Comments to the National Math Panel
Representing TODOS and NCSM
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I am Mark Driscoll, representing both TODOS and the National Council of Supervisors of Mathematics (NCSM). I am a member of both organizations and Editor of the NCSM Journal of Mathematics Education Leadership. On behalf of both, let me say that we are very grateful to the National Mathematics Panel for inviting us to be represented here today.

My remarks pertain to the Panel's category of interest, "Learning Processes," with implications for the "Instructional Practices" subgroup. Specifically, on behalf of TODOS and NCSM, I want to call your attention to the issue of enhancing the mathematical success of English Language Learners (ELLs), and to the associated issue of galvanizing mathematics education leadership in this regard.

In the past three decades, the number of U.S. children living in households where the native language is not English more than doubled from 9% to 19%. (Firestone et al, 2006) The total number of students labeled as "Limited English Proficiency" is 9.6% of the student population, or 4.5 million. (Abedi, 2004). Many of these children are taught mathematics in English, which adds a considerable learning hurdle for them. In these remarks, I will cite some research results and promising practices that give shape to an imperative, yet a hope-filled imperative, regarding our helping ELLs become more successful in mathematics.

In brief, we believe it imperative to *teach ELLs the academic language of mathematics, not as vocabulary drill, but in the context of working on mathematics tasks that are challenging and have high cognitive demand.* We also believe it imperative for national leaders to encourage and support district and school leaders in building teachers' capacities to teach ELLs in this way.

I said these are *hope-filled* imperatives, because results, tools, and practices already exist that can help transform ELLs' experience in mathematics classrooms. We lack coherent programs for scaling up their use, and that requires galvanized leadership. Let me elaborate.

Consider first the results of the QUASAR project from the 1990's (Silver & Stein, 1996; Silver et al, 1995). QUASAR, a five-year intervention in six middle schools serving poor communities, was both a school demonstration project and a complex research study of educational change and improvement. One strand focused on types of classroom mathematics tasks and on the nature of student engagement with tasks. (Henningsen & Stein, 1997) The researchers distinguished tasks according to *cognitive demand*. They noted that different mathematics tasks make different levels of cognitive demand and that the cognitive demand of a task can change during a lesson, depending on what teachers and students do in implementing them.

Using extensive classroom observation and analysis, along with a project-developed Cognitive Assessment Instrument, the study concluded that student learning gains were greatest in classrooms in which instructional tasks consistently encouraged high-level student thinking and reasoning (e.g., conjecturing, justifying, interpreting), and least in classrooms in which instructional tasks were consistently procedural in nature. In brief, the project led to the conclusion that, in order to foster *all* students' success in mathematics, teachers must support students' cognitive activity by providing a regular diet of work on meaningful tasks for which neither the complexity nor the cognitive demand is reduced--i.e., tasks that involve 'doing mathematics.'

For ELLs, the phrase "meaningful tasks" takes on even more complexity because of the role of academic language. This provides a pointed challenge to teachers and administrators. Particularly because of current testing demands, many are tempted to address ELL needs by separating language work from mathematics work, with strategies such as vocabulary drills. (Firestone et al, 2006) Often, this lack of integration of language and content development results in a lack of active engagement by ELLs in the mathematical work being done in their classrooms. (Brenner, 1998)

However, despite the added challenge of academic language, there is no need to cease heeding the QUASAR message, as evidenced in the story of one 5th-grade teacher, whose work has been studied by Chval and Khisty (Chval & Khisty, 2001; Khisty & Chval, 2002). Sarah (a pseudonym) teaches in a school that is nearly 100% Latino in one of the poorest neighborhoods in a large urban school district in the Mid-West. In the focal year of the study, the average child entered her classroom half a year behind the expected 4.8 in the ITBS, with only five of the 24 students performing at the 4.8 level or above. After just eight months in Sarah's classroom, her students outperformed the other fifth-graders in her school, as well as other fifth-graders in her district, and 15 of the 24 (62.5%) performed at the 5.8 level or above. This success was typical of Sarah in other years.

In tracing the roots of this success, Chval and Khisty document a consistent use by Sarah of writing assignments and classroom discourse related to challenging mathematics problems, used as occasions for clarifying--not simplifying--mathematical language. To get a flavor for how such discourse works, consider the following brief interaction between Sarah and her students (p. 23 of Chval & Khisty, 2001; a similar exchange is recorded on p. 8 of Khisty & Chval, 2002). It is the first week of school and the children have been engaged in a challenging geometry problem. The word "congruent" has been introduced:

Sarah: Look at that word everyone. Congruent. What does that mean?

Student: Like another copy.

Sarah: An exact copy. Because here, look here is the circle. Is this circle congruent to that circle?

Chorus: No.

Sarah: No, they're not exact copies. They're similar, they're both circles, but they're not exact copies.

Of course, Sarah is but a case of one. However, we believe that scaling up success like hers is possible, if our leaders--at national, district, and school levels--act to increase attention in teacher education to:

- The importance of integrating content and academic language development in classroom discourse. (See, for example, the framework and tools in Garrison et al, 2006.)
- The crucial role that teacher attention to cognitive demand plays in the mathematical work done by all students, but especially by ELLs. (See, for example, the framework and tools in Stein et al, 2000)
- The importance of attending to mathematical language and its specialized discourse, and of learning how to create learning environments that use multimodal mathematical communication--speaking, writing, diagramming, etc.

A quick example can elaborate the third bullet. Along with several colleagues, I am currently involved in an effort by New York City's Office of English Language Learners to solve a problem through the professional development and collaborative efforts of teachers, coaches, and administrators. The problem: In the city, there is an unexplained achievement gap in mathematics between ELLs and others. The participants: middle-school teams comprising assistant principals, math coaches, and ESL specialists. The goal of the effort: From lesson preparation to interacting with students in the classroom to analyzing student work, each school team will be more effective in understanding evidence of difficulty with academic language as well as evidence of difficulty with mathematical concepts, and will inform the teaching and support of ELLs accordingly.

A core activity in this effort has been the gathering and analysis by the school teams of student work on challenging mathematics problems. We have chosen to use problems primarily from a project[1] that is currently field testing professional development materials focused on geometric thinking. We believe that suitable geometry problems invite multimodal mathematical communication, especially when the student work being gathered is in the form of newsprint presentations by small groups of students.

For example, one of the problems pertains to geometric dissections and first asks solvers to cut up a given parallelogram and rearrange all the pieces to make a rectangle. Then, it tells them: "In a sequence of pictures, show where you decided to cut and how you rearranged the pieces." Next, "Describe in words where you decided to cut and how you rearranged the pieces." And, ultimately, "Will your method allow you to transform *any* parallelogram into a rectangle?" The transitions from pictorial to verbal explanations and from specific cases to mathematical generalization provide teachers ample opportunities to clarify and develop mathematical language for students. During the coming year, we hope to determine how significant such opportunities are in creating effective learning environments for ELLs.

Thank you for your time and attention.

[1] Fostering Geometric Thinking in the Middle Grades, NSF EHR-0353409. Education Development Center, Newton, MA., 2004-2008. Mark Driscoll and June Mark, Co-Principal Investigators.

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