Doing and Teaching Disciplinary Literacy with Adolescent Learners: A Social and Cultural Enterprise

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In this essay, Elizabeth Birr Moje argues that educators can make radical change in student learning and well-being if they reframe teachers' work with youth as less about meeting standards and more about teaching youth to navigate the multiple literacy contexts in which they live, learn, and work. To that end, Moje offers a take on disciplinary literacy instruction that puts the process of inquiry at its center. In contrast to a frame that ignores or removes value, purpose, affect, emotion, imagination, social interaction, and the learning and challenging of cultural conventions from the work of adolescent literacy teaching, she presents a teaching heuristic designed to capitalize on the social and cultural nature of disciplinary inquiry and support students in navigating multiple literacy contexts as part of the teaching of disciplinary literacy, characterized by what she terms the 4Es: engage, elicit/engineer, examine, and evaluate.

After almost fifty years of scholars urging teachers to support adolescents' content-area reading by using various teaching strategies (see Alvermann & Moore, 1991; Herber, 1978; Phelps, 2005), policy makers, school leaders, and secondary school teachers are showing interest in the literacy learning needs of adolescents. Perhaps spurred by the new Common Core State Standards (CCSSO, 2010) or by the failure of early reading policies for the early grades designed to "inoculate" children adequately against literacy struggle (Snow & Moje, 2010), policy makers and school leaders have identified adolescents as particularly in need of development, with *disciplinary literacy teaching* as one solution to developing the skills youth need.

In this essay, I offer a conceptual framework to advance the development of teaching practices and school structures that support youth in deep disciplinary literacy learning. I begin with the question of what we are forgetting

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as we rush to improve adolescent learners' skills as outlined in the Common Core and other standards documents, such as the Next Generation Science Standards (NGSS Lead States, 2013). If literacy learning and practice are about more than the accumulation of skills, if disciplines are human constructions replete with social purpose and cultural conventions, then where and when is that social and cultural learning done, especially for young people who are not apprenticed into the disciplinary domains from an early age? How do we support the development of disciplinary literacy *practice* as a human, social construction rather than merely the learning of discrete skills?

I argue that education researchers, leaders, policy makers, and teachers might spur radical change in student learning and well-being by conceptualizing more fully the notion of disciplinary literacy, rather than only defining some, partial, standards for its enactment. Literacy researchers and professional developers should work with teachers of adolescents to reconceive of the subject areas as human constructions, or disciplines, and to understand the term *discipline* as more than a synonym for *subject* or *content area*. Disciplines are, in effect, domains or cultures in which certain kinds of texts are read and written for certain purposes and thus require certain kinds of literacy practice (O'Brien, Stewart, & Moje, 1995). If disciplines are cultures—or subcultures (Ball & Lacey, 1984)—then it stands to reason that disciplines are also highly social and that members of disciplines approach their work with curiosity, imagination, and passion. Thus, any work on adolescent literacy teaching and learning should include domains such as affect and emotion, imagination and curiosity, value and purpose (what some refer to as "motivation"), and social and cultural practices, interactions, conventions, and norms. Unfortunately, much of the current work on adolescent literacy is stripped of attention to the social and cultural nature of disciplinary teaching and learning, even much of the scholarship that identifies itself as being about disciplinary literacy development.

To counter this prevailing trend in theories of disciplinary literacy practice and instruction, I offer a take that makes inquiry within a community of practice and discourse central to the learning of the literacy practices of a discipline. Skills-based literacy teaching that is abstracted from purpose and value reduces disciplinary concepts to "stuff" to be mastered and disciplinary literacy practices to forms and procedures to be memorized. Learning the definitions of the technical language of disciplinary subjects is not as useful, for example, if students are not engaged in disciplinary inquiry, because they have no way to apply the language they are learning. If, however, teachers, school leaders, policy makers, and researchers reconceive of literacy teaching and learning as being about teaching young people the purposeful and meaningful literacy practices engaged by people within and across disciplinary domains, then teachers can embed literacy teaching practice in meaningful ways. Rather than expecting youth to arrive in the classroom with a preexisting motivation to learn a discipline, teachers can apprentice and guide students into their

own understanding of the value and purpose of disciplinary reading, writing, and speaking. Moreover, the framework I propose allows teachers to attend to the emotion and imagination—the humanity—of disciplinary work with adolescent students, even as they teach the literacy and disciplinary concepts and practices necessary for navigating through school and life.

In contrast to the standards and numerous curricular interventions designed to address these affective dimensions of disciplinary practice, I offer a framework that capitalizes on them. Including affective, social, and cultural dimensions such as curiosity, imagination, passion, and emotion is critical because such dimensions are central to productive life and work in a disciplinary discourse community and to good citizenship for those who do not pursue the achievement of expertise in a given discipline. Finally, I argue for a view of disciplinary literacy that makes navigating across disciplinary communities as important as being skilled inside those communities. This framework, then, considers disciplinary literacy teaching as more than just a matter of teaching literacy skills that are useful in a discipline. With this approach, those skills will develop, but more important skills, those of being able to navigate across multiple domains of life, including disciplinary domains, can also be built. The heuristic I offer, then, is one to support disciplinary literacy teaching as the practice of teaching youth to navigate their school classes, their communities, and their lives.

Disciplinary Literacy: Exploring and Expanding the Construct

What is disciplinary literacy? Literacy practice is always domain specific in the sense that all literacy is enacted in a specific context, for a specific purpose, and to or with a specific audience. Disciplinary literacy, however, refers to the specialized literacy practices of a given disciplinary domain, such as mathematics or history or visual art.[1] Some scholars expand the definition of disciplinary literacy to include ways of thinking that are specific to the disciplines (Leinhardt & Young, 1996; Wineburg, 2001). The historian, for example, considers the past and in so doing must try to situate her thinking in not only past events but also past mores and conventions. She must develop empathy with actors in the past as a way of constructing a representation of that past or her account of past events will be warped by present attitudes. Mathematicians, by contrast, are concerned with both real and imaginary worlds, and the time and place of those questions matter only insofar as the mathematics is meant to be applied in the world. That is, theoretical mathematicians pose questions that imagine possibilities and consider time only as a variable; applied mathematicians pose questions that can be answered with empirical data in the present and future (e.g., the engineering of a bridge). Members of these and other disciplines learn to think about and see the world in particular ways (Stevens & Hall, 1998) and to ask questions that reflect those ways of seeing, knowing, and thinking (Wineburg, 2001). These differences shape the ques-

tions members of these disciplines ask and how they consider the data or the arguments they would make to address those questions.

Thus, including how one thinks in a definition of disciplinary literacy is a sensible proposition given that it is difficult to read and write texts in and to an epistemic—or knowledge-driven—community when one does not share the same ways of knowing and thinking as the members of that community. However, to reduce disciplinary literacy to ways of knowing or thinking associated with those disciplines absent attention to how members of disciplines use oral and written language as part and parcel of their work fails to uncover the fundamental aspects of disciplinary literacy (Norris & Phillips, 2002). The language practices that attend to ways of knowing and producing and communicating knowledge are what many scholars refer to as discourses (Gee, 1996; Michaels & O'Connor, 1990). It is these "ways with words" (Heath, 1983) of the disciplines—the ways of speaking, listening, reading, and writing that reflect ways of disciplinary knowing and thinking—that students must learn to fully appropriate the practices and concepts of a discipline (Lemke, 1990). Indeed, many scholars argue that these language-based practices are critical not only to disciplinary learning but also to civic participation and to efforts to attain social justice (Lee & Spratley, 2010; Moje, 2007; Norris & Phillips, 2003).

In contrast to perspectives that focus more on disciplinary thinking than on literacy practices, Shanahan and Shanahan (2008) offer a conception that is more explicitly about reading and writing. They draw from their research with two members each of three different disciplines (chemistry, mathematics, and history) to argue that *disciplinary literacy* refers to the specialized skills and codes necessary for reading and writing in various disciplines and technical fields. Similarly, Norris and Phillips (2002) distinguish between fundamental and derived forms of literate practice in science, arguing that fundamental perspectives on scientific literacy root the phrase in literate practice rather than in scientific thinking or knowledge.

For my part, I also cast disciplinary literacy as the knowledge of and skill with the specialized linguistic codes, technical vocabularies, and discourse practices that draw from and reproduce the epistemic understandings and routine practices of a discipline. But I add what I consider a crucial dimension by arguing that disciplinary literacy involves "uncovering, examining, practicing, challenging, and rebuilding the tools of knowledge production and critique" (Moje, 2007, p. 10). That is, to teach disciplinary literacy, teachers need to involve learners in inquiry that allows the learner to gain insight into how questions are asked and examined and how conclusions are drawn, supported, communicated, contested, and defended.

Equally important to my conception of disciplinary literacy is the recognition that the disciplines are cultures in which certain kinds of texts are read and written for certain purposes and with or to certain audiences. As a result, the texts read or written in a given disciplinary culture demand particular kinds of literacy practice relevant to the needs, goals, and conventions of

those purposes and audiences. The practices involved in reading and writing within a given culture imbue the skilled individual with membership in the discourse community that perpetuates the culture. The practices are markers of one's membership and identity and thus carry with them power and emotional investment.

Conceiving of a discipline as a culture or a discourse community challenges notions of disciplines as stable bodies of knowledge and reminds us that disciplines are human constructions. This conceptualization of disciplines as cultures or discourse communities draws attention to the need to help youth learn to navigate from their home, community, and national cultural practices and discourses to and from those disciplines they are expected to learn in school. Disciplines are highly specialized—and fairly exclusive—cultural groups, and just as one has to learn the conventions and practices of a new culture, so does one have to learn the conventions and practices of a discipline. The difference, however, is that every day young people move to and from home and school and, once in school, across disciplinary boundaries. In effect, young people are traversing multiple cultures in a given day, and several of those cultures are highly specialized. The high level of specialization of a given discipline stems in part from the work its members do to build and perpetuate its place in the world. The specialized rituals, procedures, and discourses entailed in gaining membership and recognition in the domain serve to maintain the disciplines even as they provide members a shorthand for communicating and identifying. That shorthand produces a hidden quality to the work of members of disciplines, and yet their work has an impact on political, economic, medical, and scientific decision making. This puts a finer point on the sense of urgency the writers of the Common Core standards, together with many who argue for disciplinary literacy instruction as an act of social justice (Carnegie Council on Advancing Adolescent Literacy, 2010; Moje, 2007), feel when arguing that more youth should be apprenticed into the discourse of the disciplines.

The construct of disciplinary literacy is further complicated by the recognition that disciplinary domains not only are specialized but also are committed to making and communicating the knowledge of that domain. In some cases, experts within a discipline aspire simply to add to knowledge rather than apply knowledge or solve a functional problem. For these disciplinary practitioners, their overall goals and purposes are confounded by their community discourse and communication practices, leading them to tightly regulate discourse and literacy practices.

Hair dressing, for example, is a highly specialized domain. Hairstylists have particular methods for cutting, coloring, and styling hair; they use specialized tools, and they engage with each other in a specialized discourse. They are not, however, typically evaluated by their ability to engage in that discourse. To the contrary, they are evaluated by their styling skill, and they must be able to communicate their specialized knowledge and skill to clients who are not part of the community. Their trade and their styling skill depend on their ability

to translate their specialized knowledge into everyday discourse that a client can understand. In contrast, the work of mathematicians, for example, is driven by the language of mathematics and by their ability to communicate almost exclusively with other mathematicians; their commodity is the knowledge they produce, communicated according to the linguistic and rhetorical conventions of their domain. On the rare occasions that members of disciplines are asked to translate their work to lay audiences, they often require translators and coaches; thus, the ways of producing and obtaining knowledge valued by the community constitute successful, skilled practice. But that insular domain-specific discourse practice often frames disciplines as inaccessible.

Why Does Disciplinary Literacy Matter?

Given the high degree of specialization and the insular nature of some disciplinary domains, why would educators hold up disciplinary literacy learning as a goal or standard for K–12 student achievement? Some have argued that we should not (Heller, 2010). However, if society hopes to continue to populate disciplines and the professions that are framed by disciplines (e.g., journalism, accounting, laboratory science, teaching), then students need the opportunity to apprentice into the ways of producing and communicating knowledge valued in the disciplines. In addition, if society hopes to generate thinking, productive citizens, then learners need the opportunity to participate in even rudimentary forms of knowledge production, to ask questions of assumptions held by and in the disciplines, to understand how disciplines work, and to push back on the knowledge that is produced (Moje, 2007, 2008). Indeed, disciplinary literacy teaching can be considered a form of socially just teaching, one that not only gives youth access to these highly specialized discourse communities but that may actually produce social justice by supporting the development of new kinds of knowledge as people from a range of backgrounds and experiences gain access to these specialized domains. Thus, disciplinary literacy teaching is not about producing new members of the disciplines (although it surely will produce some new members, and perhaps some from a range of diverse backgrounds) but about providing all students with the opportunity to understand how disciplines work and to raise questions about the trustworthiness of disciplinary knowledge (Moje, 2007, 2008, 2010).

Opportunities to engage in disciplinary literacy practice can also contribute to the development of what Erickson (2014) calls "rational dependence," or the *reasoned* reliance on the knowledge of experts, because it develops at least a basic understanding of the standards for and language of knowledge production and claim making. Finally, learning from a fully conceptualized disciplinary literacy practice can allow youth to pursue their curiosities and follow their imaginations (Enciso, 2013) as they use disciplinary language and literacy tools to pursue meaningful questions of interest to them and to others. When one strips away the technical language and disciplinary discourse, it is evident that the questions asked by mathematicians, historians, natural scientists, and liter-

ary theorists are quite similar to the questions of very young children in the sense that they are questions of wonder about how the world and society work.

A Heuristic for Teaching Disciplinary Literacy

With this framing of disciplinary literacy, I turn to what it would look like to teach disciplinary literacy. This is no small task, and the challenges should not be underestimated: teaching disciplinary literacy is not simply a matter of creating standards and expecting teachers to engage in instruction that will help youth achieve those standards. To that end, I offer a disciplinary literacy teaching heuristic to support that change.

Given the theoretical dimensions of disciplinary literacy practice as described above, one might begin to infer new approaches for teaching disciplinary literacy. Before doing so, however, there remains the matter of organizing instruction in the fast-paced, hectic, and sometimes chaotic contexts of middle school and high school classrooms. I have spent my career in classrooms as a high school teacher and as a researcher of disciplinary literacy. Drawing from my experience and research, I have developed a heuristic that frames key teaching practices for disciplinary literacy instruction by drawing from practices of the disciplines and by supporting students in learning to navigate the literacy practices of different disciplines and other life domains. This heuristic for approaching disciplinary literacy includes four Es: *engage, elicit/engineer, examine*, and *evaluate*.

The heuristic serves as a reminder to build these dimensions into disciplinary instruction for the purpose of supporting the learning of both disciplinary concepts and disciplinary literacy practices. Specifically, the first E reminds teachers to *engage* the practices of the discipline under study. It prompts us to ask how much our daily classroom practices are like those of the disciplines. The second E—*elicit/engineer*—which is really E^2, helps the teacher remember that adolescents are not experts and that their engagement in disciplinary practices needs to be engineered. Specifically, the second E focuses on eliciting the knowledge and skills youth bring to the disciplinary inquiry and then engineering the necessary knowledge (Moje & Speyer, 2014) for engaging in the inquiry. The third E—*examining*—serves as a prompt for getting students to *examine* closely words and ways with words. The fourth E—*evaluating*—takes up the navigational work of disciplinary literacy teaching and encourages metadiscursive practices (New London Group, 1996) by asking students to *evaluate* when, why, and how disciplinary language is and is not useful. Many elements of the 4Es represent aspects of good literacy teaching; the heuristic is meant to pull good teaching practices together in a practical, guiding framework that is initiated by attention to disciplinary practices, which revolve around inquiry. In the next section, I give extended attention to the *engage* portion of the 4Es rubric, in part because it is the launch point and centerpiece of disciplinary

literacy learning, and in part because it is the least well-elaborated aspect of disciplinary literacy theory.

The First E: Engage

The first dimension of the 4Es framework is that teachers should engage students in the everyday practices of the discipline such as carrying out investigations or debating ideas with peers. Students cannot learn the literacy practices of the discipline if they are not engaged in the everyday work of the discipline. Similarly, there is little point in teaching literacy skills that are not warranted or demanded by the purposes of the discipline, at least not under the guise of disciplinary literacy learning.

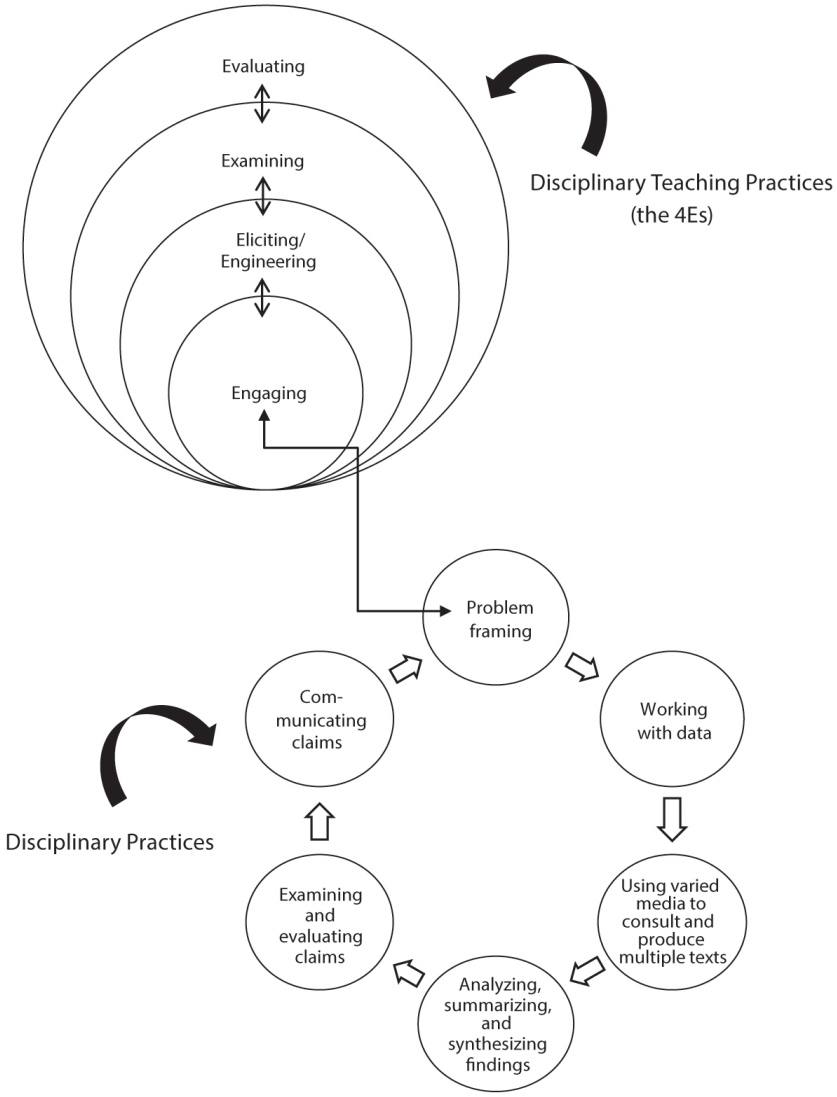
This argument begs the questions: What are the everyday practices of the different disciplines, and how can teachers know those practices well enough to teach them to students? Key disciplinary practices—that is, the things members of disciplines do every day to accomplish their work—differ in powerful ways by discipline. Natural scientists think about the world and ask different types of questions from mathematicians. Historians and literary theorists use texts as data sources, but different types of texts for different purposes. The list of differences could go on and on, and teachers need to introduce students to those differences in explicit ways (see "Evaluate" below). But in every case, members of disciplines ask questions or frame problems; work with data of some type; read and write a range of texts; record, analyze, and synthesize data; and communicate their findings. These overarching inquiry practices are ones that are only rarely engaged in middle and high school classrooms but are practices central to powerful disciplinary learning (Bransford & Donovan, 2005).

Drawing from a number of studies of the practices, literacy and otherwise, of disciplinary experts (e.g., Bain, Lander, Hines, & Mercado, 2008; Bass, 2006; Shanahan & Shanahan, 2008; Shreiner, 2009; Wineburg, 1991, 1998; Yore, Hand, & Prain, 2002), I have analyzed the central everyday practices of the four general areas of disciplinary inquiry: mathematics, natural science, social sciences, and language and literary studies. There are important differences among these disciplines (see Moje, 2007), yet members engage in the six shared practices that make up a disciplinary cycle (see figure 1). This cycle can guide the ways teachers engage youth in disciplinary practices. Within each part of the cycle, teachers will need to elicit/engineer, examine, and evaluate students' work with oral and written language in the service of disciplinary inquiry.

— Framing Questions/Problems

Whether a mathematician or a literary theorist, a physicist or a historian, the scholar poses a question or frames a problem to be studied. This is an essential starting point for disciplinary work, although questions and problems are

FIGURE 1 *4Es Heuristic with Disciplinary Practices*



often reframed in the process of inquiry, and the process might be iterative. Without the question or problem to study, the work is virtually meaningless. And without meaning, there is little reason for the learner to be motivated to engage in what amounts to literacy drill-and-practice. Just as members of a discipline read and write research literature, notes from their own investigation, data tables, lab journals, and reports framed as evidence-based arguments for a reason, students of the discipline need a reason to read and write

as they do. This part of the inquiry cycle needs to be more than an "essential question" pulled from a teacher's lesson plan, however. It needs to drive an investigation—whether empirical or theoretical—and thus needs to be a developmentally appropriate version of a real question that would be asked in the discipline. This point does not mean that only students should generate questions; excellent inquiry-based curricular units have been developed for use across school districts in accordance with various state content standards (e.g., Fortus, Dershimer, Krajcik, Marx, & Mamlok-Naaman, 2004). But it does mean that the questions must be real questions asked in the world, questions that stimulate interest and spark curiosity (Blumenfeld et al., 1991; Guthrie, Hoa, Wigfield, Tonks, & Perencevich, 2006).

— Working with Data

All disciplinary practitioners work with data of some kind, although what members of different disciplines count as data can be dramatically different. For example, a literary critic finds evidence inside a text, using an author's words within a given theoretical perspective, to make an argument about that text. A natural scientist might manipulate naturally occurring substances to determine what new substance is produced when the two original substances react. What looks like a data point to one disciplinarian (a historian's primary source) might be read as a piece of literature by another (a literary theorist) (see Wineburg, 1998). And, indeed, what might be a primary source in one context might in another be literature. Thus, knowing what texts, phenomena, materials, and experiences count as data depends on the purpose for working with the source and, to some extent, the audience to which the data analysis will be directed. Working with various texts, materials, tools, observations, and phenomena can allow young people the opportunity to understand not only which data matter in a given discipline but also the similarities and differences across disciplines. Such practice is likely to help students recognize that what counts as a data point even within a discipline is always mediated by the context and purpose of the inquiry.

Despite these differences, there are also many parallels in what counts as data across disciplines. The geologist, for example, might read a rock formation for evidence much like a literary critic reads print; both will use knowledge of history, extant theories, and the past research of others as secondary data that allow them to interpret the data at hand. The key point here is that students need opportunities to get their hands on—literally or metaphorically—data and to work with them throughout the inquiry cycle. They need opportunities to design methods for collecting data in response to a given inquiry problem or question, to organize and analyze data, and to draw conclusions from data. Too often we give students either hypothetical inquiry activities or hypothetical data. Affording students actual opportunities to engage in inquiry is far more likely to motivate a need to read and write in response to that inquiry. For example, students in science classes might design experiments that take

them through an inquiry process, such as testing the hypothesis that more bacteria grow under artificial nails than under natural nails as part of a unit on the spread of disease by bacterial and viral infections. Or students might investigate the question of whether approaches to freedoms guaranteed by the U.S. Constitution have changed over time by searching for and studying federal laws, Supreme Court decisions, and related media from various time periods with a focus on examining how sources are shaped by the people who prepared them and on constructing an account that represents a claim across sources. Whatever the subject area, the critical point is that students have opportunities to collect and work with the materials, phenomena, tools, and texts that constitute data in the discipline.

— Using Varied Media to Consult and Produce Multiple Texts

In schools, students typically have the opportunity to work with a limited number and type of texts, and their access to a range of media in varied forms to represent and read information is equally limited. Apart from the images displayed next to print in textbooks, many classrooms are print dominant or make little use of multimodal formats for accessing or representing knowledge. Nothing could be further from the truth in rigorous disciplinary inquiry settings. Paper and pencil abound, as do computers, tablets, and calculators. Each is used as part of the design, data collection, and analysis process. Perhaps even more important, ideas and claims are exchanged using social media, e-mail, charts, maps, photographs, video recordings, presentations, logs and journals, and traditional publications. Most important, multimodal representations are de rigueur in laboratories, archives, and field work. Opportunities to read and write (or compose) multimodal forms are critical for fostering disciplinary literacy skills because they are part and parcel of actual disciplinary practices.

— Analyzing, Summarizing, and Synthesizing Data into Findings Related to the Question Posed

This process is central to the work of disciplines; although it is not typically considered in literacy teaching, it depends heavily on literacy skills and facility with text. Bain (2006) writes about the need for a historian to sift through the welter of facts to determine which are relevant to the historical problem under study. In addition to sourcing or corroborating data points and sources (Wineburg, 1991), the historian must read and identify pertinent facts. This work is perhaps the most challenging of all the phases of the inquiry cycle, and yet little research has investigated how to support novice disciplinary learners in analyzing, summarizing, and synthesizing actual data. Indeed, in many cases, young students need to first learn how to *record* the data systematically. A key aspect of disciplinary inquiry is being able to claim, with confidence, that the data are accurate and representative of the sample, however defined. In many cases, teachers give data to students rather than engaging them in the critical

processes of collecting and caring for it. Learning the processes of recording, cleaning, representing, and organizing data should be considered central to disciplinary literacy. It is worth noting that many of the cognitive literacy strategies offered by content-reading researchers are organizational strategies designed to help students extract information and, in some cases, meaning from text (e.g., Vacca & Vacca, 2004). Rather than tossing aside these strategies, teachers could productively employ them as organizational tools in this phase of the cycle (see "Elicit/Engineer" below).

— Examining and Evaluating One's Own Claims and the Claims of Others

Members of disciplines regularly interrogate and evaluate claims, a central practice that is rarely enacted in classrooms. Indeed, much of secondary schooling involves reading claims made by members of disciplines as represented through textbooks, which typically strip the claims of evidence and authorial voice and present them as undisputed facts (Bain, 2006; Paxton, 1999). Not only is the practice of interrogation important to learning to do the work of disciplines (learning to write an evidence-based argument, for example, can be bolstered by examining the claims of others), but it is also crucial to developing critically literate citizens who can engage with and make decisions about information based on disciplinary claims but found in popular social texts (e.g., political referenda, news articles and reports, community proposals, social media) (Erickson, 2014; Norris & Phillips, 2003). Some practices for helping students learn to evaluate claims include holding poster fairs where they examine each other's claims about similar investigations or inviting discipline-based experts into the classroom to serve as "reviewers" of students' work (Hall & Turow, 2006).

— Communicating Claims Orally and in Writing

Communicating in the disciplines takes many forms. Among other communication forms, members of disciplines keep journals and jot notes intended only for self-communication. They brainstorm and send e-mail requests for advice. They talk with each other and argue claims face to face. They read background information on past investigations or experiments, record observations or measurements, and publish carefully documented arguments based on evidence. Despite these varied forms, the current focus in disciplinary literacy work tends to emphasize *written* evidence-based argumentation (e.g., Demirag & Gunel, 2014), probably prompted by the Common Core State Standards (CCSSO, 2010). As illustrated, the everyday communication practices of members of disciplines are far more varied than argument writing alone and also should be engaged, modeled, and scaffolded. In particular, it is important to provide opportunities for students to talk with one another as questions are framed, data gathered, and claims formed. Learning to produce a well-written, evidence-based argument is challenging work, and important inroads in the role of opportunities for oral communication about the inquiry process are being made on this front by a number of scholars (e.g., Coffin, 2006; Goldman,

2012; Hand, Wallace, & Yang, 2004). But students can benefit from practice in an even broader range of communication practices that members of the disciplines engage in throughout the inquiry process, rather than only at the culmination of the process, because each of these practices is part of the overall process of making meaning through inquiry.

In particular, the literate practice of translating one form of representation to another is one that should be regularly and explicitly taught because it is both challenging and generative (Moje et al., 2004). A proficient mathematician can often look at a table of numbers and automatically translate the numbers into an equation or a line plotted on a graph based on her reading of the relationship between the rows and columns of a table. This is important translational work that is commonly done across forms of representation central to the discipline, translational work that is often invisible—and perhaps seems somewhat magical—to students. How often do we explicitly engage adolescent students in such translations, asking them to write sentences that represent the relationships between or among numbers in a table? How often do we support students in translating a written text into a visual image or a data array into a claim? Making the translations and other keys to communicating knowledge visible can provide access to understanding and thus humanize the work by making it clear that it is not the product of innate talent but, rather, a learned reading and representational practice. Such moves also allow novices to question the knowledge produced.

— Using the Cycle of Disciplinary Practices

Looking across these disciplinary practices, teachers planning for disciplinary literacy instruction need to ask how often, when, and to what extent they engage their students in the practices central to the disciplines that frame the school subject they teach. How can students possibly apprentice into those disciplines without the opportunity to try on the work in developmentally appropriate, scaffolded experiences? I suggest that these practices be the framework for unit planning and that daily lessons regularly focus on one or more of these practices. It should be noted that inquiry-based, problem-based, and design-based approaches to science and history (e.g., Akkus, Gunel, & Hand, 2007; Bain, 2006; Marx, Blumenfeld, Krajcik, & Soloway, 1997) operate very much in this vein and make good templates for teachers' disciplinary practice teaching, although many of those approaches could more fully attend to scaffolding students' literacy skill development and their work with a range of texts.

The Second E: Elicit/Engineer

Knowing and participating in a developmentally appropriate facsimile of the practices of a given discipline or subject area and knowing how these practices are unique to each area are a first step in developing disciplinary literacy skills. But even when they are engaged in disciplinary practices, adolescent students are not members of the discipline; they do not have the wealth

of knowledge or the reading, writing, and language skills that members of the discipline possess. Teachers need to teach them—to *elicit* and *engineer* the necessary knowledge, skills, and practices for students to make meaning as they engage in these practices.

Eliciting and engineering is where the teaching tools and strategies that were originally presented in the research literature as content literacy teaching strategies (Herber, 1978) find a place in the 4Es framework for disciplinary literacy. Contrary to some perspectives that suggest content literacy strategies either are obsolete or belong only in an intermediate, generic stage of literacy teaching (Shanahan & Shanahan, 2008), I situate within the 4Es framework valuable content literacy strategies and practices, such as questioning the author (Beck & McKeown, 2002), Word Generation (Snow, Lawrence, & White, 2009), reciprocal teaching (Palincsar & Brown, 1984), or the K-W-L (Know–Want to Learn–Learned) framework (Ogle, 1986), to name just a few. I see strategies, or engineering tools, as the powerful work of eliciting and engineering adolescent students' skills for engaging in disciplinary reading and writing practices. Similarly, strategies for discussion and debate, reading and writing of multiple texts, reading and writing with multiple media, and working with technical and everyday vocabulary all extend the possibilities teachers have for eliciting and engineering students' skills on a daily basis. But elicitation and engineering work should sit within disciplinary inquiry practices that both apprentice learners into these specialized, private domains and provide purpose and audience for young people. With purpose and a clear audience with whom they can communicate, the work of disciplinary learning becomes meaningful for students. They have a reason to read, write, and talk. Without that meaningfulness, skills can be taught, but they are taught as abstractions. They are not deeply learned, and rarely are they transferred as students attempt to navigate the multiple contexts of their lives (e.g., Hinchman & Zalewski, 1996; Leander & Lovvorn, 2006; Moje, 1996; Moje, Overby, Tysvaer, & Morris, 2008). Framing the eliciting and engineering work in disciplinary inquiry also acknowledges that students are developing scholars with emotion and curiosity and human beings who need voice, agency, and meaning even as they learn how to enter the discourse community and culture of a discipline.

The Third E: Examine

The third E in the heuristic encourages teachers to help students examine the meanings of words, phrases, and symbols in a given subject area or discipline and the ways that people use language in the discipline under study. With its focus on disciplinary discourses, this dimension reminds the teacher that working with words needs to move beyond understanding word meanings or how to use words effectively in argument and other forms of discipline-based communication. Although this dimension could be collapsed under the second E, this move is about more than helping students understand or produce disciplinary texts. This move begins the work of helping students navigate by

drawing attention to the technical language and discourse practices of the discipline and thus ensuring that youth become fluent in the language needed to engage. By examining language use closely within a discipline, students have an opportunity to learn about and question why members of a disciplinary discourse community read, write, and talk in particular ways. Working on disciplinary discourses also provides opportunities for students to raise questions about the social and cultural practices and values that shape how knowledge is made and communicated in a discipline.

This dimension, together with the fourth E, *evaluate*, is critical to the reconceptualization of disciplinary literacy as about taking on the language practices of a specialized cultural group and critical to understanding this work as advancing social justice. When these discourses are made visible, then an adolescent learner can make decisions about whether, how, and when to navigate into and out of those language practices. Opportunities to explicitly examine language, its functions, and its products support the development of disciplinary language facility (Coffin, 2006; Schleppegrell, 2004), the learning of content, and the "disciplined perception" necessary for deep disciplinary learning (Stevens & Hall, 1998). Interrogating *why* there are certain ways with words—rather than taking those ways as a given—also makes clear to students that the disciplines are human constructions, with social and cultural norms, rather than merely bodies of knowledge to be digested. Explicit conversations around how language is used and how it functions to construct meaning and action (Halliday & Matthiessen, 2004) afford students the agency to question the value of the knowledge by wondering about whose interests might be served by maintaining particular perspectives. Erickson's (2014) concept of rational dependence is also enhanced by examining language closely, because this practice provides insight into how language can be used to manipulate understandings. Even when individuals are not experts in a given area, they can learn to look closely at how language is used to represent concepts and thus can at least begin to evaluate whether the author is invested in the topic or offering an external view on it (Schleppegrell, Achugar, & Oteíza, 2004). This work might involve looking up words in dictionaries, discussing different ways to say the same thing, or simply pointing out to students that different disciplines use language in different ways. Teachers can use a range of teaching tools to support this examining dimension, including principles of systemic functional linguistics (Schleppegrell et al., 2004) and strategies offered in the Word Generation practices (Snow et al., 2009).

The Fourth E: Evaluate

Related to the examining dimension of disciplinary literacy teaching is the dimension that engages students in *evaluating* why, when, and how disciplinary discourses are useful and why, when, and how they are not useful. Explicit attention to these questions can help students learn to navigate across and between their own everyday habits of mind, their identities and cultural prac-

tices, and those that are valued in the discipline. Evaluating language practices might look something like the way a chemistry teacher explains the concept of significant digits by contrasting it with how numbers are used in mathematics (rounding to the nearest ten), because the calculations in chemistry will be used in experiments and other applications where precise measurements matter to effects obtained in the experiment (Moje, 1997). Or it might involve students in writing different versions of claims about data for different audiences to help them understand that audience and purpose shape the nature of both data and language use. For example, one study might ask students to make two different claims about data from an experiment on hand washing to reduce bacteria and viruses, one to their mothers and one to scientists (Moje et al., 2004), with a focus on what they would say differently and why.

Why is learning to navigate between these realms important? One obvious reason is that students in middle and high schools are required to navigate various worlds on a daily basis. Not only must they navigate from home to school, but during the school day they must navigate across subject-area classrooms that are shaped by different disciplinary traditions and practices and organized by different people. When teachers ask students to determine the value of particular practices for the work they are doing in that classroom, that subject area, or that discipline, then those same students can be supported in learning to work with facility, confidence, and agency in the disciplinary traditions. Such conversations decrease the likelihood of a teacher hearing what I have heard on more than one occasion when teaching a particular disciplinary literacy practice: "But my [insert the relevant subject area] teacher told me to . . ." When students are brought into a conversation about why various genres, rhetorical devices, and linguistic constructions are valued, they are much more likely to use them appropriately. The metacognitive, metalinguistic, and metadiscursive awareness (New London Group, 1996) developed through explicit evaluations of the usefulness of words, phrases, and discourses is paramount both to identifying with the discipline—an important ingredient of deep learning (Gee, 2000/2001; Lave, 1996; Stevens, O'Connor, Garrison, Jocuns, & Amos, 2008)—and to instantiating concepts learned (Bransford, 2000). Meta-level conversations also bring cultural practices and values to the surface, provide opportunities to explore vocabulary meanings and discourse practices, and give a sense of agency—learners can decide for themselves how and when to use what they have learned only when they are aware of the power and potential of a given concept or practice.

Developing Skilled Disciplinary Literacy Teaching: What Do Teachers Need?

The work of teaching disciplinary literacy is not simple. If it were, teachers would be doing it already. Putting the ideas I've offered into practice is not a matter of producing shared standards, although standards can support such

work. Nor is this work merely a function of demanding that more complex texts be read, and read more closely. And despite the value I place on the 4Es heuristic, a heuristic alone will not be enough to enable teachers to do the complex work embedded in the Es. Teachers need supportive school structures, especially the time to plan for and enact inquiry units to allow them to move through the dimensions of the heuristic. They need material resources, such as access to multiple media that will provide multiple texts. Finally, teachers need a strong knowledge and practice base for disciplinary teaching. The complexity of the work is almost overwhelming unless well supported by school and district leaders. There are no quick fixes, no tidy curriculum packages to buy, and no one-stop professional development sessions that will make disciplinary literacy teaching and learning a reality across the nation. This is time- and labor-intensive work that demands attention, commitment, and support over the long term.

Knowledge and Practices Teachers Need

Although it is tempting to default to the idea that to teach disciplinary literacy well one needs either deep disciplinary knowledge or deep knowledge of literacy skills, neither is true. In fact, the unavoidable truth is that *both* are needed, which is one of the challenges of the work. A strong teacher of disciplinary literacy must know some content in the discipline. However, few members of a given discipline such as history, for example, know everything there is to know about history. As Wineburg (1998) demonstrates in his analysis of expert historians reading texts related to Abraham Lincoln's presidency, those with expertise directly related to the topic appeared to engage in disciplinary literacy practices with more ease and flexibility than those without, but all of the history experts possessed the knowledge of how to search the texts, contextualize them, examine the credibility of the sources, and corroborate claims across source material. Although a certain level of disciplinary content knowledge is important, equally important is the knowledge of how to obtain and make sense of disciplinary evidence. That knowledge-in-practice is what teachers need for disciplinary literacy instruction, and these practices are rarely taught in university content courses (Levine, 2006). Thus, simply turning to university content courses is unlikely to be adequate for the task at hand. Instead, disciplinary teachers need better, not necessarily more, content preparation that allows them to be apprenticed into the disciplines by actively participating in the valued practices of those areas. They also need better clinical experiences in disciplinary literacy teaching afforded by working in classrooms with veteran teachers who can model such practice (Levine, 2006).

Teachers also need to understand the basic processes and skills that undergird literate practice (Snow, Griffin, & Burns, 2005), as well as the domain-specific literacy skills and practices of their disciplines (Lee & Spratley, 2010; Moje & Speyer, 2014). In addition, teachers need a great deal of knowledge of how texts work in their disciplines (Alexander & Jetton, 2000; Leinhardt

& Young, 1996; Moje, Stockdill, Kim, & Kim, 2011), of how to assess the challenges and affordances of various texts, and of how students learn from texts (Alexander, Kulikowich, & Jetton, 1994; Chambliss, 1995; Goldman, 1997). Finally, they need knowledge of and skill in how to assess what students have learned about both content and literacy. In particular, teachers—and school leaders and policy makers—need to understand that achievement does not equal learning. Improved test scores could be attained through drill-and-practice methods or even through lecture methods, but the most robust learning will not be achieved through such means (Bransford, 2000).

To carry forward the work of helping youth navigate across their school days and from in-school to out-of-school contexts and back again, teachers need to develop knowledge of youth and family cultures and youth development. Teachers could benefit from more attention to how social identities and cultural backgrounds mediate student learning of the new cultural practices demanded by disciplines. Teachers need opportunities to learn about particular students' experiences, backgrounds, and uses of texts, and they need practice in how to scaffold students' navigation across everyday and content-area discourse and learning communities without appearing to suggest that the goal is to move from one discourse community to another—implicitly better—community. The task of valuing the multiple communities and cultures of adolescent learners' lives while simultaneously introducing new cultural and linguistic practices is daunting, especially given the 100–180 students a typical middle or high school teacher might see in a given day. Providing opportunities for teachers to practice supporting students in the work of navigating will be important to both new teacher education programs and to the continued professional learning of veteran teachers as the nation seeks to advance the teaching of disciplinary literacy practices and skills.

Resources Teachers Need

At its core, disciplinary learning is an apprenticeship process. Experts develop over long periods of time. Adolescents will not become disciplinary experts or even develop high levels of facility with disciplinary practice in the time they spend in middle and high school subject–area classes. But they can begin the apprenticeship process. That said, those who set policy (and evaluate teachers) need to recognize that launching a policy initiative such as common standards and then demanding that adolescents suddenly become adept readers and writers of increasingly complex disciplinary texts will fall short of the goal of building a nation of college- and career-ready, productive citizens.

Doing so may also crush the spirits of teachers and students. Teachers will be frustrated as they attempt to learn disciplinary literacy practices themselves while at the same time trying to apprentice youth into the disciplines within constrained and compressed time frames. To adequately support the work of disciplinary teaching, standards need to be finely tuned to reflect the expected shifts in development and learning of young people over time so that teach-

ers have better guides or targets for student development. Schools and school districts must follow with plans to coordinate student learning and development across the grades so that curricula and pedagogical practices do not replicate targets already achieved and miss those yet to be hit. Teachers need to be afforded the opportunity to talk and plan with one another across grade levels and disciplines. Primary grade teachers should begin the apprenticeship work (Cervetti, Pearson, Bravo, & Barber, 2006; Duke & Pearson, 2002), and the process should progress not in rigid or linear ways but with the recognition that increasing facility with the tools of language and discourse will mediate and develop students' apprenticeship into the discipline over time, just as human cognition and social practice develop through tool use in communities of practice over time (Vygotsky, 1986).

Recognizing that disciplinary literacy learning is a spiraling, developmental, apprenticeship process underscores the argument that mentioning facts and information—even when done repeatedly in long lectures—does not lead to rich and sustained learning. As articulated in the National Research Council's report on how people learn (Bransford, 2000) and its subsequent analysis of the best research on how students learn history, science, and mathematics (NRC, 2005), robust learning depends on the development of deep understanding of core disciplinary knowledge framed conceptually to facilitate access, retrieval, and use. Providing that conceptual frame through inquiry (NRC, 2005) produces robust learning but requires the twin resources of planning and teaching time.

Professional Learning Opportunities and Supports

Finally, like their students, veteran teachers, novice teachers, and school leaders need professional development opportunities that are crafted as apprenticeships into disciplinary literacy teaching. Professional development cast as one-stop lectures, even daylong sessions, will introduce or remind teachers of useful teaching tools and strategies that can be incorporated into the various dimensions of eliciting, engineering, examining, and evaluating, but they will not help teachers and school leaders build the inquiry frameworks necessary to do the work of disciplinary literacy teaching (Bransford, 2000).

This work requires that teachers have opportunities to talk with each other over time, to study their own teaching and the teaching of others, to read and question, and to be apprenticed into disciplinary literacy teaching practices (Greenleaf, 2006; Greenleaf & Brown, 2014). Schools and school systems need to restructure the professional learning opportunities they provide teachers to focus on the navigational work that teachers and students alike must do.

Teacher education programs should similarly consider the support they give to disciplinary literacy learning. One effective move is to ensure that novice teachers have the opportunity to learn about disciplinary literacy in disciplinary cohorts where they can take deep dives into how texts, text practices, and

linguistic, rhetorical, and discursive conventions differ by disciplines (Bain & Moje, 2012; Moje, 2014). Whether integrated into formal programmatic structures or by employing regular workshop sessions, the work of learning to teach disciplinary literacy should begin with a focus on understanding how disciplinary assumptions about knowledge and knowledge production shape the literacy practices and skills demanded by those disciplines.

Until teachers themselves have the opportunity to apprentice into disciplinary cultures and discourse communities, it is unlikely they will be able to do the same for their students. Such professional development work might include opportunities to work with members of disciplinary communities, to conduct inquiry, and to practice speaking, reading, and writing within the discipline. It might also demand opportunities to read and discuss discipline-based research and to read and think together with other subject-area teachers about the practices of disciplinary inquiry through firsthand (physical inquiry) and secondhand (text-based inquiry) investigation (Palincsar & Magnusson, 2001). Whatever the structure, the professional development opportunities need to be sustained, collaborative, and discipline rich.

In sum, a central challenge of disciplinary literacy teaching is not that we need more standards or even that there are so many skills to teach. Instead, I argue that the central challenge lies in thinking that this work is simply about setting standards, or even about developing good curricula, finding great texts, and teaching certain strategies. Disciplinary literacy, or navigational teaching, requires teachers, school leaders, and researchers to recognize several key points. First, disciplines are cultures; they have their own conventions and norms that are highly specialized to particular purposes and audiences. Second, disciplinary practice is action oriented; it revolves around human beings trying to solve problems or address questions of curiosity, passion, or urgency. Third, learners need purposeful and meaningful experiences with texts situated in sensible conceptual frameworks. Fourth, disciplinary literacy practices can be learned by all youth, not just the "good readers" or the Advanced Placement or honors students; indeed, more students might be motivated to read and write in the disciplinary subject areas if they were trying to answer real questions of the disciplines. Finally, teachers need both teaching and planning time and professional learning supports to enact demanding disciplinary literacy teaching practices. If educators can agree on those assumptions, then we can begin to craft disciplinary literacy curricula and teaching practices that will support all students in deeper and more meaningful learning for productive lives beyond high school.

Notes

1. It should be noted that what constitutes a discipline versus a subdiscipline or field is a question worth pursuing but one that is beyond the scope of this article. I refer in broad strokes to the disciplinary divisions that frame the four dominant subject areas

of schooling: mathematics, social sciences, natural sciences, and language and literary studies. Within each of those categories exist more precise disciplinary divisions. Within the social sciences, for example, reside history and economics, which are vastly different disciplinary traditions. Even in history some scholars work from a humanist approach and others from a social scientific approach. Thus, the disciplines themselves are not neatly organized or predictable. For the purposes of conceptualizing disciplinary literacy, however, these broad categories are sufficient to *begin* a conversation. More theorizing is needed to move the work forward with precision.

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