

A Social Semiotics Framework for Conceptualizing Content Area Literacies

Considering how conceptions and uses of text vary across disciplines can lead teachers to more responsive literacy instruction and students to deeper understanding of subject matter.

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Regardless of decades of oft-repeated calls for secondary teachers to support their students' reading and writing in each discipline (e.g., Herber, 1978), literacy instruction remains difficult to integrate into the daily practices of content area teachers (Hall, 2005). There are many reasons why explicit literacy instruction is often absent from content area lessons: Teachers in different disciplines may not believe it is their responsibility to teach reading and writing (O'Brien & Stewart, 1990), and even those who believe it is their responsibility may not feel adequately trained to provide it (Yore, 1991) in ways that meet the needs and build on the interests of individual students in specific communities (Conley, Kerner, & Reynolds, 2005). Moreover, some educational contexts can discourage approaches to reading that emphasize actively questioning texts rather than passively accepting them as repositories of information (O'Brien, Stewart, & Moje, 1995).

Integrating content area literacy instruction in schools is therefore a multifaceted challenge, requiring attention to teacher beliefs and teacher change, to the characteristics of effective teacher education, and to the identities and backgrounds of specific adolescents living in specific educational and societal contexts. The intention of this article, however, is to respond to another principal reason why content area literacy instruction has failed to take root in many secondary classrooms: It is often characterized by generic recommendations that do not account for discipline-specific frameworks for reading and writing texts with discipline-specific characteristics (Moje, 2008).

Accordingly, this article addresses how uses and conceptions of text may vary from discipline to discipline and how the reading and writing done therein may consequently differ. An understanding of these differences not only may lead to more responsive literacy instruction within each content area, but it also may help teachers to support adolescents in thinking meta-discursively about discipline-specific characteristics of texts as they read and design texts across multiple content areas. This type of content area literacy instruction would move beyond descriptions of general strategies for reading and writing individual texts (e.g., Block & Pressley, 2002; Emig, 1971),

instead encouraging students to develop overarching frameworks for thinking about how the forms and uses of texts vary from discipline to discipline.

Conceptualizing Content Area Teaching From a Social Semiotics Perspective

English language arts, mathematics, science, and social studies are examples of distinguishable communities of practice, each with its own history of solving particular sets of problems in particular ways according to particular epistemologies (Siskin, 1994). According to theories of social semiotics (Halliday, 1978; Hodge & Kress, 1988), a field of study that addresses how messages are used and exchanged within social groups, academic disciplines are continuously re-created in and through a variety of texts.

A text can be any instance of communication that is used to convey meaning—such as a mineral that students examine to ascertain its properties, a map that students search to locate trading routes, and the written and spoken words that serve as instructions to perform discipline-specific tasks on these texts—all of which instantiate what it means to “do earth science” or “do history” (for instance) at a given point in time.

Teachers’ enacted lessons, from opening to closing bell, are themselves larger texts that combine various resources to direct students’ constructions of meaning. When the content areas are viewed through this theoretical lens, teaching becomes an act of text designing (New London Group, 1996) as teachers draw from the available designs within their disciplinary contexts to create newly designed texts. Available designs include different modes, or socially fashioned resources for making meaning, such as images, spoken words, gestures, and three-dimensional models. Each mode is characterized by a distinctive set of affordances, or potential uses to which it lends itself (Gibson, 1979).

According to a social semiotics framework, content area teachers select available designs on the basis of how those designs afford the expression of discipline-specific content and enable their students to reach discipline-specific goals. For instance, to teach about the digestive system, a biology teacher may use spoken words to accompany hand gestures over a three-dimensional model of different organs. The model conveys the shape and spatial position of various

organs, and the gestures convey the movement of food, both of which are central to an understanding of how the digestive system works. In this case, written words alone may not hold the same affordances in explaining the digestive system as other combinations of modes.

Classroom texts do not simply represent objects or phenomena in the world and people’s experiences of them, however (Halliday, 1978). Although texts indeed fulfill this ideational or referential function of language by indicating the content of a discipline, each text also fulfills the interpersonal function of language through instantiating people’s social positions in relation to one another.

For instance, mathematical worksheets may seem impersonal and objective because of the absence of first-person pronouns (O’Halloran, 2005), whereas protagonists in young adult novels may be positioned as approachable, fallible, and similar to young readers (Stephens, 2007). Through the interpersonal function of communication, students and teachers express different social positions in relation to each other and to their disciplines as they constantly exchange, encounter, combine, and design texts.

Understanding Disciplinary Literature Through a Social Semiotic Lens

This section outlines how disciplines are often instantiated in distinct ways through the stream of texts that constitute them. Although each individual teacher may enact her or his discipline in idiosyncratic ways, and although disciplinary practices may overlap, this broad outline nonetheless is intended to speculate on how disciplines remain distinguishable from one another because of the types of texts and approaches to texts that are oftentimes found therein.

English Language Arts

The teaching of language arts derives from different traditions of what it means to “do English.” In one tradition, instruction in English is strongly associated with instruction in grammar; indeed, according to Applebee (1974), instruction in grammar was the first widespread tradition to become a part of English curricula. With principles imported from the study of Latin and Greek, instruction in this tradition

emphasizes the correction of errors in writing, the parsing of sentences, and the identification of various parts of speech and functions of words in sentences. Under this tradition, common texts may be stand-alone sentences that students read with the intention of underlining and annotating words.

In contrast to approaches to English that underscore the formal components of language, concurrent traditions of reading for aesthetic pleasure and writing for personal expression have also been central goals for past and current English curricula (Applebee, 1974). To this end, literature remains a central province of English instruction. Definitions of literature have long been contested, but they often include poetry, drama, and short or extended narratives of characters' lives designed to enable readers to sympathize with individual characters.

As technology continues to evolve, the dual goals of reading for enjoyment and writing for expression now include the interpretation and composition of informational and multimedia texts as a proper province for English instruction (International Reading Association & National Council of Teachers of English, 1996). Like printed texts, many multimedia texts also explicitly acknowledge the presence of their authors. Videos on YouTube, MySpace pages, blogs, and virtual worlds such as Second Life can celebrate individual authorship as people seek to distinguish their avatars, pages, videos, style, and point of view from others (Knobel & Lankshear, 2006).

English is a distinctive discipline, not only in the forms of texts used therein but also in approaches to reading these texts. In many classrooms, divergent understandings of texts are allowed and even encouraged as students construct multiple interpretations and opinions shaped by their personal life experiences (Rosenblatt, 1995). Another accepted approach to reading in this discipline entails attending to a text's form and structure, including the literary techniques used therein, rather than exclusively focusing on the content of the text itself (Squire, 2003). For example, a reading of poetry may focus on simile, metaphor, alliteration, and tone to the same extent that it focuses on the interpretations that students derive from the poem, such as what it means to "wander lonely as a cloud."

The discipline of English is not exclusively focused on the content of texts in another way: Teachers may place equal emphases on processes that students use as they read and design these texts (Squire, 2003). Thus, explicit instruction on comprehension strategies (such as visualizing or summarizing) or on writing processes (such as outlining and editing) are also considered as a central domain of this discipline as students become proficient with the language arts strands of reading, speaking, listening, viewing, and writing. Although all content areas would ideally include attention to the *how* of reading and writing texts, rather than solely attending to the *what* of the content, in many schools English language arts remains the designated province for students to learn about processes behind reading and designing a variety of texts (Hall, 2005).

In English, just as individual authorship is often permitted and acknowledged—even celebrated and considered an important object of study—in the texts that students read, so, too, is individual authorship rewarded in the texts that students write. A primary purpose of this discipline has been to teach each student "to give expression to thoughts of his [*sic*] own" (the Committee of Ten, as quoted in Applebee, 1974, p. 33).

This emphasis on *individual* thoughts, rather than on shared historical contexts and group affiliations as in disciplines of history (Wineburg, 1991), and this emphasis on individual *thoughts*, rather than on observable outcomes related to objective physical phenomena as in disciplines of science (Bazerman, 1988), are two characteristics that distinguish English as seeming "more personal than [other subjects]" (Siskin, 1994, p. 154; cf. Elbow, 1990), a characteristic that is instantiated in and through the texts that students read and write. In terms of the ideational function of language, therefore, the discipline of English often emphasizes individual thoughts and the processes by which these thoughts can be most effectively under-

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stood, shaped, and expressed using specific devices and techniques.

Mathematics

Unlike other subjects which depend heavily on written words as key purveyors of content, a primary semiotic system used in mathematics is numeric and symbolic (O'Halloran, 2005). In mathematics, students use numbers and symbols as they collect and analyze data to answer questions, display data to share their answers with others, explain spatial relationships, detect and encode patterns, apply strategies to solve problems, and develop proofs (National Council of Teachers of Mathematics, 2000).

To be sure, numbers and symbols interact with other sign systems that are also indispensable to an understanding of mathematics. Spoken explanations mediate students' comprehension of numbers and symbols, and gestures (e.g., pointing to a line of a mathematical proof on the board) ensure that all people are talking about the same mathematical object (Sfard, 2009). Graphs and other visual displays are used to illustrate quantities and relations between numbers, and sketches and physical objects (e.g., a whole pizza divided into parts) can serve to concretize concepts such as operations with fractions (Danesi, 2008). Words such as *prove* and *solve* are common in word problems, instructions, scenarios, and commands.

Nonetheless, in mathematics, numbers and symbols hold a privileged and central position because they are a principal, if not exclusive, means through which mathematicians solve many of their problems (O'Halloran, 2005), an assertion confirmed by Shanahan and Shanahan (2008a), who found that mathematicians believed written explanations were ancillary to numeric and symbolic formulae and proofs in a text. In the popularly used system of Arabic numerals (e.g., 0, 1, 2, 3), numbers and symbols allow for the solving of problems through the alignment of base-10 place values, an affordance not offered by other forms of representation such as images, gestures, or words.

The extensive use of this sign system holds several implications for the nature of texts in this content area. First, in terms of the interpersonal function

of language, students are often placed in the role of obeying implicit commands whose author is seemingly nonexistent (Rotman, 2000). For instance, students who see the problem $60.5 \div 5$ are implicitly being asked to solve or divide. These linguistic commands are not necessary because they are assumed within the numeric and symbolic problem. Common representations in mathematics, then, place students in a compliant role as they respond to the anonymous command to perform an operation or solve a particular problem. Maps, poems, cells, diagrams, photographs, narratives, and other popular texts in different content areas do not carry the same implicit commands.

The supremacy of the numeric and symbolic sign system holds a second significant consequence for texts in mathematics as well: It depicts the represented world as objective and precise. In writing of the affordances of numbers, Lemke (1998) asserted that numbers convey matters of degree, or topological meanings, more aptly and exactly than words, which are better suited to classify the world into matters of kind, or typological meanings. Words such as *large*, *hot*, *less*, and *some* convey the world subjectively in comparison with unknown standards, whereas numbers and units of measurement indicate agreed-upon, standardized quantities (e.g., 3 milliliters).

Although units of measurement, such as kilograms and centimeters, are common in both mathematics and science, in the former discipline they can also be unnecessary. In science, in which the object of study is the physical world, numbers are connected to discernible phenomena: 22 degrees Celsius, 22 micrograms, 22 chromosomes, and 22 moons all mean something different as scientists seek to describe, explain, predict, and manipulate phenomena in the universe. In terms of the ideational function of language, then, scientific texts often include observable referents. In contrast, 22 in mathematics may not be attached to an observable external referent in the physical world (Rotman, 2000), as in the case of $22x = 44$, a text that is coherent as a stand-alone text in this content area.

Just as texts in mathematics are semiotically distinct, approaches to reading and writing these texts are distinct as well. For example, mathematicians have determined that a text such as $(5 + 2 \div 0.5)^2 - 2 \cdot 5$

should be read by completing operations in parentheses first, by multiplying or dividing before adding or subtracting, and by attending to the placement of a “dot” because a fraction of an inch can determine whether it indicates a decimal or a multiplication sign.

In numeric and symbolic texts, each mark bears significant informational weight, each symbol is understood according to a strict set of conventions, and each problem often has one correct answer (although there are often multiple ways to find that answer). Writing numeric and symbolic problems also requires precision, as students must attend to each mark, letter, and number, as well as to their spatial placement and order, as they attempt to correctly perform specific algorithms.

Science

Branches of science commonly required of students in school include earth science, biology, chemistry, and physical science. Although these courses each entail the study of different phenomena, they are united in their goals to teach scientific methods and habits of mind, including systematic inquiry into problems (American Association for the Advancement of Science, 1993). These habits of mind are developed and demonstrated as students describe, explain, and predict natural phenomena, and as they use their knowledge of science to evaluate others’ arguments or to form their own arguments to effect change in their environments (Roth & Barton, 2004).

As students are inquiring, reading, writing, and acting scientifically, one common feature across domains of science is attention to the physical universe, including the human body, planets, landscapes, atoms, and more. Moreover, scientists often emphasize these objects of study themselves, rather than emphasizing the people studying the object. According to Bazerman (1988), the factual statements in many scientific texts, coupled with a relative lack of words that refer to the author, lead to the misconception that “To write science is commonly thought not to write at all, just simply to record the natural facts” (p. 14). Bazerman further noted that even when scientists indicate their presence through the use of first-person pronouns and verbs that indicate their actions, “The object [of study] is taken as given, independent of perception and knowing; all the human action is only in

the process of coming to know the object” (p. 31).

Another commonality unites the various branches of sciences: Scientists and science teachers regularly integrate a wide variety of sign systems that are indispensable to the construction and communication of meaning (Alvermann & Wilson, in press; Lemke, 1998). Because science addresses issues related to the physical universe, and because the relative spatial arrangement and physical characteristics of these phenomena are often vital to an understanding of them, science is particularly dependent on the use of a variety of visual displays (Pauwels, 2006).

For example, videos and gestures enable students to visualize movement (e.g., seafloor spreading), while models and diagrams omit extraneous visual information to focus on salient objects that may be too large or small to photograph (e.g., the solar system). As part of coming to know the physical universe, branches of science are also characterized by a long history of using a variety of equipment (Rosenthal & Bybee, 1987)—such as microscopes, graduated cylinders, and thermometers—themselves texts that are read in the service of understanding the focal text (e.g., cells) that students are reading.

In sum, texts in science are distinctive for several reasons. First, in terms of the ideational function of language, much of scientific representation emphasizes tangible objects. Scientific representations may refer to invisible processes or laws that have consequences for these objects, refer to the process of coming to know these objects, or refer to the objects themselves. This disciplinary emphasis on physical phenomena leads science teachers to employ many (more or less) iconic representations, or signs that bear a physical semblance to the represented object (Peirce, 1991), to convey their content.

Social Studies

Social studies encompasses the subdisciplines of anthropology, geography, economics, political science,

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and history, each of which entails distinctive frameworks for studying human life in the past and present (Wilson & Wineburg, 1988). Regardless of the branch of social studies that is taught, a majority of instructional time in social studies is textbook based (Levstik, 2008). In history, the most commonly taught branch of social studies in secondary U.S. schools (Levstik, 2008), students may also read primary-source documents that require an understanding of specialist technical vocabularies or archaic language.

Despite the prevalence of written texts in social studies classrooms, photographs, maps, videos, music, monuments, and other man-made cultural artifacts also fall under the domain of social studies as appropriate items for analysis and discussion (e.g., Wineburg, 2000). Shanahan and Shanahan (2008a) noted, however, that nonprint texts were often considered ancillary or supplementary to historians as they read, unlike scientists who considered visual texts to be key purveyors of content.

One commonly stated aim of history curricula has been to develop a shared sense of national identity and to prepare students for citizenship (National Council for the Social Studies, 1997). Another more recent approach to this discipline has been to reject master narratives that indicate shared identities, and to instead emphasize individual or group differences by attending to the particular vantage points and experiences that inform the creation of any text (Lévesque, 2008). Both of these aims of history address issues of individual, group, or national identity—whether shared or disparate.

Along with addressing issues of identity and citizenship, history also may be organized around central themes such as cause and effect or change and continuity over time (Brophy, 1996; Timmins, Vernon, & Kinealy, 2005). Although some historians view their discipline in terms of these overarching historical themes, other historians view it in terms of a set of historiography skills, including locating and

evaluating a variety of primary and secondary sources and using them as evidence to support interpretations (Lévesque, 2008). Unlike science and mathematics, whose goals are often to develop theorems or rules that can hold true across multiple contexts, most findings in history are permeated in particulars and are not expected to be generalizable to populations in all regions and time periods (Brophy, 1996).

These characteristics of history have consequences for how students are expected to relate to texts within this discipline. Because history is steeped in particulars, and because it addresses issues of personal or group identity, one aim of historical reading is to read empathetically, with the understanding that another's viewpoint may be shaped by affiliations and experiences different from one's own (Timmins et al., 2005).

The discipline's time-specific, context-specific conception of texts requires that students complement their empathetic reading with a critical one as they recognize the self-interested vantage point from which the author is writing and as they seek to corroborate sources or to understand the same event from multiple perspectives. In short, reading in history is concerned with issues of sourcing and contextualization (Shanahan & Shanahan, 2008b; Wineburg, 1991), as students ask questions about the historical context in which the text was written, about the personal and group affiliations of the author, and about the perspectives that are absent from the text.

As with all of the other disciplines, representation in history is in some ways unique. In terms of the ideational function of language, as in science, historical representations may refer to observable events or phenomena, such as the inauguration of U.S. President Calvin Coolidge, but they may also place an equal emphasis on intangible themes, such as power, governance, change, or people's thoughts about this event. In terms of the interpersonal function of language, students are encouraged to recognize that historical texts indeed have visible, subjective authors who write from particular positions that should be considered in the reading of the text.

This approach to reading may seem consonant with approaches for reading texts in English, leading to assumptions that the two content areas are compatible in terms of a humanities approach to reading that

characterizes both disciplines (Wineburg & Grossman, 2000). Although reading in history and English may seem similar, Wineburg and Grossman (2000) noted that acceptable approaches to reading texts in English need not (but may) attend to the group affiliations of the author and the historical or geographic contexts in which the text was written, whereas reading in history is frequently characterized by attending to these issues.

Implications for Content Area Literacy Instruction

This outline of discipline-specific characteristics is not intended to suggest that discipline-specific texts and the practices surrounding them are immutable or reified. On the contrary, as disciplines sustain contact with one another, hybrid literacy practices may emerge as teachers encounter a wider repertoire of available designs from which they can draw. Nonetheless, this outline is based on the assumption that disciplines remain distinguishable from one another. This outline, therefore, is intended as a provisional heuristic for thinking about how conceptions of literacy may differ from discipline to discipline with consequent implications for students' reading and writing instruction.

Implication One

Disciplinary reading instruction can entail more than comprehension strategy instruction; it can also entail encouraging students to take a broad view of the uses and forms of texts in each discipline.

Comprehension instruction has often been conceived as teaching students how to understand individual texts through applying general cognitive strategies such as summarizing, an approach that has been questioned by others (e.g., Conley, 2008; Moje, 2008) who believe that more discipline-specific, context-specific approaches may be required to equip students to communicate and to act powerfully across diverse and complex domains.

A social semiotics perspective of the disciplines also calls into question the idea that generic comprehension strategies sufficiently equip students to be literate in each content area; instead, this perspective implies that comprehension strategies alone may

not lead students to recognize how and why forms of texts, reading, or writing differ according to sets of discipline-specific practices and goals.

This perspective, therefore, calls for strategy instruction to be complemented with a different kind of literacy instruction, one that supports students in developing overarching metadiscursive frameworks for articulating how and why the purposes, uses, and forms of texts vary from one content area to another. As teachers reflect on how they can provide explicit instruction on the distinctive qualities of representation in their respective disciplines, they can move toward helping their students develop these frameworks for understanding the often implicit norms that underlie disciplinary literacy practices.

Implication Two

When definitions of text are expanded beyond printed words, reading and writing instruction includes explicit attention to the characteristics of multimodal representations.

Texts across the content areas are diverse: Numbers and symbols, the natural world, measuring instruments, gestures, written words, and boundless combinations of these texts will be found to varying extents in different disciplines. The concept of affordances is central to literacy instruction when definitions of text allow for these multiple modes (Wilson, 2008). This concept provides students with a metalanguage for reflecting on the relative semiotic power of representations, which are often selected and used based upon the degree to which they afford the expression of discipline-specific content or enable users to reach discipline-specific goals.

As students read and write texts while attending to their affordances, they can use the concept of affordances to identify why some modes are apt (or inept) conveyors of discipline-specific content, and they can themselves reflectively design representations that most fully enable them to convey desired meanings. Conversely, students can develop a metalanguage for articulating the ways in which a mode does *not* afford the clear expression of certain types of meanings, and they can use this concept to question how texts exclude or conceal meanings just as they include them (see Table 1 for specific teaching suggestions related to these implications).

Table 1 Ideas for Teaching Disciplinary Literacies

Discipline	Questions for developing metadiscursive awareness	Activities for teaching about the affordances and constraints of representations
English language arts	<ul style="list-style-type: none"> • What is language arts? • We will be [writing a poem]. What would make this text effective? How do these criteria for effectiveness compare to the criteria for effective writing for the texts you're writing in your other classes right now? 	<ul style="list-style-type: none"> • Students can make a website whose purpose is to represent a theme they've been discussing [masculinity, jealousy], and discuss why they chose different representations for those themes [music, images] to convey their ideas.
Mathematics	<ul style="list-style-type: none"> • What is mathematics? • We will be [using percents to compare discount prices and justify purchases]. What representational tools can we use to help us solve these problems? What representational tools can we use to explain our purchases to others? How does this compare to the ways we present evidence in science? 	<ul style="list-style-type: none"> • Students can analyze mathematical justifications, such as the argument that their school scored poorly or well on a standardized test. Students can study bar graphs made by their district, identify the author or lack thereof, and identify how graphs change qualitative data into numbers. They can then discuss the transformations, strengths, and weaknesses entailed in describing school achievement using numbers and symbols.
Science	<ul style="list-style-type: none"> • What is science? • We will be explaining [lunar phases]. What kind of representations could we use to best explain this concept to somebody who didn't know about it? How do the forms of representation we used to present [lunar phases] compare to how we represented [what causes ocean waves] earlier this year? Why do we communicate science using these common forms of representation? 	<ul style="list-style-type: none"> • Students can discuss how they would represent [sound waves]: What kind of representation would they use? Why? What does the [diagram, model, video] allow them to represent? What aspects of [sound waves] does this representation leave out? • Students can analyze popular cultural accounts of science [such as the documentary "An Inconvenient Truth"] and discuss how representations such as line graphs and dramatic music are used to persuade the audience in different ways. They can discuss the strengths and limitations of each type of representation.
Social science	<ul style="list-style-type: none"> • What is history? • We will be [evaluating Truman's decision to drop the atomic bomb]. What sources can we use to help us understand the reasons behind this decision and its impact on the world? How do these sources compare to the sources you use in your other classes to support your opinions? 	<ul style="list-style-type: none"> • Students can "read" several sources (e.g., a monument, a painting, period music, an audiorecording, a diary) and discuss what conclusions the source enables them to draw and what conclusions they cannot draw from the source.

Developing Frameworks Across Content Areas

Students have always encountered a variety of representations in schools: From listening to lectures to understanding gestures to viewing diagrams, students have long been charged to make sense of multiple modes. However, they have not often received instruction on why these modes are important to each discipline or on how these modes might be used to reach discipline-specific goals and to display particular types of content.

Moreover, students have often not received instruction on how and why the forms of texts they are expected to write might vary as they participate in

different disciplines. A social semiotics perspective recommends that students develop metadiscursive frameworks for approaching multiple literacies as they occur within different disciplines. Guided by these frameworks, students may have a more powerful platform for understanding and designing texts in the content areas.

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