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Innumeracy:
The Product of Misrepresentation

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Innumeracy refers to one's inability to understand mathematics. Or, more simply, innumeracy is mathematical illiteracy. The main problem with innumeracy is the fact that most of society does not see it as a problem. In fact, many people boast about their innumeracy. Consider a table of five people at a restaurant: they split the check and attempt to calculate the tip. More often than not, at least one individual at the table will joke about the fact that they don't know how to do make that simple calculation. This flippancy toward the prevalence of mathematics has become an accepted norm, though it can be detrimental in many aspects of life – from finances, to home maintenance, to personal healthcare. The growing innumeracy trend can be overcome, however, by society emphasizing a greater enforcement of the understanding of mathematics and its purposes. This can be done by addressing mathematical education and removing psychological blocks related to the mathematical mind, dispelling romantic misconceptions with math's nature, and confronting the media's role through probability misrepresentation.

Confronting Innumeracy

A leading researcher on innumeracy is John Allen Paulos (1988). In his book *Innumeracy: Mathematical Illiteracy and its Consequences,* Paulos explains the dangers of innumeracy and the common misconceptions society has in regard to mathematics. A supporter of Paulos's work, Barbara Luckett (2009), presents his book at a seminar on mathematical research. She explains a few of his examples and goes in depth on the causes of innumeracy, both societal and psychological. Supporting quotes and

statistics are given by Christine Lagorio (2005), writer for the CBS News, Richard Cohen (2006), Washington Post columnist, and Ronald Bailey (2011), an award-winning science correspondent.

Researchers agree that the first step toward enforcing a greater understanding of mathematics and its purposes is fixing the issue of poor mathematical education at the elementary and high school levels. "[E]arly mathematics education is generally poor" says Paulos (1988, p.73). Many teachers at these levels of academia lack sufficient knowledge and interest in mathematics. The mathematically talented tend to go into higher paying fields rather than teaching. One result of poor mathematical education is number numbness. There is a lack of exposure to large numbers at a young age, thus many adults have a hard time visualizing large numbers and their impact; for instance, million, billion, and trillion are often grouped together and thought of as similar numbers, though they are vastly different (Paulos 1988). One million seconds is about eleven and a half days while one billion seconds is almost thirty-two years, and one trillion seconds is nearly thirty-two thousand years. Furthermore, most curricula give focus to computation, and not conceptual examples. CBS news reports that "15-year-olds in the United States are below average in applying math skills to real-life tasks" (Lagorio, 2005). Students are taught to the test; they learn how to "plug and chug" or how to do only the computations necessary to pass exams. They are not shown the more interesting, life applicable side to mathematics.

Math Phobia and Psychological Blocks

Math anxiety and the psychological block of the non-mathematical mind contribute to growing innumeracy. Math phobia most commonly consists of "the sweat, the panic, the trembling, cold fear that comes from the teacher casting an eye in your direction and calling you to the blackboard. It is like being summoned to your own execution" (Cohen, 2006). It is often created by a "cycle of not understanding the material, feeling of frustration and failure, eventually leading to giving up" (Luckett, 2006). While

legitimate, these issues do not need to endure; they can be overcome with more efficient teaching methods and greater exposure to problem solving in general. According to Paulos (1988), "older students fear word problems in part because they have not been asked to find solutions to such quantitative questions at the elementary level" (p.73). The answer is straightforward; students need to be exposed to more problem solving. They need to practice math to be comfortable using it. Also, society's negative portrayal of mathematics contributes to the psychological block many people experience when it comes to math. Cohen (2006) states, "[y]ou will never need to know algebra. I have never once used it and never once even rued that I could not use it." When people of prominence say this, it greatly skews the general public's thinking toward mathematics, causing innumeracy growth.

By addressing the romantic misconceptions associated with the nature of mathematics, growing innumeracy can be diminished. First, the thought that math is only computational is a myth that must be dispelled. This is just as false as the thought that writing is just typing skills; many more cognitive ideas come into play when doing mathematics. Second, the belief that math is entirely hierarchical should be confronted. It is true that some mathematical areas build on others, but this is not of sole importance. In fact, "[m]any sophisticated mathematical ideas can be taught to someone with limited prior math knowledge" (Luckett, 2009). To increase interest in mathematics, mathematicians can start addressing a wider audience with their research. Third, the notion that only a select few people can excel in mathematics is a self-defeating cultural myth. Yes, math comes more easily to some people, but that does not mean that the common person should not have a working understanding of mathematics. Barbra Luckett (2009) explains, "Problems result from insufficient exposure to mathematical thought processes rather than inability to compute". The potential to excel in mathematics is there for people willing to work; understanding comes with practice. Fourth, there is a false impression that math is just mechanical, cold, hard facts. This is not true; mathematics is relatable to real life, it is a tricky process which recounts

personal situations in a way in which proper decision making can be done. Paulos (1988) says, "[P]ure mathematics is only part of the story; almost equally important is the interplay between these ideal Platonic forms (or whatever they are) and their possible interpretation in the real world" (p.90). Luckett (2009) further argues that "people need to be able to look at real-world scenarios quantitatively in order to accurately assess them and make good decisions." Therefore, great care and understanding is required when dealing with mathematical entities.

A closely related issue is the media's role in innumeracy; their biased portrayal of mathematical affairs greatly affects the public's understanding of probabilities. Statistics are reported out of context. A news story may relate that a company let go ten percent of its employees; however what is not reported is the size of the company. That could have been five thousand employees, or just ten. Also, the news tends to cover situations out of proportion with their occurrences, making rare events seem common. The general public has a gross overestimation of the probability of a terrorist attack, while the highly likely car accident is not nearly as feared. In reality, Bailey (2011) relates that there is about a one in 20 million chance of being killed by a terrorist while the chances of being killed in a car accident is one in 19,000. He goes further to compare that people are four times more likely to be struck by lightning than killed by a terrorist. Thus, it is pertinent to the decline of innumeracy that the media start covering matters completely and in accordance with their likelihood

Acknowledge the Problem to Overcome it

By emphasizing a greater enforcement of the understanding of mathematics and its purposes, the growing innumeracy trend can be overcome. This can be accomplished by fixing poor mathematical education at the elementary and high school levels, properly addressing the issue of math anxiety, debunking the romantic misconceptions associated with the nature of mathematics, and adjusting the media's portrayal of probabilities. The modern world is reliant upon mathematics whether through

finance, business, politics, or even sports, yet society seems unconcerned with learning and understanding that very topic. They are indifferent when it comes to the issue of innumeracy and are more concerned with hostages on an airplane than addressing crime rate or poverty (Paulos, 1988). For people unwilling to address their innumeracy, there will be fewer job prospects, an inability to accurately assess risk, and an increase in financial mismanagement.

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