

## Listening, Speaking, and Writing in a Content Area

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"When you write out the [math] problems, you're figuring out how to do it and realizing how the problem works and why it does." (Thomas)

"Writing sentences [about mathematics] is just wasting your lead." (Taylor)

"It doesn't take long to like tell people what you're trying to talk about." (Haley)

What causes children to have such different perspectives about how talking and writing can be helpful to learning mathematics? In this Problems Court paper we explore the question, what can be learned about ways to help children successfully participate in the literacy processes of listening speaking, and writing? Specifically, our aim is to launch an inquiry about what is required from students to successfully participate in listening, speaking, and writing<sup>1</sup> in a content area. We use analysis and excerpts from interviews with 15 third graders to bring students' voices and perceptions about the role of listening, speaking, and writing in their learning of mathematics.

### Review of Literature

From various perspectives we know that listening, speaking, and writing are important facets of subject area learning. For example, the sociocultural learning theory of Vygotsky (1978) provides a framework for this Problems Court paper on listening, speaking, and writing. There are at least two ways in which sociocultural learning theory informs the ideas presented here. First, one's use of language to negotiate meaning is central. For Vygotsky, language was the most important psychological tool or sign. As a sign, language mediates learning. Second, Vygotsky emphasized the importance of language on human thought. In his view, meaning originates between individuals. "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level: first *between* people (*interpsychological*), and then *inside* the child (*intrapsychological*)" (p. 57). That is, through speech in the social or external domain, the child transforms and internalizes what is learned. What the child knew previously is internally reconstructed. If so, it seems that talking—and its companion, listening—are strategic to learning.

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<sup>1</sup> We acknowledge the importance of reading in a content area. However, in this paper, we focus on the literacy processes of listening, speaking, and writing.

In addition, the studies by Douglas Barnes and Courtney Cazden (among others) support the primacy of classroom talk in learning. For example, Barnes (1992) described the ways in which children use exploratory talk to tentatively work at “rearranging their thoughts during improvised talk” (p. 108). To Barnes, children used exploratory talk on the way to final draft language, “which amounts to a formal completed presentation for a teacher’s approval” (p. 108). Cazden (1986) stated that spoken language “is the medium by which much teaching takes place and in which students demonstrate to teachers much of what they know” (p. 432). Considered in this way, classroom discourse merits thoughtful consideration when exploring student learning in content areas.

Burbules (1993) expanded the role of talk, or speaking, to that of something more dynamic. Burbules used the term “dialogical relation” to describe a relation between people in the context of discussion, a relation “to ‘carry away’ its participants, to ‘catch them up’ in an interaction that takes on a force and direction of its own, often leading them beyond any intended goal to new and unexpected insights” (p. 20). In this view, talk appears to be suspended from traditional classroom conversations; conversations are dependent on participants and their interaction.

To summarize, language may be seen to support learning by the way in which it is used to negotiate meaning, to explore thought, to teach and to learn, and to enter into a dialogical relation with another. When consideration of literacy development is extended, it is logical that teachers of all content areas would appreciate the language demands of their particular fields. And what of listening, speaking, and writing in mathematics?

The ideas above, regarding the roles of talk and language in learning, can be applied to a content area such as mathematics. Clearly, the leading organization in mathematics education, the National Council of Teachers of Mathematics (NCTM), places value in mathematical discourse, viewing discourse as “ways of representing, thinking, talking, and agreeing and disagreeing” (NCTM, 1991, p.20). In subject area learning, as students become literate, they learn to communicate their understandings. The National Council of Teachers of Mathematics (2000) assert the following regarding communication:

Communication is an essential part of mathematics and mathematics education. It is a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, discussion, and amendment. The communication process also helps build meaning and permanence for ideas and makes them public. When students are challenged to think and reason about mathematics and to communicate the results of their thinking to others orally or in writing, they learn to be clear and convincing. Listening to others’ explanations gives students opportunities to develop their own understandings. (p. 60)

Implied but not specified in these dynamics are norms of participation in teaching and learning that differ from traditional mathematics teaching. Also implied but not specified is the idea that teachers and students are able to navigate mathematical discourse through the use of listening and speaking. However, little guidance is given teachers (and students) regarding the new roles and responsibilities that participation in such discourse carries. In addition, NCTM

advocates that mathematics teaching and learning include such dynamic processes as reasoning and problem solving, again without specific assistance to teachers as to how they might go about choreographing these processes.

Others (e.g., NCTM, 1991, 2000; [Countryman, 1992](#)) advocate that writing in mathematics classes can help students make sense of mathematics by, clarifying their thinking, constructing arguments, posing questions, reflecting about their work, and developing new approaches for solving problems. Burns (1995) stated, "Writing encourages students to examine their ideas and reflect on what they have learned" (p. 13). Underscoring Barnes's (1992) notion of exploratory talk, one could deduce the value through writing of students' increasing ability to clarify understandings. In addition, there is a uniquely reflective component to writing. McCallum and Whitlow (1994) argue that understanding patterns in mathematics shares many commonalities to the way in which children come to understand the patterns in language use.

To summarize, when applied to the content area of mathematics, the literacy process of listening, speaking, and writing are vital to the growth of students' mathematical thinking. The nation's leading professional organization in mathematics education purported benefits to students engaged in these literacy processes when they wrote, "Students who have opportunities, encouragement, and support for speaking, writing, reading, and listening in mathematics classes reap dual benefits: they communicate to learn mathematics, and they learn to communicate mathematically" (NCTM, 2000, p. 60). The key is to provide students with the opportunities to engage in such literacy processes.

### Setting

To provide context for our discussion in this Problems Court, we describe a specific third grade classroom and our experiences in this class during mathematics instruction. The setting is a third grade classroom in an elementary school in northwestern North Carolina. One of the authors co-teaches mathematics in this classroom. In this third grade classroom, students sat at desks clustered in groups of four and five. In these clusters, students regularly worked in pairs or small groups to discuss and work on tasks. The teachers fostered norms of participation where students were provided with rich, hands-on tasks and expected to communicate their emerging mathematical ideas while listening to one another. The teachers planned for discussion and disagreement, listening carefully to student responses in order for mathematical thinking to build through discourse. Teacher questions were open-ended, with follow-up questions that probed students' reasoning (Tell us more about... What do others think? Do you agree/disagree?). Student responses typically included "I think....because...." statements. They regularly recorded numerical sentences (where applicable) and drawings to explain their thinking or how they arrived at a solution. Frequently, students were asked to write sentences with words to explain solution strategies.

During the interviews students described their math class as follows: "It's an adventure." "Kind of hard, kind of easy." "Challenging." "Frustrating." "Interesting, fun." "It's an adventure." "Lots of ideas to talk about."

### Student Interviews

Many of the questions that the authors asked the third graders were related to their perceptions of speaking, listening, and writing to learn math. Below we summarize their responses and provide some excerpts to illustrate their voices. As you read, consider the many complex issues raised by the students about using speaking, listening, and writing to learn mathematics.

### *Speaking*

Speaking was the preferred mode for most of the students when asked how they could best demonstrate their understanding about mathematics. For most children talking is natural and learned early in life but they still have to think about how and when to use talking to help them think about learning math. Some examples of how they thought about speaking in their math class were to give answers, to give opinions, to prove answers, to debate, to tell Dr. Crumbaugh what they had been doing while she was gone. Additional examples included to share things out loud, to explain problems (so that students at their table can correct you if you're wrong), to figure out problems, to give a different idea, to help everyone, and to help them.

When asked if she liked to explain her ideas during math, one student responded: "I try to but sometimes I explain things that like sometimes I can't explain what I'm thinking, you know when that happens? Sometimes I have something that is the answer to the question and I can't explain it with words, I can only explain it in my mind and on paper." Another student was asked, "Why do you talk [during mathematics discussions]?" The child responded, "When it's interesting, ideas build onto stuff, new stuff. It helps everyone, give you an idea or a different idea."

### *Listening*

Most students preferred listening as the way they learned math best. They talked about using listening to know what to do, to hear others' opinions, to help them understand, to hear others' ideas, to help them "catch on," to learn how to do stuff, to get to know the problem better, to help you figure out the question, and to give them a different idea.

A student who preferred listening as the way he learns best during math explained: "We listen to the teachers and we listen to the other children's ideas and we learn what they know from what we hear and when you're talking, you can't really learn anything from that and when you're writing, you're writing what you already know."

### *Writing*

Children talked about writing for different purposes including writing math problems, writing sentences to explain their thinking, drawing pictures, and writing problems on the board. For most children, writing presented more of a challenge. It was the least favorite form of communication when learning math. From their perspective writing was hard, their hands got tired, it was hard to explain in writing, writing was too much work. Children also responded by

saying if you did something wrong you have to write all over again, sentences take too long, and writing is just "wasting your lead."

### Discussion

To initiate discussion during our Problems Court session, we posed the following questions:

- What is required for students to successfully participate in small and whole group discussions in content areas?
- In what ways can teachers help students learn the skills required to successfully participate in small and whole group discussions in content areas?
- What do teachers need to know to support students' successful participation in discussions and writing in content area classes?
- In what ways are issues of successful participation in the literacy processes of listening, speaking, and writing the same and different for various content areas in elementary classes?
- How can teachers help students learn to communicate their ideas in writing about content area topics?
- What is the role of teacher educators?

A lively discussion ensued with the primary focus on writing. Participants talked about the complexity of writing and the many challenges to supporting children in their writing and seeing writing as a tool for learning. They also discussed the importance of audience when writing and perhaps children did not like to write because they felt that they were communicating with an expert, the teacher, who already knew what they were trying to write about. Another suggested that we call it something besides "writing". Questions were also posed about how the writing was evaluated and the messages students received about the value of writing during math class. The discussion concluded in agreement that more interactions were needed between the field of reading and language arts and mathematics to help teachers and students learn more about how to successfully use speaking, listening, and writing to learn mathematics.

In this setting where the teachers planned for the third graders to communicate their mathematical ideas, listening, speaking, and writing were commonplace. And from the students' perspectives, these literacy processes appeared to be influential as they learned third grade mathematics. The authors were intrigued by students' perceptions of the role of listening and speaking in their learning, noting they were preferred by the children. In addition, the fact that writing presented more of a challenge was expected, as writing is more complex than listening or speaking. Somewhere between talking and writing sentences in this third grade mathematics class was picture drawing to communicate understanding. Might picture drawing in third grade mathematics reveal emergent mathematical understandings, perhaps parallel to emergent readers who draw pictures to tell stories? Rather than provide children with content comprehension strategies, the teachers operated on the assumption that language use would foster mathematical understanding. That is, to successfully communicate mathematical ideas, children needed opportunities to communicate their ideas, to listen, talk, and write during mathematics.

As discussed earlier, language use plays a strategic role in learning, and communication is prioritized by the national organization for mathematics educators. However, because these literacy processes are not typical in mathematics classrooms, students' perceptions inform further investigation. There is much to be learned about these new roles and responsibilities for teachers and for students, and the authors intend for the ideas presented in this Problems Court paper to prompt further discussion.

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