

TODOS: Mathematics for ALL

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The mission of TODOS: Mathematics for ALL is to advocate for an equitable and high quality mathematics education for all students, in particular Latino/Hispanic students, by increasing the equity awareness of educators and their ability to foster students' proficiency in rigorous and coherent mathematics.

Testimony before the National Mathematics Panel June 29, 2006

Presented by:

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INTRODUCTION:

Thank you for this opportunity to address this distinguished panel. Your task is extraordinarily important to the mathematics and mathematics education community, but even more so to the millions of students in our country for whom your recommendations will have significant consequences. And behind every student there is an army of teachers: they are the ones who can implement your recommendations and make realities out of your vision. Teachers need you so that they can help their students. Teachers need our help as well. We wish you well and are ready to assist you further as needed.

I am the President of TODOS: Mathematics for All, an organization that advocates for an equitable and high quality mathematics education for all students, in particular Hispanic/Latino as well as students from minority populations such as Native Americans, African Americans, and others. These student groups have a disproportionate number of dropouts, struggling students and underachievers. (Reese, Miller, Mazzeo, Dossey, 1997; NAEP, 2006)

My remarks represent those of TODOS as well as my own professional experience of over 40 years as a teacher of mathematics at all levels, K through the university level. My career in education began in North Carolina classrooms, and includes 35 years in the Mathematics Department at the University of North Carolina Charlotte where I am the Bonnie E. Cone Distinguished Professor for Teaching Emerita. I have been involved in mathematics at many levels: for example as Chair of the North Carolina Mathematics Curriculum, as Director of Teacher Preparation at the National Science Foundation, as a member of the US National Commission on Mathematics Instruction, as a researcher, author of papers, books for teachers, K - 12 textbooks for students, and other such professional activities. I am also what we now call an ELL, English Language Learner – a unique experience that led me to the study on the importance of language in mathematics and on which I elaborate in this report.

DISCUSSION AND RECOMMENDATIONS:

Since our time is short, I will limit my observations and recommendations to address one of the points listed on the Executive Order with regards to the Report to the President on Strengthening Mathematics Education. I include in my written report a list of research references that support my conclusions.

Point for discussion, (c): *The processes by which students of various abilities and backgrounds learn mathematics*, with implications for instruction, teacher education, assessment, and materials development.

All students regardless of their background, color, ethnicity, culture or physical challenges must have an equal opportunity and support to learn mathematics. This means that suitable accommodations **must be made** to promote achievement and access for all students. (Haycock, Education Trust, 2006). They must have the opportunity to learn challenging rigorous mathematics from a ***qualified*** teacher who not only teaches the content but who makes connections according to the needs of learners. These needs include culture, background, experience, language, and previous knowledge (Saxe, 1988; Khisty, 1996; Moschkovich, 1999).

When dealing with a diverse student population and differentiated instruction, one area in mathematics merits particular attention: Problem Solving or more specifically Word Problems. We have targeted this area because the majority of students consider word problems a challenge and most teachers overwhelmingly agree. We are talking about ***real*** world problems because in the real world there are no exercises, only word problems. And students will admit that they will usually “*add, subtract, multiply or divide*” until they get the answer in the back of the book.

Further, results from the US Performance in Mathematics Literacy and Problem Solving (PISA), confirm that our country has the greatest percentages of students at or below the lowest levels of proficiency and at all levels the US is below the international averages (OECD, 2003). This report is also supported by data that shows gaps widening (The Condition of Education, 2002). This is not a problem of a few students, but a more national problem of US students being able to:

- Read and reason to interpret the problem
- Represent mathematically
- Resolve or determine the solution
- Reflect on the results – do they make sense?
- Relate: explain the problem and justify the solution/s

In the steps above note the heavy emphasis on reasoning, and **communication**. There is not a more important task in school mathematics (Polya, 1945) than to be a successful problem solver. It is not a step-by-step algorithm, but a process to understand and successfully solve a problem. It is the foundation of the Scientific Method, and the most useful tool that students can take away from their mathematics classrooms.

When presented with a problem, we rely on previous situations or experiences or knowledge, other people’s input or advice or communication, and on our own investigation. We must

provide the same to our students: not just exercises to solve, but mathematics problems that can be solved individually, as a group or class, with ample opportunities for students to discuss, justify, and communicate their knowledge. They will also develop their own approach, learn others, and understand and use “traditional” strategies. They will practice and learn as well as communicate their learning. Communication in mathematics is complex because it takes so many modes: words in English or the academic language of mathematics, symbols, graphs, through visuals, manipulatives or models, etc. Mathematics is a language with its own syntax, grammar, words, phrases and sentences.

Students *whose first language is English* have difficulty with word problems: for example, in a problem in the NC End of Course Assessment there was a question about ‘toll roads’ but there are no toll roads in our state. Many students that could do the math were stumped because of the language. This difficulty is then confounded when we are dealing with words **that are not** part of the student’s experiences, culture, background, and even language. It is not reasonable to expect that all our teachers speak the many languages, including versions of English that their students speak. However, they must focus on the language as well as the mathematics so that their students, first and second language learners can all succeed. Teachers must ask: What are the prerequisite concepts and skills? What is the required Mathematics AND English vocabulary? What do the words, phrases, and sentences mean? Are these part of our common experiences? If not, how can we change the problem or use a teachable moment to teach and reach all students? This requires additional components in the preparation of teachers: preparation in mathematics, in differentiated instruction, in issues dealing with language in the classroom, and with their own equity awareness.

RECOMMENDATIONS:

Teachers, in service and pre-service, must be appropriately prepared to deal with the diversity in their classrooms.

- Differentiated instruction keeping equity and students’ needs in the forefront.
- Tiered lessons, or lessons adjusted for individual needs.
- Creative tutoring or tutors and assistance from within and outside the classroom.
- Resourceful team teaching – learning from each other as well as from those from other disciplines including ELL or Bilingual Teachers.
- Instructional strategies and tools to deal with language issues – for ALL Students with additional assistance for ELL!
- High expectations and access.

Teachers must use materials and textbooks that enhance their own teaching and student’s learning and success through:

- Rigorous treatment of the mathematics content, concepts, skills and applications.
- Emphasis on problem solving, with real world applications or with clear connections within mathematics or other disciplines.
- Attention to the language of English and Mathematics: prerequisite and new words, symbols, models, pictures, etc.
- Alignment to state requirements and assessments.

Students must be given equal opportunities:

- For learning mathematics:
 - Providing additional instruction, time and support,
 - Accommodating to learning styles, culture, previous knowledge, etc., as needed.
- For Problem Solving:
 - Through rich mathematical problems that **promote reasoning**
 - With opportunities for student groupings to maximize learning
 - Demanding justification and communicating mathematically
- In assessments and language: **Assessing the content knowledge and not the knowledge of language.** *Students can learn more language through mathematics and more mathematics through language.*
- For success and access to higher mathematics: Having the highest expectations and support for each student.

In conclusion, I would like to thank the National Mathematics Panel for the work that you have done, for what you will do, and for all you will have to endure. Thank you for giving me this opportunity to address these concerns that are crucial to you report. Good luck and call on me if I can be of further assistance.

Miriam A. Leiva, President
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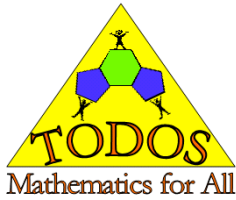
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