Sally Mitchell – Comments to the National Math Panel - September 14, 2006

Ladies and Gentleman of the National Mathematics Advisory Panel,

I am very excited to be here today because mathematics education has a vital role in science education. My name is Sally Mitchell and I am a chemistry and physics teacher in East Syracuse, New York. I am also a PhD candidate in Science Education at Syracuse University. I have been studying the correlation between mathematics and science education for the past 5 years, and I have several points that I would like to address.

I left teaching to start my family in 1987 and when I returned to teaching in 1997, I was shocked at what I found in the chemistry classroom. At first I couldn't put my finger on the problem, but then when I taught physics the following year, I knew immediately what was wrong with science. The answer was mathematics. My students could not measure properly, were calculator dependent, could not estimate, and did not use or speak the universal language of measurement, also known as, the metric system.

I remember entering 6th grade during the 1970's and my science teacher told me "by the time I graduated from high school, the United States would be using the metric system". I believed my teacher and I did not even give it a second thought, I converted right over to the metric system, went onto college and majored in chemistry and biology, and I never had a problem with measurement or estimation. The entire world went to the metric system, and in 1976, the Olympics went metric. There was national pride in the metric system. My estimation skills were fantastic, I had points of references, and the prefixes made calculations and data collection a breeze. Money was metric so it

seemed a logical choice to standardize measurement throughout the world. Everyone was on board, but something happened here in the United States… a swipe of a pen from the National Government, and all of a sudden, the inch-pound system was back in full force.

I first realized that the United States was at a disadvantage using the inch-pound system 5 years ago when I was judging a Science Olympiad event called Metric Estimation. The students had no clue to what a kilogram of mass was or distances in millimeters. The winner of the competition was not a United States citizen but a boy from a foreign country. This boy had an excellent ability to estimate and he had a grasp on using the metric system. I began pre-testing my students on their abilities to estimate and I was shocked at the results. They had no clue as to points of references in measurement using the metric system, the system used exclusively in science and medicine. I then pre-tested my students on their abilities using the inch-pound system and the results were even worse.

I found that students knew more metric measurements than inch-pound units, but they were so confused using both systems, they just gave up. When quizzed on simple questions such as:

How many cups are in a pint? Or What is the mass of 1 gallon of water? or

How many cubic inches are in a gallon? Or How much does a gallon of water weight?

Hardly any of the students knew the answer to even one of the above questions.

Then I remembered my confusion when I was 5 years old. I had the mumps and with it, I had a very high temperature. When my mother took out the thermometer and I looked at it, the thermometer read 105. I was delirious and she went and got out a

washcloth with water on it and placed it on my head. I thought since the boiling point of water was 100, that the water on the cloth would sizzle. I didn't understand why it didn't. I was confused because I was taught 2 different systems of measurement.

That problem is still here today in the USA. When I pre-test my students in chemistry at the beginning of the school year, I ask: "What is the normal freezing point of water? " And then "What is the normal boiling point of water?"

I was shocked at the answers of 32 for the freezing point and 100 as the boiling point. Why were students using 2 different systems of measure? After much investigation, I came to the conclusion: Students were watching the news on TV and the temperatures were always reported in Fahrenheit units, but the weather stations are refusing to place units on the numbers so students just didn't get it that it was in Fahrenheit. Then when they come to science class, they measure the boiling point of water using Celsius thermometers.

During my dissertation work, I designed an instrument to measure a student's ability to estimate. I held up a 2-L bottle of soda that was half filled. I asked the students to estimate the amount of liquid inside of the bottle. 99.9% of the students wrote an answer that included liters as the units. Then I held up a gallon container containing one liter of liquid. 80% of the student wrote their answer as ¼ of a gallon. Both contained the same amount of liquid, yet, we have conditioned our children to 2 sets of measurements for volume.

Students listen to their teachers. Children follow in their parent's footsteps. It is up to us, as educators, to look at the problems associated with the fact that the United States of America is the last of the industrialized nations to convert totally over to the

metric system. It is up to us as educators to realize that the United States is falling behind other countries in math and science, and one of the pieces of the puzzle to fix this problem is to simply teach and use the metric system exclusively, just like the rest of the world.

Congress authorized the use of the Metric System for use in the United States in 1866. At the time, each state was supplied with a set of standard metric weights and measures. In 1875, the United States became one of seventeen nations to sign the Treaty of the Meter, an international agreement of refining the accuracy of the standards. In 1968, Congress authorized a three-year study of the system of measurements in the US. The study concluded that the US would eventually join the rest of the world by adopting the metric system. Congress then passed the Conversion Act of 1975 and people began to embrace the metric system. Mathematics was on board with the rest of the world, and then, I am not sure what happened, but then inch-pounds were back in the math curriculum.

With the “extra time” saved by not having to teach both systems of measurement, mathematics teachers could address other topics or cover topics in greater detail. Science teachers would not spend hours and hours trying to teach a 16 year old the universal system of measurement. If children used this system at home and in school, they could estimate better and then compete successfully in the world.

As an aside, my son spent the last year as a foreign exchange student in Switzerland. He excelled in all of his studies and didn’t blink an eye when it came time to travel 30 kilometers to the next town, or the weather reported in Celsius. We are holding onto volume in gallons, distances in inches, feet, yards, and miles, and

temperatures in Fahrenheit. All of our other measuring units are metric units such as calories, joules, watts, amps, volts, ohms, kilograms, liters. It is such an easy and practical thing to do; yet math educators still are forced to teach the inch-pound system. Instead, allow the social studies teachers to take over this role and allow them to explain how the US held onto an antiquated system for so long and put it in the history books. Allow the math teachers to teach a system that is standardized and coherent, one unit for each type of measure (meter-length, kilograms – mass).

Just remember, students will learn what we teach them. If students learn only the metric system and live metrically at home, it will make our jobs as educators easier. I have done my job in chemistry teaching and living the universal system of measurement. **Leave no child behind**! I have done my part to make my students successful in math and science, now you have the opportunity to help math and science.

Sincerely,

Sally B. Mitchell
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