

Writing “Voiced” Arguments About Science Topics

ANSWERING THE CCSS CALL FOR INTEGRATED LITERACY INSTRUCTION

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What happens when sixth graders write “voiced” arguments about a science-sleuth simulation? They push us to coordinate teaching strategies from disciplinary and content area literacy.

With the release of the Common Core State Standards (CCSS) and the attendant emphasis on an “integrated model of literacy” (National Governors Association Center for Best Practices [NGA Center] & Council of Chief State School Officers [CCSSO], 2010, p. 4), content area teachers will need support in meeting the challenge of providing robust instruction that incorporates reading, writing, listening, speaking, and viewing as vehicles for engaging students in their subject matter and building deep content knowledge (Conley, 2008). Content area teachers will also be charged with the responsibility of developing students’ proficiency in writing academic arguments across the curriculum. According to the CCSS website, “The ability to write logical arguments based on substantive claims, sound reasoning, and relevant evidence is a cornerstone of the



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writing standards” (For more information, see www.corestandards.org/about-the-standards/key-points-in-english-language-arts).

The challenge is thus twofold: to design instruction that integrates the English language arts and thereby advances student engagement with and command of content area material and to teach students about the general and disciplinary-specific practices of argumentation. Given that the CCSS emphasize literacy development as a “shared responsibility” (NGA Center & CCSSO, 2010), it will be necessary for language arts and content area teachers to coordinate instructional efforts so that students develop a facility with writing arguments in different subjects, as the practices for argumentation vary according to the particular expectations of each discipline (Hyland, 2008).

It will also be important for teachers to note that the standards for argument are largely silent on the issue of voice, except for the provision that writers “establish and maintain a formal style” (NGA Center & CCSSO, 2010, p. 42). Yet, what often makes arguments compelling is, in fact, voice: how writers come across as “confident” and “authoritative” (Hyland, 2008, p. 6).

Likewise, writers' credibility (i.e., how they project trustworthiness vis-à-vis sound reasoning, sufficient evidence, credible sources, and understanding of the subject—in effect, the CCSS writing standards for argument) is conveyed through voice (Toulmin, 1958). Teachers would do well to engage students in exploring voice in argumentative discourse and how voicing practices vary across disciplines.

Promoting voiced arguments can be a challenge, one that I attempted to meet as a sixth-grade teacher responsible for all subjects. The purpose of this article is to share the results of an action-research project that I undertook to evaluate my success in helping sixth graders produce voiced arguments about topics from our science curriculum (e.g., states of matter, physical and chemical changes, the water cycle). Specifically, I offer an account of my instructional approach, student writing samples, and a discussion of the potential benefits and limitations of this approach.

Background on the Study: Promoting Voiced Expository Writing

My motivation for developing this approach—a scientific inquiry based on an integrated model of literacy that included extensive opportunities for argumentative writing—grew from my commitment to supporting my students in meeting the standards for writing arguments. According to the CCSS (NGA Center & CCSSO, 2010), sixth graders must be able to

Write arguments to support claims with clear reasons and relevant evidence: (a) Introduce claim(s) and organize the reasons and evidence clearly; (b) Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text; (c) Use words, phrases, and clauses to clarify the relationships among claim(s) and reasons; (d) Establish and maintain a formal style; (e) Provide a concluding statement or section that follows from the argument presented. (p. 42)

In addition, my interest in developing an instructional program focused on voiced arguments

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grew from my mounting concern with students' attitudes toward expository writing and the painful admission that the research reports they produced lacked voice—conviction, commitment, and command of the subject matter. I created a survey to gauge students' perceptions of writing informational essays, and the results only intensified my commitment to forging an alternative approach. In the words of students: Writing an essay is like

- Getting beat up by a bully
- Going against a 12-foot wave
- Smelly cheese
- Piling up facts
- Writing a paragraph

These analogies revealed just how painful and perfunctory students found expository writing to be. For many, such writing was no more than a paragraph or a pile of facts. These descriptions troubled me more than the “smelly cheese” variety, because if students perceived informational writing in such finite terms, then their roles as authors would be equally limited to those of a paragraph maker and fact reporter. I wanted more for my students—I wanted them to inhabit their texts in terms that afforded agency, authority, and even power as essayists. In short, I hoped they might project different voices when writing.

And so began my campaign to raise students' voices and the teacher-research study that gave rise to the instructional approach described herein. From the outset of this classroom-based inquiry, however, I encountered a problem: how to define *voice* to teach students to write voiced essays about science content.

Hyland's (2008) work on “disciplinary voice” offers such a definition. Based on his review of 240 research articles from 10 leading journals in nine disciplines, Hyland concluded that “academic writing always has voice” (p. 6) to the extent that it conveys writers' self-representations and stances toward readers. Disciplinary voice is thus both individual and communal; the authors Hyland studied didn't “sacrifice personal voice” but instead made “choices” to “align” themselves with “one disciplinary community rather than another” (p. 6).

According to Hyland (2008), academic discourse in no way “eradicates personal choice,” because writers “still decide how aggressive, conciliatory, confident or self-effacing” (p. 6) they want to be. Writers make these decisions by determining the “level of authorized personality” (p. 7) that is sanctioned

within their discourse community. Although Hyland found that “writers in the humanities and social sciences take far more personal positions than those in the science and engineering fields” (p.13), he nonetheless asserts that “academic writing can’t not have voice” (p. 6).

Hyland (2008) thus dismantled the false dichotomy between personal and public voice, promulgated by the historical debate among composition theorists (Elbow, 1994), that had stymied my own writing instruction. I had struggled with this same tension: whether to promote student voice (Spandel, 2009) or to groom my students to appropriate the formal registers of academic discourse (Bartholomae, 1985). However, according to Hyland, this is a false choice, because disciplinary voice is ultimately a matter of writers “recognizing and making choices from the rhetorical options in their fields” so that they are able to “convey a persona and appeal to readers from within the boundaries of their disciplines” (p. 6).

Clark and Ivanič’s (1997) account of voice as “discoursal self” also explains how writers construct self-representations as they develop greater consciousness and control over the particular discourse practices that are invoked at the moment of writing. Within any discourse—literary or scientific—“prototypical identities” are available to writers who, in taking up the conventions of that discourse, also take up its attendant values, beliefs, and epistemologies. The selves that writers bring to the page ultimately depend on which discourses are available and, moreover, on the choices writers make from the options at hand. According to Clark and Ivanič, students’ voices—their possible textual identities—will remain limited, both if access to a range of discourses is denied and if those discoursal choices are made unconsciously.

The discourse that held the most promise of raising new and improved voices was argumentative writing, given that the CCSS privileges argumentation as *the* means by which authors exercise their agency and power as critical, independent thinkers. In this mode of writing, I reasoned, students would be more likely to project themselves as forceful thinkers and confident knowers. Having been greatly persuaded by Bakhtin’s (1981) and Kesler’s (2012) accounts of voice as “dialogic” (born in conversation with others), I also viewed argumentation itself as the most likely medium for voiced writing. Finally, by engaging students in a lively exchange of ideas through oral

and written arguments featuring science content, I was also able to redress the following shortcomings of previous instruction that had likely diminished students’ voices.

Up to this point, my approach to expository writing involved teaching students to write research reports on self-selected topics. This had the unfortunate consequence of setting students up to build knowledge about their individual topics independent of one another. Lacking any opportunity to engage in shared inquiry around a common topic, students did not benefit from the exchange of ideas that often deepens understanding. Not surprisingly, their reports suffered from superficial knowledge and treatment of topics that inevitably limited their voices as writers—their confidence and command of the material. What is more, this teaching approach privileged only one purpose of expository writing: to inform.

However, as Britton, Burgess, Martin, McLeod, and Rosen (1975) explained in their seminal work on “transactional” writing, expository texts serve several purposes—to instruct, inform, or persuade—and these purposes also shape the writer’s voice quite differently. Thus, by narrowly focusing my instruction on writing to inform, I had unwittingly limited my students’ voices.

Committed to expanding students’ access to a range of discourses and voice options, as Clark and Ivanič (1997) suggested, I developed a unit around the one purpose of expository writing I had overlooked: writing to persuade. Teaching my sixth graders about argumentative writing in conjunction with our shared investigation of science topics, I believed, would not only promote different voices than the research reports had, but would also engage students in a joint effort to build substantive content area knowledge by exchanging views on the topics under study.

A Description of My Instruction

With these aims in mind, I launched a 6-week voice unit wherein students played the roles of “science sleuths” and developed arguments to solve the following problem (which was dramatized in a video from a commercially available program): How can a company’s frozen drink weigh more than its liquid drink, even though the two products have exactly the same ingredients and volume? Over the course of the simulation, students developed three distinct theories

to explain the weight difference—frost on the bottle, cracks in the bottle, or a combination of both frost and cracks (“frocr”)—which they debated with their peers and subsequently wrote about.

A problem-based inquiry appealed to me for several reasons. Foremost, it was a motivating challenge for my students, who were determined to solve the mystery at hand. Students begged to see the episode during lunch and after school, and their level of engagement was compelling in itself. But more than that, I designed the unit to capitalize on the following principles of effective argument and integrated literacy instruction.

In his recent work on teaching argument, Hillocks (2011) claimed that “good arguments begin with looking at the data that is likely to become the evidence and which gives rise to a thesis statement or major claim” (p. xxi). The simulation, in effect, required students to begin with data that they would analyze and interpret, and in the process use as evidence, to support their eventual thesis about the likely cause of the weight difference.

Additionally, to reap the benefits of integrated literacy instruction, I built in opportunities for students to “manipulate” the science content by reading, writing, listening, speaking, and viewing related material (Chamberlain & Crane, 2009). First, we viewed the science-sleuth video multiple times, using various graphic organizers to help students focus their attention on critical features: the problem, likely causes of the problem, and how different characters explain the problem. During these successive viewings, students recorded information (e.g., data presented in the program, direct quotes from characters) in their science logs and prepared a range of quick-writes to clarify their evolving understanding of the problem and the content (Hohenshell & Hand, 2006).

Students also participated in a variety of discussion formats—think-pair-shares, small-group conversations with fellow and rival theorists, and whole-class debriefings. The writing served as a springboard for the discussion and helped students to be better prepared to take an active role in the exchange of ideas. Likewise, the discussion afforded students an oral rehearsal for their writing, allowing them to practice articulating their theory, presenting

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relevant supporting evidence, and addressing counterclaims (Adler & Rougle, 2005). Students also read about the topics under study and responded to the readings by writing, drawing, and discussing the featured scientific concepts.

While focusing on the science-sleuth program and integrating the English language arts to advance students’ content knowledge during science class, I also provided explicit instruction on argument during language arts. Consistent with Ray’s (1999) “inquiry” approach, I first immersed students in a range of “mentor” texts, so they could “notice and name” the defining features of argument.

During this immersion phase, I presented a series of lessons about the general model of argument outlined by Toulmin (1958) but invited my students to define each component in terms that made sense to them: claim (“taking a stand”); evidence (“how you support your theory with facts, quotes, and data”); counterclaim (“the other side”); and rebuttals (“shoot downs”). Because my primary aim was to address the CCSS writing standards for argument, I did not engage students in exploring what it means to write arguments like scientists. This, however, would be an important next step, particularly because Hyland (2008) found that of all the disciplines he investigated, engineering and science had the fewest markers of “textual voice”—expressions of writers’ “judgments, opinions, and commitments” (p. 7). I will address this limitation of my instructional approach when discussing the implications of this study.

Students also participated in a debate using notes they had recorded on a graphic organizer that included the components of argument identified above. The informal writing in preparation for the debate allowed students to map out their arguments, to consolidate their thinking, and to have a reference at hand to scaffold their participation in the discussion. During the debate, representatives from the frost, crack, and frocr theories each had the opportunity to deliver opening statements that laid out their claims and evidence. Then, each group addressed rival theorists’ counterclaims and presented rebuttals. After the debate, students did a reflective write, adding any new evidence, counterclaims, or rebuttals to their graphic organizer.

Finally, to support students in writing their arguments about the science-sleuth program, I demonstrated how to write introductory, supporting, and concluding paragraphs. Based on this model, we generated a rubric that listed requirements for

the essay: Theory, Reasons, Direct Evidence, Solid Defense, and Paragraphing. Students then composed their arguments independently, and I continued to provide individualized support through writing conferences.

Participants and Methods

This study is based on the work of 26 sixth graders—13 girls and 13 boys—who attended an upper elementary (grades 4–6) school in an affluent community of central New Jersey. There were 21 Caucasian students, two Asian American students, two Eastern Indian students, and one African American student. The class average on the California Achievement Test was at the 87 percentile (stanine 7), which indicates an “above average” profile of academic achievement.

Applying Strauss and Corbin’s (1998) grounded theory method of analysis, I coded all 26 essays to identify salient themes that suggested a theory of voiced writing grounded in the students’ work rather than based on a priori categories. Examining each student’s argumentative essay, I noted “patterned regularities” (Wolcott, 1994)—recurrent textual properties—that struck me as interesting, surprising, or significant expressions of voice.

I then analyzed 11 essays that stood out as “more clearly voiced” to discover any features across these texts that suggested possible dimensions of voiced writing. I focused on students’ word choice (e.g., how they described their own and others’ theories, reasons, and evidence); sentence construction (the subjects and verbs in their sentences, as well as how they used words, phrases, and clauses to show the relationship between their and others’ claims); tone (conciliatory or adversarial); register (formal or informal style); and point of view (first, second, or third person). By focusing on these textual properties, I was able to delineate the themes of voiced argument that consistently emerged within the 11 texts.

I then compared my findings from these 11 essays with the 15 others that I had rated as “less clearly voiced” to draw out any meaningful distinctions between the two text sets. When certain voice themes emerged in the more voiced essays only, I assumed that they were definitive indicators of voice. I also used themes that appeared in both sets of essays to qualify any claims about voiced writing that were based on my initial analysis of the 11 more voiced texts.

When presenting the findings of this study in the next section, I will identify student work samples

by gender to illustrate the nearly equal distribution of male (six) and female (five) authors of the more voiced essays.

Findings

Based on my analysis of the 26 essays, I discovered three main themes that the more clearly voiced texts had in common: (1) I-ness, (2) relationship with rivals, and (3) relationship with content knowledge. Specifically, the writers’ I-ness (or presence in their texts as authors of ideas taking responsibility for their claims and openly implicating themselves as sources of knowledge) was born in a nexus of relationships, in concert with and in conflict with a number of conversational or “dialogic” partners.

First Theme: I-ness

The first voice property to surface in the 11 more clearly voiced texts was the students’ use of “I-statements”—first-person references—to establish themselves as the agents of the actions within their texts. The following examples from three students’ essays illustrate this trend: (1) “I have challenged this theory by recognizing its flaws”; (2) “I have proved that the crack theory could not work, not once but twice”; (3) “There is one point that the crack theorists made on their behalf that I would like to contradict.”

Students adopted the first-person point of view and, with it, the respective roles of proving, challenging, and contradicting. By using active rather than passive verbs, these students made their positions as authors clear, and, consistent with Clark and Ivanič’s (1997) description of “authorial presence” (p. 152), they also assumed full responsibility for the assertions they delivered within each clause. I-ness, as manifested in the students’ subject and verb choices, meant that they had produced voiced essays by positing a “self as author” with “something worth saying” (p. 152). With these reporting verbs, the authors also made “their commitment to [their] own the ideas” known (Clark & Ivanič, 1997, p. 134). They didn’t equivocate or maintain a neutral stance in their texts. Instead, they took a side and even rallied against other theories.

As one I-statement after another made clear, these essayists achieved a far wider range of authorship than did their counterparts. They authored by “coming up with” theories, “discovering problems,” “seeking answers,” and “finding” solutions. Their visibility as authors—as the sources of ideas, data, and

conclusions—far exceeded those of the less voiced texts. Through sentence construction, verb choices, and point of view, my sixth graders had established I-ness: creating a space for themselves inside their texts and insinuating themselves as authorities on the issue at hand.

Second Theme: Relationship With Rivals

In one voiced essay after another, students used vivid adjectives to describe their own theories (e.g., “undoubtedly superior”) and those of others (e.g., “totally pathetic”). They also chose colorful nouns, referring to some theorists as “leaders” and to others as “total failures.” Finally, these students made dramatic verb choices, describing how they “completely destroyed” and even “disintegrated” rivals’ claims.

Interestingly, several authors of the more clearly voiced essays used the expression “competing theories” when referring to the frost and crack theories. These linguistic patterns that expressed opposition were noteworthy because, within qualitative research, it is important to represent the data in the terms offered by the respondents (Merriam, 1998). As defined by my sixth graders, the second voice dimension was the “language of competition.” Because this label emerged from the essays, and specifically from the students’ adjectives, nouns, verbs, and tone—all of which implied a contest of some sort—the expression seemed “best fitted to the data” (Merriam, 1998, p. 183) in the early phase of my analysis.

These combative terms and adversarial tone were hard to ignore; I had never seen students use such contentious language in expository writing. Nowhere was this type of language more evident than in their disparaging remarks about rival theorists. In fact, every one of the 11 essays included some kind of derogatory comment. According to a student who wrote an especially voiced essay, the crack theory was “unequivocally weak.” In another voiced essay, the author asked, “Is the solution the insufficient crack theory which only the minority desperately and weakly try to defend?”

Moreover, one student valorized his theory by proclaiming that it showed “more complex reasoning, a finer understanding to what occurred and, of

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course, a plentiful amount of evidence.” With these remarks, the student not only glorified his theory, but he also promoted himself as one capable of such advanced thinking. Another student fashioned her theory, and herself, in equally flattering terms, remarking: “The frost theory is comparatively flawless.” The words *more*, *finer*, and *comparatively* clearly established a relationship between competing theories.

These language patterns that defined one theory in terms of the other indicated that many students had used their relationship with other theories to extol the virtues of their own. Upon closer analysis, it was clear that students had *relied* on the competition to embolden their claims to knowledge and to promote their theories and themselves as the authors of those theories. It is commonplace within qualitative research to draw connections between existing categories and, in the process, to develop such “links” into a workable theory that both describes and interprets the available data (Hamersley & Atkinson, 1983). I determined that such a connection existed between the categories “I-ness” and “language of competition”: Students had forged their I-ness out of the competition itself, fortifying their authorial presence by standing in opposition to other theorists.

Thus, it appeared that I-ness depended on, and was only fully realized in, the students’ adversarial relationships with other theorists. I therefore renamed the second dimension of voice “relationship with rivals,” which described the actual functions of students’ language patterns and, in effect, made clear the link between this category of voiced writing and I-ness.

Third Theme: Relationship With Content Knowledge

“Relationship with content knowledge,” the final category of voiced writing to surface in the data, refers to students’ manner of relating to the science-sleuth subject matter and to classmates’ treatment of that material. The authors of the more clearly voiced essays made the most of their peers’ insights to advance their own understandings. They fully participated in the rich dialogue of claims and counterclaims *within their essays* by interacting with others (both fellow and opposing theorists), thereby producing texts that exhibited a dialogic relationship with the science content knowledge.

As the following two examples illustrate, these authors acknowledged the content problems that were established in the debate (e.g., cracks in the bottle caused the weight loss and the cracks were “microscopic”), and by doing so, stepped beyond what Bereiter and Scardamalia (1987) called mere knowledge telling when composing their texts. Both students not only addressed these controversial points but also used the microscopic cracks idea—an obvious challenge to and potential setback for the frost theory—to formulate new lines of argument:

There is one point that the Crack theorists made on their behalf that I would like to contradict. They had claimed that the crack was actually microscopic which explains why it couldn't be seen by the naked eye. If the crack were microscopic, there would be an incredibly slim chance that one whole tenth of a gram would evaporate out in only two hours. Two prove this, I have a past experience related to this. Every summer, I would bring a frozen bottle to camp everyday that I placed in the freezer the night before. I remember that even during the heat wave, it would be three to four hours before all the water melts. (Author #1, boy)

Even if there was a crack, which there wasn't, it would be noticed by the perceptive Kate (Quality Control Expert), because of all her detailed examination of everything that passes through her territory. As N., a representative of the Crack theory retaliated, “the crack is microscopic, so you need a microscope to see it.” But how could this be? A microscopic crack would not let out any K! Zing!! (Author #2, girl)

This content problem—the existence of microscopic cracks—created a constraint for the writers, whose new goal was to concede the crack theorists' point and yet still refute the crack theory itself. To accomplish this goal, the writers generated ideas that would expose potential problems with both the overall crack theory and the microscopic crack premise, in particular.

For example, in addressing the crack theory, author #2 coordinated several ideas: that Kate was perceptive; that as the quality control expert, Kate would have detected cracks; and that the size of the crack would limit the amount of leakage. Author #1 also applied a relevant past experience to galvanize his thinking on the issue. Not losing sight of his rhetorical goal, the author transferred concepts from the program (e.g., states of matter) to an experience

at summer camp, thereby reorganizing his knowledge of the issue to resolve the microscopic crack problem.

In a manner consistent with Bereiter and Scardamalia's (1987) knowledge-transforming model, both students addressed the challenges posed by the crack theorists and coordinated several ideas: (1) states of matter; (2) time frames for changes in states of matter; (3) quantities of matter that would evaporate through microscopic cracks within a given time period; and, (4) program characters' attributes and behaviors. Because the two writers had a particular goal in mind, they drew new connections between existing ideas and revamped their knowledge accordingly. Thus, what was initially a content problem became a rhetorical constraint, which in turn impelled the writers to adjust their thinking on the matter.

As the two passages show, the authors of the more clearly voiced arguments exhibited a more active and interactive relationship to the subject matter. They addressed content problems from the debate, used different frames of reference (e.g., personal experience and direct observation of video characters) to make sense of those problems, and integrated several ideas to make their case. By performing a robust mediation of the available information, these writers established their I-ness as sources of knowledge.

Closing Thoughts

The science-sleuth unit is an apt illustration of integrated literacy instruction that builds content area knowledge and promotes voiced argumentative writing about science topics. Given the three voice themes that surfaced in my students' essays—I-ness, relationship with rivals, and relationship with content knowledge—I am tempted to valorize my instructional approach. Seeing these spirited and forceful self-representations spring from the page convinced me that argumentative discourse is a powerful medium, especially for adolescents intimidated by expository writing.

However, it is clear to me that my students didn't simply draw on this discourse and its respective practices, values, and epistemologies. In appropriating argumentative writing in terms that made sense to *them*, my students transformed the discourse itself and forged their own 12-year-old version of a scientific community. As members of this community, they developed ways of relating to the subject matter and

to one another—in effect, creating their own norms for disciplinary voice.

Although my sixth graders' voicing practices may have suited the competitive field that emerged in our classroom, their arguments were well outside the disciplinary boundaries of scientific writing (Hyland, 2008). Their strident I-ness would certainly not be welcomed, let alone valued, by the scientific community. Such rhetorical bravado and aggressively self-referential voices would only undermine their persuasiveness within the field of science (Hyland, 2008). And, as Penrose and Fennell (1992) reported in their study of scientific prose, "experts" do not express "agency," nor do they write statements about "proving" a "theory," as my sixth graders had (p. 5). In short, students' adolescent versions of disciplinary voice violated the conventions of scientific discourse.

By the same token, as Kesler (2012) explained, my sixth graders forged their voices not on their own but through the discourse community that had come to life in our classroom over the course of the simulation. When addressing potential rivals and allies, students adopted a range of voices, and although not entirely agreeable, likeable, or appropriate for scientific discourse, these personae did serve to heighten their authorial presence in their texts.

The voicing process, as performed by students, involved competition and no small measure of intellectual aggression. In fact, what set the especially voiced essays apart was the authors' willingness to work through others' ideas to advance their own. In line with Bakhtin's (1981) description of dialogism, students appropriated others' understandings to extend their own knowledge. Voice, then, is not so much a *property* of writers or of texts, but a *process* of "knowing together": a collaborative, though hardly congenial, exercise of establishing one's authority as a meaning maker by talking with, against, and through other voices.

Yet I have to confess my own discomfort with the intellectual tradition that this particular account of voiced writing invokes. Although students brought different selves to the page, their textual identities were bald exaggerations of Western epistemologies: competitive, combative, and self-promoting (Tannen, 2000). As much as I believe in the potential value

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my instructional approach, I am nonetheless uneasy about promoting an intellectual tradition that pits one knower against and above others (Tannen, 2000).

As teachers address the CCSS argumentative writing standards, it will be important to consider the terms for *voice* that are consciously and unconsciously built into their curriculum. When teaching argument, the challenge will be to foster spirited engagement without naturalizing "ceremonial combat" and leading students to think that the only way to "demonstrate their intellectual prowess is to criticize, find fault, and attack" (Tannen, 2000, p. B7). Helping students write with authority, conviction, and commitment to their claims requires teachers to be vigilant about the discourse practices and intellectual traditions they unwittingly privilege in their instruction.

It is for this reason that language arts and content area teachers will need to coordinate instruction to ensure that students understand both general and discipline-appropriate models of argument. As a self-contained teacher, I did not have the benefit of collaborating with science teachers, an obvious limitation of my study. Because I encouraged my students to fashion their own 12-year-old version of a scientific community and to express agency in terms that made sense to them, they did not learn what it means to write arguments like scientists and therefore failed to produce discourse that would be recognized as convincing within the science field.

To avoid this outcome, language arts and content area teachers need to join efforts, first by developing a collection of mentor texts from a range of scientific publications for popular and academic audiences alike. They would then mine these texts, determining how different authors established their credibility and conviction while observing the boundaries of the discipline. Working together to identify the voicing practices of disciplinary insiders, language arts and content area teachers would be better equipped to demystify the conventions of scientific writing for their students.

For example, they could help students realize that although first-person point of view and active voice are increasingly recognized as acceptable voicing options in scientific writing, authors in this field tend to "downplay" their "personal role in the research," as well as their "individual authority," opting instead to let the "facts speak for themselves" (Hyland, 2008, p. 15). Likewise, teachers could show students that

what makes scientific discourse convincing is not an “intrusive or personal style,” but “objectivity of [the writer’s] interpretations” (p. 17). Teachers could also make students aware of the different ways that

Take Action

STEPS FOR IMMEDIATE IMPLEMENTATION

- ✓ Engage students in solving a problem-based simulation or case that presents a data set that students must analyze to formulate a claim. The data then become the evidence they marshal to support their claim. (See “More to Explore” for simulation resources.)
- ✓ Encourage collaboration and role-playing, in which students keep case report journals, meet with allies and opponents, and formally debate so that they perform the production strategies of argumentation.
- ✓ Teach students about the elements of an argument (drawing on Toulmin, 1958): claim, evidence, warrants, counterclaims, rebuttals, logos, ethos, pathos, etc.
- ✓ Immerse students in an ongoing study of opinion/argumentative “mentor texts” so that they can see how writers of opinion/argumentative texts advance and substantiate claims as well as address counterclaims and present rebuttals. This study of mentor texts helps students understand the defining characteristics of the genre and appreciate how different writers approach the genre.
- ✓ Guide students in developing a working definition of *voice* based on the text exemplars. Explore how writers establish ethos (credibility or character/persona of the writer) and write with authority, conviction, and confidence without going overboard. Pose questions such as: What makes this writer convincing, trustworthy, credible? What character or persona will be most effective in serving your purpose and your audience? What tone (serious, earnest, sarcastic, funny, dispassionate) is best suited for the intended audience?
- ✓ To help students appreciate other ways to “voice” or position themselves in their opinion pieces, present Carl R. Roger’s framework for argument that emphasizes building common ground, validating opposing views, and developing rational (rather than emotionally charged and antagonistic) arguments.

science writers compose statements of proof (Penrose & Fennell, 1992).

After this study of mentor texts, language arts and content area teachers could then engage students in developing guidelines for revising their general arguments to more closely approximate a scientific disciplinary voice. Coordinated efforts of this sort allow students to reap the benefits of instruction featuring a “blend of practices from both disciplinary and content-area literacy approaches” (Brozo, Moorman, Meyer, & Stewart, 2013, p. 353). To be sure, my students were well served by generic content area strategies; they developed deep knowledge of the science content by reading, writing, listening, speaking, and viewing the material under study and by applying general models of argumentation to deepen their engagement with and understanding of the science topics.

By the same token, the necessary next step of studying science mentor texts, identifying the voicing practices of disciplinary insiders, and revising their arguments accordingly would also afford students the opportunity to produce more “discipline-appropriate” writing (Brozo et al., p. 354). The challenge that remains for all teachers is finding that balance of general and discipline-specific literacy approaches that suits the developmental and instructional needs of students as well as the content demands of a given course of study.

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CONNECTED CONTENT-BASED RESOURCES

BOOKS

- Caine, K. (2008). *Writing to persuade: Minilessons to help students plan, draft, and revise*. Portsmouth, NH: Heinemann.
- Lunsford, A.A., Rusczkiewicz, J.L., & Walters, K. (2007). *Everything's an argument* (4th ed.). Boston: Bedford St. Martin's.
- Smagorinsky, P., Johannessen, L.R., Kahn, E.A., & McCann, T.M. (2011). *Teaching students to write argument*. Portsmouth, NH: Heinemann.

VIDEOS

- *Science Sleuths*, a series of interactive videos
- *History Alive* offers simulations for social studies

ONLINE RESOURCE

- *PhET Interactive Simulations* offers simulations for science and mathematics topics: phet.colorado.edu/en/simulations/category/by-level/middle-school