“A Commentary on the Importance of Using Correct Mathematical Terminology” or “One Reason Why Students May Have Trouble Understanding College Professors”

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“I think we need a few more of those thingies to support the bridge,” said the structural engineer. “Why don’t we put some of those curved do-jiggies above the windows?” posed the architect. “Some of your number-deals are high . . . here, I’ll give you an Rx for some stuff,” prescribed the doctor. Have you ever considered how difficult it would be to communicate, even at a basic level, without using the right vocabulary?

In recent years, teachers have explored several non-traditional ways of teaching mathematics. Increased emphasis on group learning and students exploring topics on their own make it possible for students to get through a K-12 mathematics curriculum without using mathematical terminology or hearing a teacher speak using correct mathematical vocabulary. One downside of group learning on a daily basis is that students do not need to use math terminology to communicate with their learning group to solve problems or complete the activities.

Mathematics is, among other things, a language. A student has to understand the vocabulary of math to understand math. In other words, a student has to recognize and understand the terms being used to grasp the topics being taught. Both the textbook and the teacher must use mathematical terminology consistently. Repeated often, the terms will be understood well enough to insure that communication between students, teachers, and textbooks leads to success in understanding mathematics.

Students can hear a word being used, and they may have read the definition in a book; however, unless they actually hear it being used in context by a teacher, it is unlikely that they will understand the term or use it when they do the math. Our experience with students in public schools, community colleges, and now at the University of Illinois, reveals that many students who say they do not understand the math, often do not comprehend the math terminology well enough to understand our explanations. Understanding terminology is the foundation of success in math and many other disciplines. This understanding comes from seeing and hearing terms being used in context rather than reading a definition in a book. The words have to be part of a student’s working vocabulary, or a communication gap is created and learning stops.

A leading text for teacher education argues the advantages of using the terms top number and bottom number rather than numerator and denominator. Noticeably missing in similar math texts for teacher education are vocabulary terms such as addends, minuend, product, quotient, coefficient, roots, vertex, chord, perimeter, reciprocal, digits, and integer. Not only can use of improper mathematical terminology lead to problems in communicating mathematical ideas, it can also be somewhat offensive. For instance, a colleague spoke of “Dolly Parton fractions” as fractions that are heavy on the top, rather than using the term improper fractions. While it is true that teachers can teach a math curriculum
and avoid math terminology, it is unlikely this approach to teaching math will increase the number of math majors at our universities.

We have found that students who have a poor mathematical vocabulary dislike math because they think that they cannot do it well. In reality, they could do math well if only they understood the mathematical terms we use in our explanations. Try to imagine teaching complex analysis or differential equations using a 3rd grade vocabulary. Moreover, even if they recognize the terminology, they may not totally grasp the concept that the term defines because they have not heard and seen the term used in context. For instance, most students hear the words area and ratio, but some of our students have no intuitive understanding or working knowledge of either. Unfortunately it seems that, by the time some of these students reach college, they are so disinterested in math that they are unwilling to learn the vocabulary and simple concepts that would enable them to understand math. This is a vicious cycle that elementary school teachers, high school teachers, and even authors of mathematical texts can address if they would make more of an effort to always use correct mathematical terminology. An explanation of how these terms relate to real life situations would help students understand the meaning of those terms.

We would agree that, in most cases, a student’s lack of understanding mathematics is attributable to a poor conceptual foundation, but at least part of the problem may be a communication gap from an incomplete math vocabulary. For instance, while working with an undergraduate, we used the term squared to explain a problem. The student asked what we meant by squared and we replied “as in 6 squared,” . . . still a blank look . . . “like 6 times 6.” “Oh yeah,” she said. Her understanding of the term times was better than her understanding of squared. Equally alarming are educators who believe and teach that generic words have only one meaning in math. For example, altogether “always means add,” and they would argue if the average height of boys is 44 inches and the average height of girls is 46 inches, then the average height of the children altogether must be 90 inches. Have you ever heard someone say guzinta (as in 3 guzinta 6 two times) or times it (instead of multiply)? Recently, a student asked what a quotient was, and thankfully understood when we responded, “answer to a division problem.” We could not bring ourselves to use the word guzinta to explain quotient. While math educators joke about this jargon, college professors usually assume their students have acquired a mathematical vocabulary, and probably do not or cannot take class time to define fundamental terminology. College instructors will refer to the numerator rather than the top number, and never consider that students might not recognize the word numerator, as the student has always heard the term top number.

The three unanswered questions we are posing are: (1) To what extent is a student’s lack of understanding college mathematics attributable to a poor working vocabulary, and to what extent to a poor conceptual foundation? (2) To what degree are vocabulary and conceptual understanding intermingled; i.e., how important is a mathematics vocabulary to success in college mathematics? (3) What constitutes a fundamental math vocabulary that provides students the opportunity to understand college mathematics? We think these questions are worthy of doctoral research.

We are not presuming that improving students’ vocabulary will solve all of the problems for students learning higher mathematics, but we do think this is a
basic part of the problem. A colleague, Claran Einfelt, while working on the Illinois Standards Achievement Test, had an elementary teacher argue that it was unreasonable for the 3rd grade ISAT test to include words such as vertex (instead of corner) because vertex was too hard for students to remember. Einfelt’s response was that 3rd graders have no trouble remembering words such as triceratops and tyrannosaurus rex and can even explain the difference between them. If teachers want to use everyday conversation in teaching, we recommend that they use/speak the correct mathematical term first, and then the vernacular, so that students will associate the correct term with ordinary usage or jargon. For example, the teacher should say “numerator or top number.” Students can and will use the correct math terminology if their teachers use correct mathematical terminology in their daily instruction.

“Learning the language shows respect for the discipline.” Carol Castellon, 2009

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