committed to helping me through this process which is now going into year three. Since then, it has been an absolute whirlwind of reading, analyzing, presenting, and defending what I have come to understand about the Cochrane principles.

Setting out to achieve the lofty goal of teaching these principles to students was no easy task. Not only did I have to acquire the terminology and concepts required to understand systematic reviews, I then had to be able to find a way to make it teachable to grade 9-12 students. I needed to be able to teach what evidence based decision making was, to explain the gold standard of the Cochrane Collaboration, and do all of that in a manner that high school students could understand, use, and remember.

"Today students, I'm going to give you the tools required to debunk anything that I teach you."

SEE ONE, DO ONE, TEACH ONE

When I had become proficient enough with the Cochrane principles to move forward, I began teaching them to students. The first thing I realized when trying to teach this process to high school students was that they needed a take-off point. That they needed some sort of framework from which they could begin the process of understanding how research is conducted and how to understand the results. I needed a simple, yet accurate, framework. The following section is a brief overview of some of the problems I've encountered when structuring my lessons to teach students how to use the principles of evidence based medicine and how I've solved them.

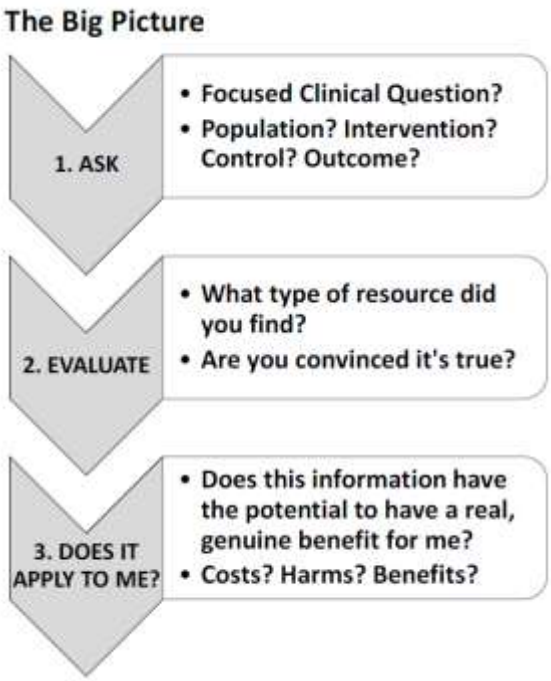
Problem 1: There's too much information to start!

Diving into the manual and standards of the Cochrane collaboration was overwhelming to say the least. I had to come up with a less intimidating way to introduce the process to the students. I needed to provide low-resolution representations of the required skills, but ones

that remained accurate as I continued to add detail and nuance to the process. Here are some examples of the introductory lessons.

What is evidence based decision making?

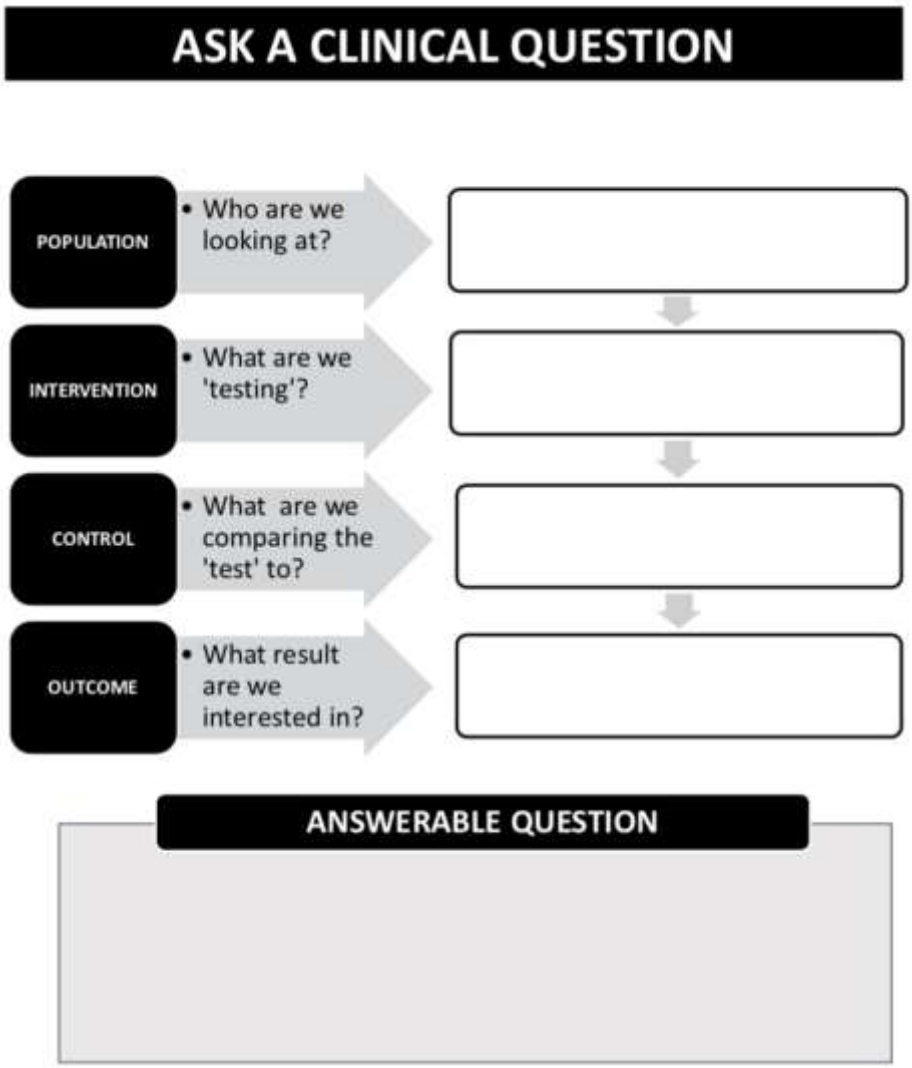
'The Big Picture'



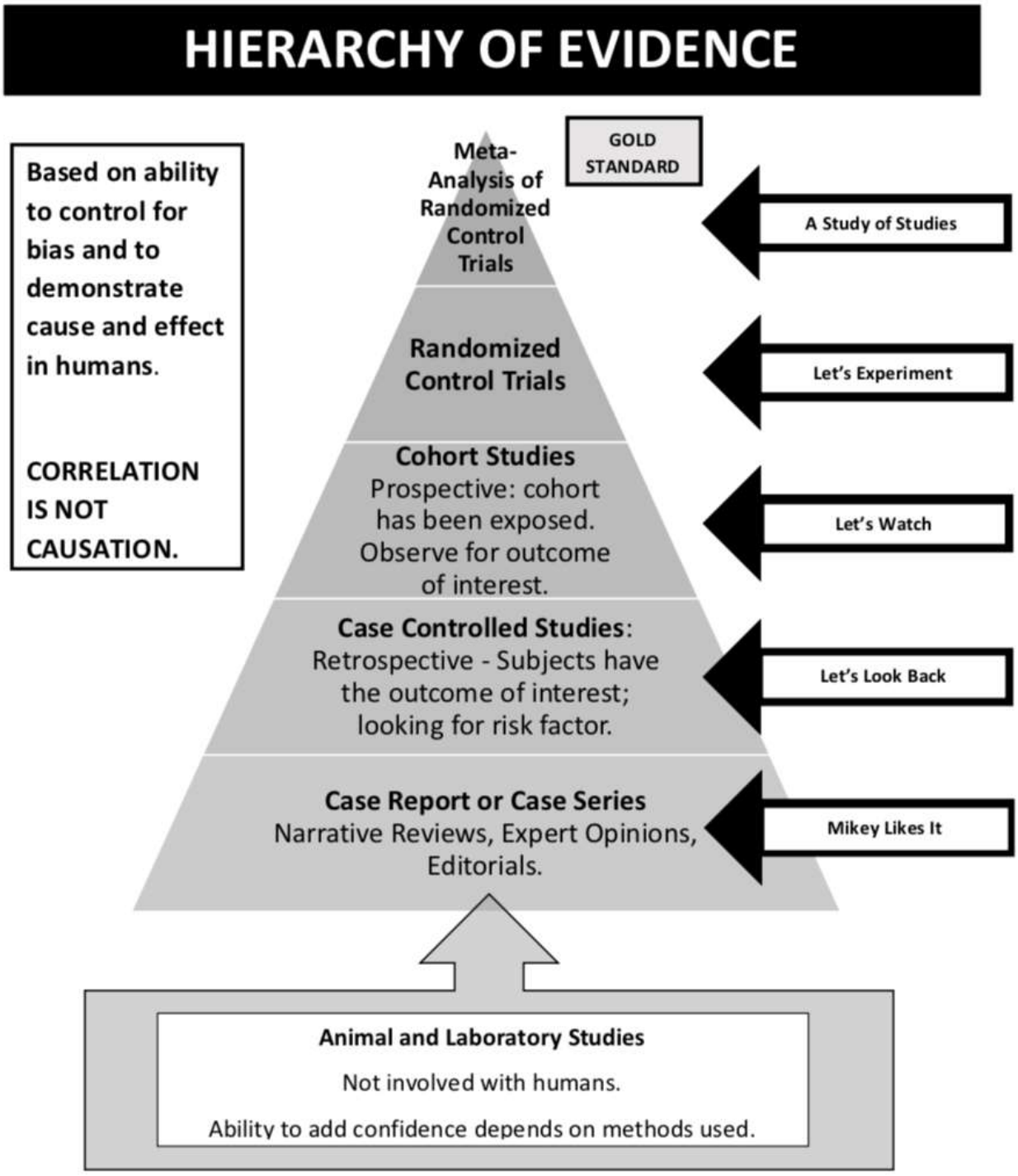
Problem 2: How Will Kids Ever Remember All of This Stuff???

Going into this project I knew that the students were going to have to learn and hold onto a significant number of new concepts, as well as manipulate all of these ideas in their heads simultaneously. As a solution, I began to develop 'maps', that is, graphic representations of the tasks that have to be completed before one can start playing the evidence game. I'm sure I went through about 30 different versions of each sheet before I settled on the right combination of graphic detail, descriptions, and a picture that represented the process of evidence based decision making. I'm sure most are familiar with the diagrams of the hierarchy of evidence, but I wanted diagrams that looked more like instructions (to remove the working memory load). Here are a few that I've created and have found to be incredibly useful.

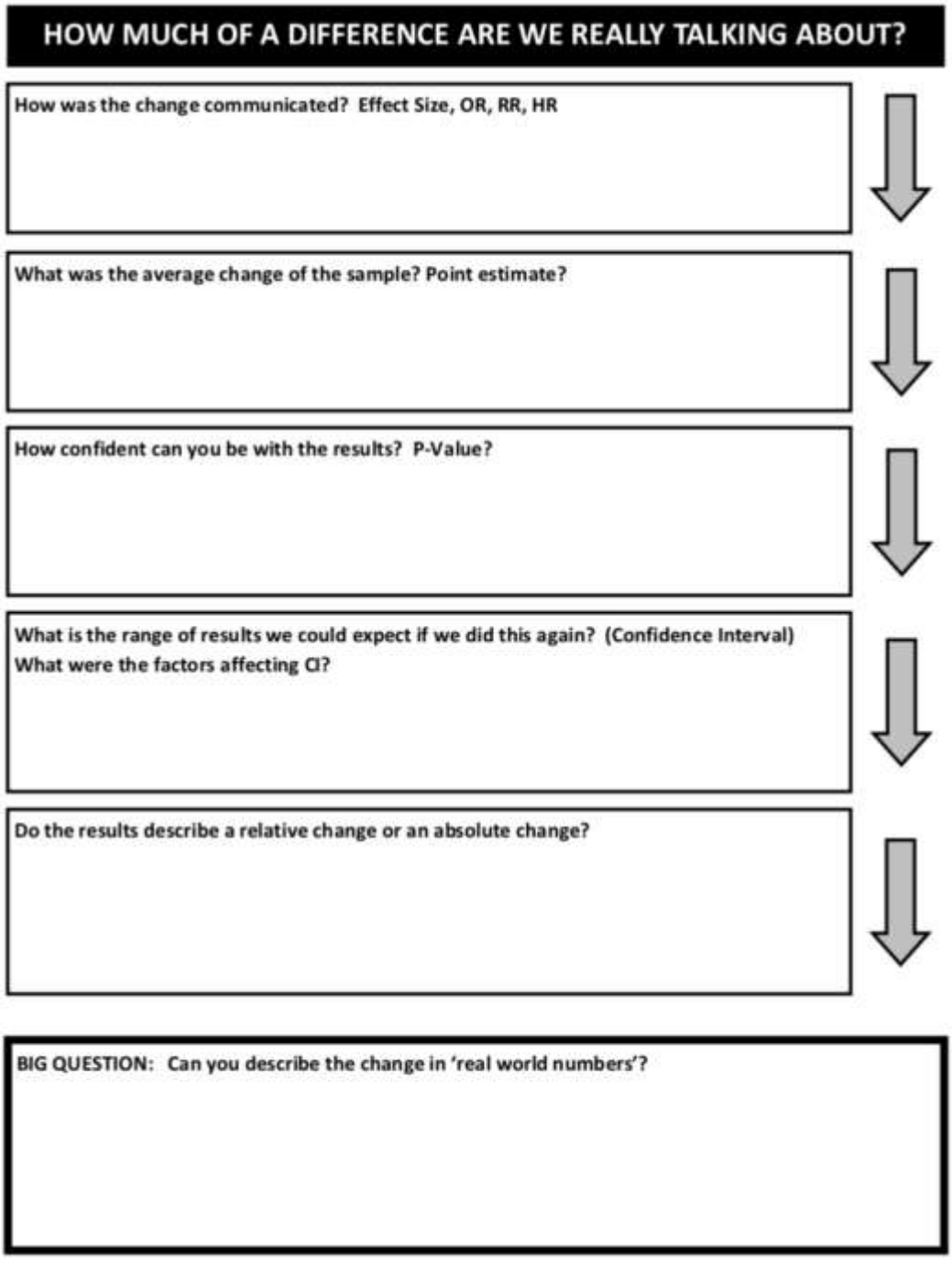
Lesson: Forming a Clinical Question



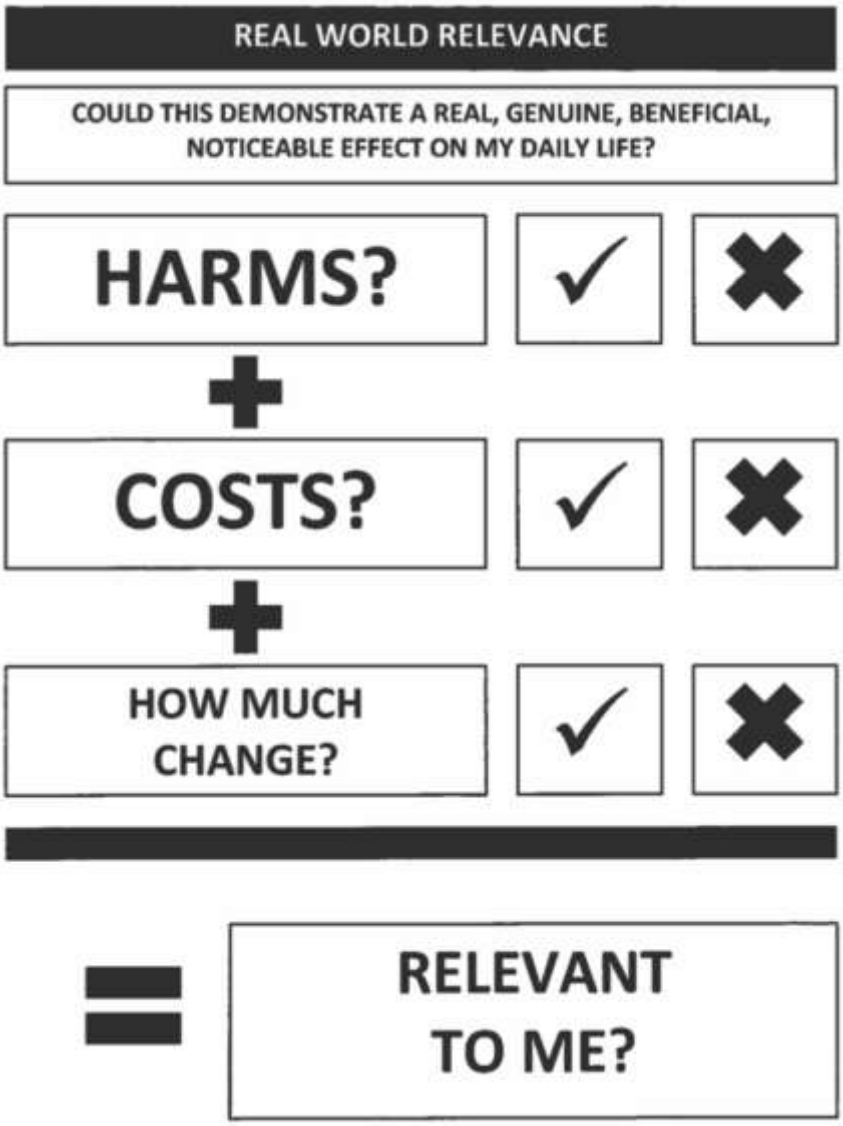
Lesson: The Hierarchy of Evidence



Lesson: Real World Change



Lesson: Clinical Relevance



Problem 3: Whoa...That's a Game Changer!

I found that teaching students about forming a clinical question and the hierarchy of evidence was relatively easy compared to teaching the concept of clinical relevance. In order to accomplish that goal, I needed to make sure that the students had a firm grasp of what I've called 'concept bombs'. To be able to pull out meaningful information from a resource, it is incredibly important to develop a more nuanced understanding of the details of what the research does, and does *not*, say. These concept bombs completely changed the way students viewed research and transformed them from people who interpreted it with a broad brush, to people who could see this nuance. Finding the right narratives that would connect the

concepts that students already understood, to the ones that I wanted them to know in a way that they could remember, was critical. I had the best luck telling funny stories to make the ideas stick.

Here are the concept bombs, as I outline them in my class:

Lesson: Concept Bombs

Correlation vs. Causation – "Pavement temperature of city streets is positively correlated with deaths from drowning…city installs pavement coolers!"

Clinical Relevance vs. Statistical Significance – "Hockey player reads a study and spends 2 years and $2000 to add 4 centimeters to his standing long jump!"

Absolute Risk Reduction vs Relative Risk Reduction – "High school student pays $500 for a '50% off' coupon to buy a t-shirt."

Surrogate measure vs. Meaningful Outcome – "Football player increases weight room time to 30 hours per week…misses football team try-out!"

Problem 4: Getting people to play the game…with a huge caveat!

Once the students knew the basic rules, it was time to start playing the evidence game.

The problem: It became incredibly easy for the students to become overwhelmed, especially after students had learned to understand the value of a systematic review (from the hierarchy lesson) and had developed the google skills to find them. Almost instantly, I found students were finding the most technical papers that they could, but were then incapable of going any further due to the complexity of the content, thus ending the game.

The Fix: What I did to fix this problem was to have them start playing the 'debunking' game. It worked like this: find a social media resource on the internet and debunk it with the proper terminology. This game way easier to play, and starting with the low hanging fruit was a lot more fun. Kids loved it! But I had to make this point INCREDIBLY CLEAR…debunking bad articles that misrepresent research is way easier than reaching accurate conclusions about studies that are done well. That distinction was critical.

Lesson: Let's Play the Debunking Game

ASSIGNMENT: CHASING RABBITS

Name:

Getting to bottom of a sensationalized headline is a critical evidence based decision making skill. Research the following headline by 'chasing the rabbit through the hole' to the primary research. Once you've found the primary research, answer the following questions.

Does the original study match up well with the headline? If not, what were the differences?

Where did the article go wrong?

What were the real world differences of the original study?

Provide a fair report of the original research.

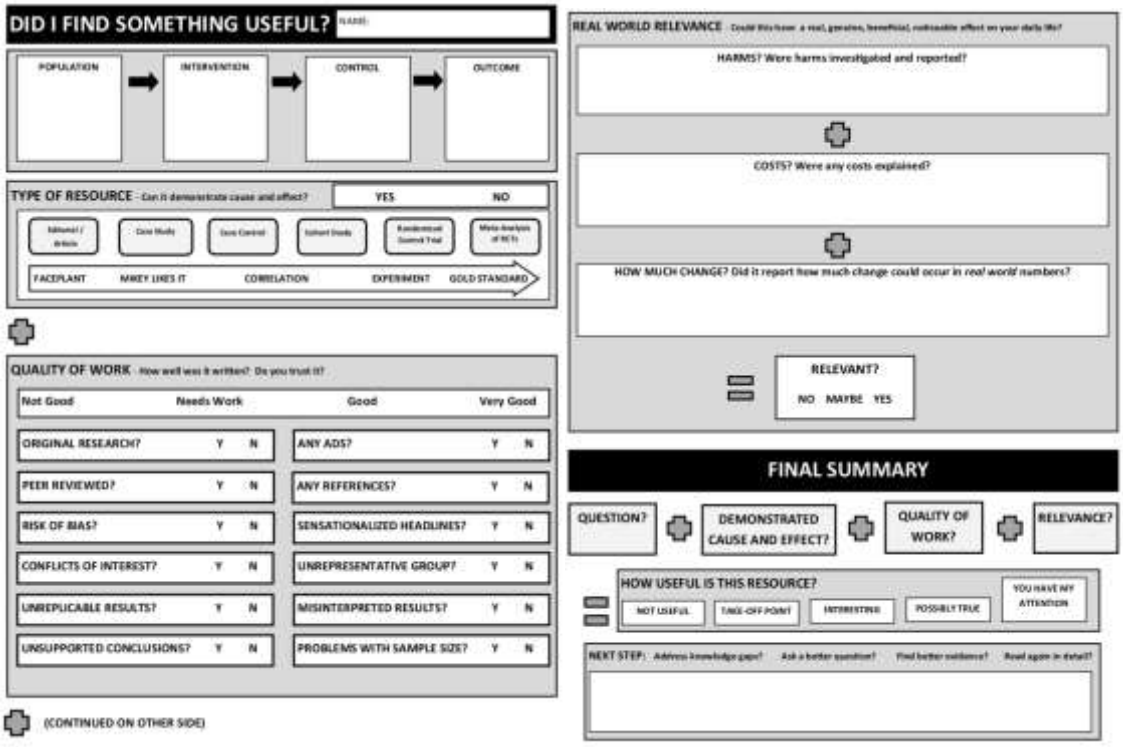
Problem 5: Putting It All Together

Developing the ability to tell stories well and to be entertaining has allowed students to be able to follow along and 'understand' everything I teach them throughout the presentation. Helping them to retain the information has been far more difficult. What they remember at the end of the session was that they understood the content at the time of the lesson, but they could not recall that information later.

The Fix:

The following is the final sheet that I created for students to use to guide them through the EBDM / debunking process. It acts as a memory prompt and allows them to remember most of the content that I've taught them, on one sheet. The sheet works a bit like a treasure map, a mix of memory prompts and 'what to do next', not unlike a quick set up guide common with many new electronics purchases. Students start at the top, work their way through the sheet step by step, and it guides them through the evidence based decision making process. Following the sheet from beginning to end helps them in forming their own conclusions, which they have to support with arguments and the proper terminology. Lastly, to check for understanding the students have to fill in the next steps section.

Here's the sheet.



HOW'D THE KIDS DO?

After working through a few examples together as a class and letting them play the debunking game for a while, I let them go to find the best possible evidence they could find on topics that were relevant to them. That is where the magic started to happen! I could not keep up to the pace with which they were diving into the relevant literature on health topics that were meaningful to them. Does "Biosteel" make you a better hockey player? Does CLA reduce body fat? Are energy drinks dangerous? Do oral contraceptives lead to depression? It was absolutely incredible to see the students learning about the topics that were important to them. I was amazed that in a relatively short period of time students had gone from reading "Buzzfeed" articles for advice, to formulating clinical questions addressing outcomes of interest, finding systematic reviews of randomized control trials, differentiating between statistical significance and real world relevance and were forming reasonable conclusions. I would leave classes exhausted, but impressed.

Since starting this curriculum, I've been able to see almost every student develop the ability to discredit bad resources while using the appropriate terminology, and many were able to start parsing out important, clinically relevant information. I started teaching these skills at the grade nine level and continued the curriculum all the way up to grade twelve university level. I'm seeing students get it at each stage, and it's been incredibly rewarding.

CONCLUDING THOUGHTS

I'm so glad that I've been able to play a role in this movement. The teachers I've been fortunate enough to share my resources with have embraced it with open arms. Some of the most common responses I have received have been, "Why didn't anyone teach me this earlier, and why isn't every student being taught this now?" I feel the same way.

After my experiences of using the principles of the Cochrane Collaboration to improve my own subject specific knowledge and pedagogical practices, I believe that it is my professional obligation to become as proficient as I can with this skillset and to teach it to as many of my colleagues who would like to do the same. I believe it is my responsibility to teach these principles to students, so they too, will have the ability to 'Debunk Anything That I Teach Them'.

Feel free to contact me anytime with any questions/comments on Twitter @raygowlett or you can reach me by email: gowletr@gmail.com

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Some of my favorite resources:

CASP - https://casp-uk.net/casp-tools-checklists/
Students For Best Evidence - http://students4bestevidence.net
Cochrane Collaboration - https://www.cochrane.org
Campbell Collaboration - https://campbellcollaboration.org
WWC (for teachers) - https://ies.ed.gov/ncee/wwc/
ResearchED.uk (for teachers) - https://researched.org.uk