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WSMA: Why Learn Math Contest

The average student is often frustrated with mathematics and intimidated by this subject because he is taught that failure is the opposite of success. Throughout school, he learns that mistakes should be avoided and he is inevitably afraid of failing. Mathematics, however, is the universal language *fueled* by failure. To understand this field, we must make mistakes and through those mistakes, gain experience. As a math enthusiast, I have learned that engendering the audacity to tackle ambitious challenges requires overcoming this fear of defeat. Today, I aspire to become a researcher in nanotechnology and believe that a mathematical background would not only help with problem solving and ingenuity that research demands, but also with the mindset of overcoming the fear of failure.

Precisely with this mindset, scientists in nanotechnology have been able to achieve seemingly impossible feats such as improved water filtration, stronger computer chips with carbon nanotubes, and more accurate cancer detectors. Within a sub-category of nanotechnology like carbon nanotubes, the use of three dimensional Euclidean geometry and elementary lattice theory are required, but more importantly, experience and intuition from mathematics helps scientists make sense of the results obtained in the experiments. For example, Euler's Polyhedron Formula states that the difference between the number of vertices and the sum of the numbers of edges and faces of a polyhedron must be exactly two. This formula by itself is not useful in nanotechnology, but being able to apply this through experience and mathematical maturity (which is often obtained by making mistakes) yields a tool that could help design double-walled nanotube oscillators to fight certain types of viruses.

The rich application of mathematics only starts in understanding carbon nanotubes. In other subfields of nanotechnology, the use of physics, differential equations, and various methods from calculus are integral for the researchers seeking to address insurmountable challenges. In fact, calculus and modern nanotechnology complement each other so well that many universities teach calculus with a nanotechnology application and recent books such as New Trends in Nanotechnology and Fractional Calculus Applications have been published to highlight the use of a classical field in math for a modern field of research with great potential. In this specific book, the authors focus on the improvement of high-yield thin films that could be crucial in creating more efficient solar energy.

By applying a classical field of mathematics along with intuition and problem solving abilities, the modern field of nanotechnology that can potentially change the way we live in the next few decades. The discoveries to be made by scientists working on the cutting-edge research would provide answers to exceptionally difficult problems. Therefore, the passion for tackling challenging questions, which comes from being fearless towards making mistakes, is a more abstract, but important use of math in nanotechnology. As I continue working through and challenging myself with hypothetical math problems in my textbook today, I am intensely motivated by the fact that I may use this material as an engineering and scientist to attempt to resolve some of the most crucial problems facing our world.