

Essay

The Absolutely True Confession of a Prospective Elementary School Math Teacher

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For nearly a decade now, I've been teaching math methodology courses (i.e., teaching content, strategies, and approaches associated with the teaching and learning of mathematics) to prospective elementary school teachers. Each semester, our very first class begins the exact same way: I walk into the room and, before I even introduce myself, I ask, "By show of hands, who here cannot read?" To date, not a single person has raised their hand in response. I, then, ask my first follow-up question: "By show of hands, who here cannot do math?" The response – even after a brief discussion about the difference between "can not" and "cannot" – is markedly different. Over the years, yes, lots and lots (and lots) of people have raised their hands to declare to me (and others in the room) that they (can not and) cannot do math. While the number of hands that gets raised – which, yes, varies from year to year, but, on average, represents approximately 30% of the room – is interesting, in and of itself, how the hands are raised, to me, is even more interesting. Hands that get raised are not cautiously or shyly raised – quite the opposite. The arms, hands, and even the fingers of those that raise their hands are unmistakably and purposefully raised straight (and I mean straight!) up in the air. Picture, for a moment, the stereotypical raised hand of an elementary school student who so desperately wants to grab their teacher's attention because they have the answer (or have to go to the washroom) – that "type" of raised hand is the raised hands I see when I ask "Who here cannot do math?" Essentially, the raised hand signifies a badge of honour, if you will. Next, I ask my second follow-up, which is intended to establish one of the main threads for the course: "Why is it socially unacceptable to not be able to read, but socially acceptable to be bad at math?" After a brief initial discussion we must, in the interest of time, move on to introductions and a discussion of the course syllabus. Just before the first class is over, I casually mention that

we will be starting our next class with a “Pop” Quiz. Alternatively stated, just before the first class is over, I strike fear into the hearts of (many) prospective elementary school teachers.

At first glance, it may appear that my initial series of questions to the class are specifically designed as a hook for the course, which is correct; however, I also ask the class “Who cannot do math?” so that I can get better sense of the level of math anxiety that I am dealing with for each specific class at the beginning of the semester. I give the Pop Quiz the second time we meet for the very same reason.

As promised, I begin the second day of each semester with a Pop Quiz, which is appended to the end of this article (see Appendix). As the students get settled, the tension in the room is palpable. I try, just a bit mind you, to alleviate this tension by letting everyone know that we are not having a Pop Quiz, but, rather, as the title on the quiz indicates, a “Spontaneous Celebration of Learning”. I get *some* laughter. Further, should any one ask if the quiz is hard, I reply with: “No, see, it’s made out of paper.” I get *some* laughter. Over the years, however, what I have learned is that the laughter does not stem from my feeble attempts to alleviate the pressure in the room; but, instead, the laughter that I hear is the expulsion of nervous energy by the prospective elementary teachers who have finally succumbed to the harsh realization that they are, in fact, going to write a Pop Quiz during just their second math (methods) class of the semester.

Although the prospective elementary teachers do not know it at the time, the purpose of the quiz is not to discern what mathematics they know and do not know; rather, the purpose of the quiz is quite simple: math-anxiety-inducing pageantry. Having done this for a number of years now, I have come to fully embrace my role as the math-anxiety-inducer during our quiz. As I am walking around and handing out the quiz (face down of course), I make sure to sternly remind the students that they: have put everything away except for a pen or a pencil; make sure to put their name on the quiz in the top left hand corner as soon as I indicate that it is ok to turn the quiz over; will be reminded when there are five, two, and one minutes remaining in the quiz; are not to look at anyone’s paper except their own; there is absolutely no talking during or after the quiz; turn their quiz in after they are finished so as to deter other people from looking at their answers; they make sure to put their pen or pencil down as soon as I say that times is up; and, that, yes, this will be for marks (it never is!). The anxiety-inducing pageantry does not stop once the quiz starts. In fact, once the quiz starts is when I really shine. As the prospective elementary school teachers are writing the quiz I make sure to visit the desk of each and every student and, in some

instances, loom over them and look, disapprovingly, at the answers that they put down thus far. In previous years, I used to have the quiz on both sides of the paper, but students would, as they saw me coming around, casually turn the paper to other side so that I would not see their answers.

Although there is not a perfect correlation between the physical manifestations of math anxiety (e.g., grimacing, fidgeting and others) and the level of math anxiety an individual is experiencing, physical manifestations are, to borrow a poker term, a good tell. To be clear, I am not a monster, that is, I will interact differently with different students, which is solely based on how visibly shaken they are from the whole experience. As a rule, those who exhibit less anxiety during the quiz are the individuals that I spend more time trying to induce anxiety from, for example, turning their page over to see the answer on the other side, and those who I know are visibly shaken and disturbed are left alone during the quiz. For the most part, prospective elementary school teachers' physical manifestations of math anxiety on the Pop Quiz have not been too extreme.

And then there was Meghan.

Simply put, Meghan was, to date, the most anxious prospective elementary school math teacher to ever take the Pop Quiz. In fact, I was able to establish, before I even handed out the quiz, that her anxiety levels were off the charts. I could tell just by looking from across the room (and, as she later confirmed, I was right). Of course, the pageantry of it all did not help.

As I started to discuss the “instructions” for the quiz (i.e., keep it turned over until I say it is ok to turn it over, do not start until I say so, keep your eyes on your own paper, pencils down means pencils down, and others), Meghan’s anxiety ramped up to a whole other level. I felt as though I was watching the psychological trauma, that is, the damage to her psyche that was occurring as a result of my Pop Quiz, she was experiencing in real time – there was no doubt that Meghan was going through an extremely traumatic experience. After the instructions were over and the quiz was underway, seeing what I had already seen with Meghan thus far, as I walked around the room I made zero attempts to further induce the extreme anxiety that she was experiencing. However, my sheer movement around the room furthered the anxiety she was experiencing. Specifically, as I came closer her anxiety became worse. In fact, my attempts at inducing anxiety for those individuals seated around her ramped up her anxiety levels even further. As I continued to move around the room I made sure to keep a constant eye on Meghan

and, as I did, I, myself, began to feel some anxiety – when I loudly declared that were only “five minutes remaining” I soon, for the first time since implementing the Pop Quiz, was concerned that I may have induced irreparable damage.

After the quiz was over, Meghan was spent. She looked as though she had just finished running a marathon or was in a car accident or some combination of the two. While her anxiety levels had subsided once the quiz was over, she was no longer with us. Yes, she was physically still in the room for the next hour and a bit, but as we went over the answers to the quiz in groups, mentally, Meghan was somewhere else. As class went on I become more and more anxious about what I had done to Meghan. Once class was over all I could hope for was that she showed up the next day.

Not only did Meghan show up the very next day, she showed up every day. Her attendance, however, did not lead to a discussion of the Pop Quiz or her math anxiety. In fact, it was a number of weeks until we even broached the subject (I did not want to push the matter any further). I then started to be concerned for yet another reason: would the both of us go through the entire semester without discussing, at length, math anxiety and the Pop Quiz? My concerns, fortunately, were quickly laid to rest when Meghan handed in her research paper (one the assignments for the course). Meghan’s research paper, entitled “Math Anxiety and Me,” is an excellent overview of mathematics anxiety research in the field of mathematics education, and, more importantly, the absolutely true confession of a prospective elementary school math teacher, which just has to be shared.

Meghan: Introduction

Math has always been a core subject in schools, being an important component of our educational systems. Yet, arguably, many students are not obtaining necessary training and understanding in math. For some, math is a simple computation involving numbers, problem solving, and calculus that they have little or no difficulty with. For others, however, math causes great distress in understanding and reasoning. I can categorize myself in the latter group: the ones who have constantly struggled in the subject. The anxiety that comes along in math for many people causes a great dislike and fear that lasts a lifetime. This paper is about the anxiety and fear I have about teaching a subject I have a lot of difficulty with, and how I will strive to be a teacher who eases the anxiety related to math for my students. There has been a lot of research conducted on how to successfully teach math, and I will be looking into these ideas to help ease

my own anxiety in the future. For example, it is well known that great teachers love the subject they are teaching, and that math skills are directly linked to the quality of instruction (Burns, 2010). I worry my, at present, that my dislike for math will filter into my own teaching, transferring distress and anxiety to my students.

Math Anxiety, Resurrected

Tobias (1978) describes math anxiety as being “a failure of nerve in the face of having to do a computation or an analysis of a problem involving numbers, geometry or mathematical concepts” (p. 78). I recently had one particular experience that resurrected, for me, my math anxiety: our second day of class. Being given fair warning that we would have an exam, I did not feel worried about the test, as we were instructed not to study for anything. However, my anxiety went from non-existent to full blown as our professor gave us rigid instructions for the test as well as a time restraint. Hello, math anxiety, good bye thinking skills!

I now understand that our professor did this on purpose in order to demonstrate that math and testing should not necessarily be done in this manner. To be honest, the anxiety I felt during this quiz played a large role in me getting *every single question wrong*. I was so upset with the test and my results that I could not even sit and listen to the explanations being presented when the class spent time figuring out the solutions. My emotions and utter distress brought back all of my previous feelings of inadequacy and inferiority in the subject of math. These emotions and feelings are not something I want to bring into my future classroom, regardless of the subject.

Fortunately, the Pop Quiz was but one of many assignments we had for this [ECUR 318.3: Teaching Elementary Mathematics] course (Even better, I found out, afterwards, that the Pop Quiz was not for marks!). I decided, for my research paper, based on the recent resurrection of my math anxiety, to dig into math anxiety research in the field of mathematics education.

Math Anxiety and Me: Searching for an Answer

Self-efficacy, as Bandura (1977) explains it, is the belief that a person can successfully execute a desired behaviour to result in a desired outcome. Looking back to the Pop Quiz, perhaps I was not self-efficacious enough to overcome my anxiety with the timed problem solving exam, therefore I lost motivation and gave up trying. Bandura (1997) also goes on to state how “a person with high self-efficacy believes they are good at something, they exert more effort, perseveres when difficulty arises, and chooses to engage in similar activities” (p. 36). Looking even further back now, I never had enough self-efficacy to believe I could conquer math

and become good at it, putting less and less effort into the problems and avoiding the subject as often as I could. Many of the articles and books I read refer to this avoidance as being very common. As long as I didn't need math, I didn't seek it out, and my anxiety was non-existent. I am not sure if Bandura's notion of self-efficacy helped me in my search for an answer. I am sure, though, that Bandura's research, the first of the math anxiety research that I read, opened the floodgates.

Math Anxiety Research and Me

There are many memories I have of math; some of them good, but most of them bad. I remember having multiplication "competitions" in grade 5 with my fellow students. I did very well in these competitions, learning, memorizing and reciting my multiplication tables with little difficulty. I believe my problems and anxiety with math started in junior high and high school with the introduction of calculus and algebra. The teachers understood the material, but they were not able to explain it to me in a way in which I could understand and make connections. There is an overreliance on procedures as opposed to actually understanding the math. Trying to memorize procedures, rules and routines without understanding the purpose of those procedures and routines, the math process is quickly forgotten and panic sets in. Math lessons, for the most part, follow a progression, so if students do not have a solid understanding of the basics, they will probably have trouble with later ideas and concepts. There is research that suggests there is an over-reliance on teaching formulas and procedures and memorization (Chin & Steve, 2012). This has been shown to produce short-term effects but no long-term retention, resulting in little forward or further progress complete with anxiety and loss of self-esteem.

I did feel that I had a solid foundation with basic math concepts, but I was not able to work through and understand the more difficult tasks. The material was presented in such a fashion that it led to a very limited understanding on my part, which is often the result of poor teaching. I feel this is because, looking back, I had teachers who could not find a way to make connections to the material that made sense to me. Hilton (1980) suggests the causes of failure in math to be "bad teachers, bad texts, and bad educational instruments" (p. 170). I am not saying my teacher(s) were bad at math or were bad teachers; I am saying that my teacher(s) understood the material too well to be able to "dumb it down" for me to understand. Brownell (1973) discusses how "the greater degree of understanding, the less the amount of practice necessary to promote and to fix learning" (p. 188), and I think this applies to my situation in many ways. I

was not able to understand the concepts, so I practiced and practiced, and became more and more frustrated because I was not confident enough to find the answer, or confident enough to move on to practice other questions. Tobias (1978) calls this “dependency.” That is to say, I was so dependent on my teacher for guidance and explanations, and the text book that had the correct answers at the back, that I was not able to perform the questions on my own.

I do remember one teacher in particular saying she had to move on to other material, and that she didn’t have time for me because I was too slow. Now, if that doesn’t make you feel stupid, insecure, and inadequate, you must have thick skin, or thicker skin than I. After this incident, I remember trying not to draw attention to myself, and if our teacher asked if anyone was having difficulties or didn’t understand, I would never dare raise my hand. I felt that I shouldn’t ask questions or ask for clarification, furthering my fear of math and lack of self-confidence. Tobias (1978) discusses how “math anxious people seem to have little or no faith in their own intuition” (p. 63). Take the idea of fractions and multiplying as an example. When multiplying, one tends to think numbers are increasing in value. But when you multiply fractions, except improper fractions, you get a smaller number. The words and concepts have one meaning when applied to one type of problem or idea, and a totally different meaning when applied to another. In a larger context, the meaning becomes difficult to understand, and the simple logic the student learns at first becomes distorted and confusing, seemingly not being able to apply the new definition to the new situation.

Certain authors and scholars (e.g., Hilton, 1980) have discussed how other factors such as non-supportive or, for that matter, over-supportive parents, and competitive siblings also contribute to math anxiety. However, these factors do not apply in my particular situation: my parents were neither non- or over-supportive of my abilities, always encouraged me to do my best, and helped when I had difficulties. I do have an older brother who is very smart and competitive, but this did not cause problems between us, it actually helped, as I had someone to turn to during my math issues. Unfortunately, Fallon, my older brother, was only able to help me so much. The above factors do not apply, but, as has been established, my anxiety remains. Having summarized the research and my own past, I now look ahead to my future math class.

Math Anxiety and My Future Math Class

Curtain-Phillips (1972) details three large problems with math education: imposed authority, public exposure, and time deadlines. I have experience with each of these problems.

For example, with respect to imposed authority, I have had experiences with thinking that the teacher was the only source of the knowledge and was unable to educate me. This needs to change so there is less emphasis on lectures, and have more student directed classes and discussion. I also agree with these points because I would never raise my hand or offer my solution in front of the class for fear of being shamed and wrong, or compared to others. “Wrong” or incorrect answers should be met with understanding by the teacher, and a desire to see how the student arrived at that particular conclusion. Being positive towards a “wrong” answer will hopefully gain more participation from the student, as well as instil more confidence. These mistakes are, for me, the best way to learn. I believe many people would agree that the most powerful learning stems from making mistakes.

As for public exposure and time restrictions, in my future math class I will not put down a wrong or incorrect answer from a student, but instead will ask them how they came to that answer and if there was another student who arrived at the same conclusion. I will also ask if anyone got a different answer, and together, either as a class or in groups, we will figure out the question. Wrong or incorrect answers give insight into the students’ thinking and possibly indicate what needs to be reviewed. Remembering that the time deadlines and restrictions placed on exams and tests caused me more stress and anxiety than anything else, I want to take the emphasis off tests. Giving assignments and projects to be evaluated for the students’ marks rather than just basing the assessment of their knowledge on one unit test at the end of the lesson. Curtain-Phillips (1972) points out the need for the classroom to change, giving all students, as well as the teacher, equal opportunity, stress-free learning, and a safe and comfortable environment.

In my classroom, particularly with math, I want to use different strategies to help my student understand the material. My own attitude and the way I approach the subject must become more positive. Since I have had so many problems with math, it can possibly show up in my teaching. I need to stay positive about math; almost enthusiastic. As such, I need to analyze my past experiences, beliefs and feelings, and work consciously to change them. Wood (1988) writes, “when teaching mathematics, the teacher is constantly being evaluated, which leads to teacher anxiety, and the ramifications of anxiety when teaching is a large and significant problem” (p.10). Changing my own attitude and working through and getting over my own anxiety will hopefully make me a more successful teacher. I want to provide my students with

clear illustrations, demonstrations or simulations to help increase their understanding through visual aids. Allowing time for practice is essential for understanding, especially when students are having difficulties. Further, I believe that instilling the notion that making mistakes is okay, and a great way to learn, will also be essential to increasing my future students' understanding of the material.

It seems to me that everyone can learn, but everyone learns in different ways. For example, using group work in math is a way to help students who are having difficulties. They can be paired with others who understand and who can possibly explain the situation in a different manner. The students can explore and conjure up different ways of figuring out problems and thinking rather than memorizing rules and procedures. Groups allow students a chance to exchange ideas, to ask questions, to explain, clarify ideas and to express feelings about their learning. Beyond group work, I suggest that acting or role playing and connecting the ideas of math and how they relate to everyday life, such as sewing, cooking, sports, home repairs, and the use of games that are based on math principles, such as cards, yahtzee or battleship, is, to me, important in the math class, in order to help students process math concepts on an instrumental level. Educating students on other math-related learning areas and what types of careers use math will further link the subject with everyday life. Using cartoons or jokes to introduce mathematical skills can help students to understand the concepts in a fun way, and may help ease the pressure of learning. Further, showing the students how to prepare study notes is a great way to group and organize material so they can understand the relationships between the concepts. This idea will also be beneficial in other subjects, as students will be able to make their own review sheets for exams, allowing for the study process to be more manageable. I also want to give my students ample time and opportunity on exams or tests, as well as giving the option of extra credit work so students can be more successful with math. Tobias (1978) says “whether it was timed tests on multiplication facts, the introduction of operations, fractions, multi-staged word problems, or solving equations that cause difficulty, for many, fear of failure was sudden, very frightening, and imminent” (p. 44). I want to be able to ease stress and anxiety for my students and hopefully allow them to reach their full potential with math (and, of course, the other subjects I will teach in my classroom). I want to encourage my students, engage them in the subject material, provide a nurturing environment, and give permission to proceed at their own pace in order to eliminate anxiety.

Conclusion and Discussion

Just thinking about math causes great fear and anxiety in many people of all ages. Children begin school as problem-solvers, thinking and reasoning their way through problems and different concepts. In other words, one could argue that children are natural mathematicians – until the instruction of authorized teachers and the implementation of rigid rules and procedures sets in, which I think almost eliminates their ability to solve, think, and understand independently. My own anxiety with math has caused worry that I will not be as successful in teaching this subject. I want to be a teacher that enables her students to succeed to their full potential in every subject, and I want to start with math. This will take time, I know, but my own difficulties with the subject will allow me to be more understanding, insightful, and aware of those students who are struggling. I still need to follow the curriculum, but I will hopefully present the material to my students in ways they can understand and relate, but also use many other methods than memorizing, and regurgitating the material. Math anxiety is very common, but there are many different approaches to ease the stress of the subject and make learning a collective effort on behalf of the teacher as well as the students.

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Appendix

SPONTANEOUS CELEBRATION OF LEARNING

Name: _____

1. If your doctor gave you three pills and told you to take one every half an hour, how long would they last you?
2. A cone and ice cream together cost \$3.50. If the ice cream costs \$3.00 more than the cone, how much did the cone cost?
3. If you took three apples from a basket that contained 14 apples, how many apples do you have?
4. If there are 12 dollars in a dozen, how many dimes are in a dozen?
5. A man purchased a pair of shoes that cost \$75 and gave the merchant a \$100 bill. After the man had gone with his shoes and his change, the merchant took the \$100 bill to the bank where he was told that it was counterfeit. What was the total loss to the merchant?
6. Two fathers and two sons shot three rabbits, yet each one took home a rabbit. How was this possible?
7. A colony of fruit flies doubles in size every minute. A single fly is placed in a jar and in an hour the jar is full. When was the jar half full?
8. Mr. and Mrs. Motsinger have three daughters. Each daughter has two brothers. How many children are there in the Motsinger family?
9. A bookworm commences on page 1 of volume I and bores his way in a straight line to the last page of volume II. If the covers of each book are 4mm thick and each book without the covers is 30mm., how far does the bookworm travel?
10. A 10 foot steel ladder is attached to the side of a ship. The rungs of the ladder are exactly one foot apart with the bottom rung just touching the water surface. If the tide rises one foot every half hour, how many rungs of the ladder will be covered with water after three hours?

Bonus Question: How many times can you subtract 1 from 25?