Towards a Theory of Practice: Critical Transdisciplinary Multiliteracies

Book Chapter

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CHAPTER 5

TOWARDS A THEORY OF PRACTICE

Critical Transdisciplinary Multiliteracies

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A BACKGROUND PROBLEM

In the fall of 1999 NYC was in the heart of an "outbreak"—the now-famous West Nile Encephalitis cases that caused several deaths around the city. In response to the outbreak, city officials began spraying neighborhoods in the city with Malathion, an insecticide that kills the species of mosquito spreading the virus. As teachers in lower Manhattan, working in the densely populated neighborhood of Chinatown, the questions this situation brought up seemed rich, and relevant to students' lives. How is the dis-

ease spread and what is its etiology? What are some ways to respond to or prevent West Nile outbreaks? Does it make sense to spray neighborhoods with Malathion, in the interest of public health? What could we learn about this epidemic from studying epidemiology and the social consequences of past epidemics?
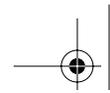
We proposed a project in which our 8th grade students would learn about this problem and suggest a solution. As part of the solution, they would take responsibility for publicizing their work to other members of the community.

Near the end of the project, one girl whose work had seemed to meet the requirements all along wrote a report about her group's findings. They were learning facts, but they could not fit the information together. They did not know the bigger purpose of the project, or what they were supposed to be learning. This situation was one of our first exposures to a central problem in the kinds of interdisciplinary projects that secondary teachers assign: students are not able to piece together disparate content knowledge and create new ideas. The project seems clear and the content is topically related, but little happens over the course of the work for students to connect to any enduring understanding of how disciplinary knowledge works.

This incident points to a fundamental misunderstanding about what interdisciplinary instruction could be. Often, interest in interdisciplinarity is based on an assumption that "life is interdisciplinary," a rather facile notion that since we use math, reading, science, and history to solve everyday problems, formal schooling should do the same if it is to be relevant to students' lives. When this approach fails, the tendency is to point to the obvious problems: these kids don't get it; they don't really understand how to work at this level; they don't really know how to read and write well enough to take on these problems; they don't really care.

We want to offer an alternative way of looking at the failure and dismissal of interdisciplinary curricula in schools. We propose a shift towards transdisciplinarity; a model based on alternative ideas of disciplinary knowledge, subject area literacies, and student subjectivities. Given our move to transdisciplinary curriculum, we address two major questions:

1. How can inquiry into disciplinary knowledge structures facilitate student learning in different subject areas?

2. What kinds of tools do students need to move from learning to critique to learning through design?

We explored curricular examples of transdisciplinarity in the context of a three-year-long research collaboration at a small public middle school in New York City's Chinatown. This research was unique, in that it involved
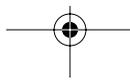
the collaboration of a university researcher with two full-time teachers, both of whom had opportunities to develop new curriculum, experiment with scheduling, and integrate work in the disciplines. It provided an opportunity to research literacy and pedagogical practices over time, with groups of sixty eighth-grade students, most of them first or second-generation immigrants from China.

This study demonstrates how a transdisciplinary curriculum can promote students' learning in humanities, science, and math classes. Inquiry into disciplinary structures as a central part of the 8th grade curricula in the core subjects developed a pedagogical stance toward work in English, social studies, mathematics, and science. At times, this stance was characterized by confusion and ambiguity among students, as they developed the ability to question texts in social studies and English but had trouble to do the same kind of critical work in science and math. In other words, we found that inquiry into disciplinary structures, even around similar types of issues such as visual literacy or persuasion, created different results and was strongly influenced by prior experiences students had had with those subjects. While a background in progressive, workshop-based reading and writing might have allowed students to question the neutrality and authorship in texts, we found the ideology of science and mathematics students had learned previously in and out of school was much more difficult to problematize.

Questioning notions central to interdisciplinarity, we challenge the assumption that knowledge is a *thing*—that exists outside of the interactions and contexts that create it. This assumption seems to underlie ideas of theme-based interdisciplinary instruction, in which students learn different bits of information, but are left on their own to make sense of these bits. This information appears to be separate from its own formation, from its use and applications. Contrast this with Foucault's (1972) notion of knowledge as practice in his study of medical discourse:

> What one must characterize and individualize is the coexistence of these dispersed and heterogeneous statements; the system that governs their division, the degree to which they depend upon one another, the way in which they interlock or exclude one another, the transformation that they undergo, and the play of their location, arrangement, and replacement. (p. XX)

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For curriculum theory and practice, Foucault's argument implies that knowledge should be conceptualized in terms of disciplinary power. The epidemic project failed to front the production of knowledge, because while students produced engaging and effective writing, and students may have learned some interesting and important facts, they had little sense of the ways to organize these facts—the knowledge necessary to design and create productions that work as public documents.
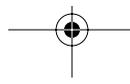
The assumption that the integrated, organic nature of the "real world" demands an interdisciplinary approach to curriculum is flawed. Being literate, generally and disciplinarily, requires an awareness of the demands of particular discourse communities. This is particularly important, as the texts encountered in school tend to position the reader or viewer through language and structure. It is for this reason that teaching a subject like science, for example, is not exclusively about the content. As Lemke (1989) points out, "What we get students to do is talk, write, and otherwise act in the special ways particular to schools and to the specialized subjects we teach" (p. 8). Part of this includes getting students to read in certain ways that the specialized subjects demand, what Hasan calls, *register*. Student work really cannot be interdisciplinary without a *register repertoire*—"what people use their language for, what social processes they engage in" (Hasan, 1996, p. 396). That is, an understanding of how language and discourses function is an integral part of learning the information in a subject area. Consequently, this issue of register changes the way we think about interdisciplinarity.

Shifting to Transdisciplinarity

Disciplines as social organized structures of knowledge production are historical and future oriented social institutions with conventions and standards to evaluate and arbitrate. They conserve and change; none are the same and some may differ radically in how they function. Etymologically, discipline derives from words meaning both to teach and to learn (Hoskins & Macve, 1986, p. 106, cited in Shumway & Messer-Davidow, 1991, p. 202). Modern disciplines are not arbitrary "administrative categories" cosmopolitan communities of practice (Shumway & Messer-Davidow, 1991, p. 208). Understanding disciplines as social practices can help relate the disciplinary organization of knowledge to other social practices (Shumway & Messer-Davidow, 1991, p. 211). Disciplinary knowledge in the sciences and humanities in representing the world also intervene in it (Fuller, 1988). A discipline has "an agenda, an attitude, and a language" (Shumway & Messer-Davidow, 1991, p. 219).

Disciplinary conventions and standards are frequently described as continuative and defensive mechanisms, which form boundaries or borders that must be negotiated. The permeability of these boundaries denotes key differences among disciplines. Borders makes working within disciplinary boundaries "intelligible because it is held against something it is not" (Stewart, 1989, p. 10). The trope of moving across disciplinary boundaries constructs a static conception of disciplinarily, that "fail[s] to allow for either changing aims and actions *within* a discipline or overlapping aims
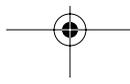
and actions among disciplines." This "two-dimensional" metaphor "fail[s] to describe adequately the role of language" (Lyon, 1992, p. 682). Below Bourdieu's notion of field with its operational metaphors of game and market is proposed as an alternative to the trope of boundaries.

Dewey argued that the structure of the disciplines should not dictate curriculum and that learning should be experiential; interdisciplinarity was also a hallmark of early progressive curricular reforms, such as Kilpatrick's "Project Method." Klein (1994, p. 4) provides a history of the   AU: not in REFs
emergence of interdisciplinarity in curriculum theorizing; concluding that, while much schooling continues to rely on subject specialization to construct different forms of knowledge and skills, progressive educators have employed the concept in interdisciplinarity to contest overspecialization in subject areas and the transmission of information over understanding and problem solving. Additionally, interdisciplinarity is credited in developing students' affective as well as their cognitive abilities, respecting student diversity, broadening students' facility with wider texts and genres, encouraging their creativity, and promoting their awareness of and response to social, political, and ethical issues. In most cases, interdisciplinarity stresses the requirement for a plurality of disciplinary approaches in problem solving, in making connections within and between disciplines, and in preparing students for social futures in an increasingly complex world that cannot be addressed by disciplines taught in isolation (Stark & Lattuca, 1997, pp. 352–355). Interdisciplinarity has been variously defines as borrowing across disciplines, collaborative problem solving, bridge building, theoretical synthesizing, and the development of new fields in overlapping areas study (Klein, 1990). This conceptual imprecision in reflected in how other   AU: not in REFs
terms associated with interdisciplinarity have been applied, including transdisciplinarity.

Inter-, multi-, trans-, and cross-disciplinary descriptors are employed to describe a wide spectrum of curriculum planning (Scott, 1979). But these terms are used in common to redefine the relation between specialization in one discipline and common work across disciplines (Glasgow, 1997, p. xxiv). Interdisciplinary teaching depends not so much on the existence of several disciplines as it depends on the existence of a point of view toward the subject matter and toward knowledge in general. Frequently, then, interdisciplinary curriculum is organized around a topic, issue, period, institution, or place, focusing on a theme rather than a particular body of knowledge or skill and on collaborative teaching. Some distinction can be made among interdisciplinary and cross-disciplinary, multi-disciplinary, and trans-disciplinary teaching. "Crossdisciplinary...refers to efforts to view one discipline from the perspective of another, often subordinating the phenomena from one discipline to the other" (Klein & Doty,
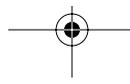
1994, p. 4). A multidisciplinary approach associate previously separate subject areas, but does little integration among them.

Given its appeal, it is important to note problems associated with interdisciplinary teaching and learning. These are generally associated with what Klein calls the 'disciplinary paradox' (Klein, 1990), "one the one hand, the fragmentation of knowledge into the disciplines leads to the necessity for interdisciplinary approaches, yet, on the other hand, interdisciplinary approaches to knowledge can only receive an epistemic justification for knowledge claims" (Petrie, 1992, p. 305). Interdisciplinarity faces the 'burden of comprehension" with the disciplines marshaled to study a particular phenomena and the additional responsibility of maintaining intra and inter-disciplinary standards and confidence (Klein, 1990). Pragmatically problem oriented, interdisciplinary professional schools, specific focus areas, minors, and general education programs are well established in tertiary education. Secondary and primary education, similarly chafe at disciplinarity's straightjacket, evident in timetables and isolated classroom teaching. Over the past several decades, curriculum standards have increasingly relied on notions of interdisciplinarity to shift the goals of teaching and learning to the understanding the processes, the appreciation of social implications, and the development of communicative capacities. Along with these standards new forms of assessment have been developed and tried. Yet, while narrow discipline-focused learning does not often apply to specific real world problems, interdisciplinary situation-based problem solving may not lead to generalizable applications (Petrie, 1992, p. 326). Given such an epistemological limitation, "The only solution would seem to try to construct some transdisciplinary notion of knowledge that encompasses all the disciplines and their specific methodologies and provides an overall epistemic justification for knowledge claims" (Petrie, 1992, p. 305).

Researchers and teachers often pair interdisciplinarity with curricular and school reform efforts to counter disciplinary overspecialization and the fragmentation of knowledge. Frequently this work is situated within binaristic debates; for example, teachers and researchers conjoin interdisciplinarity with child-centered pedagogy and traditional disciplinarity with teacher-centered curriculum. Fish (1989) argues that it is impossible to "inhabit" one disciplinary field at a time (p. 21). Knowledge production is inherently local; texts must constantly be "imported" to do interdisciplinary work (p. 19). They carry signs of their discipline of origin. Consequently, interdisciplinary tasks require "information" or "techniques" taken from existing disciplines or reconstructed in some new or expanded discipline (p. 21).

Critics of interdisciplinary curriculum have argued that discipline-based standards are weakened by interdisciplinary approaches. Students need to be introduced to disciplinary practices and concepts before they can make interdisciplinary connections. Further, disadvantaged students'

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unfamiliarity with discipline-centered discourses is often overlooked in interdisciplinary education. Wineburg and Grossman's (2000) work points to these issues:

> What tends to happen with such curricula is that disciplines become storehouses containing topics for classroom activities; typically, however, only one part of the disciplinary storehouse is raided while another is systematically ignored. . . . [T]he "disciplined" part of the disciplinary tends to fall away, leaving a body of information without the tools for evaluating its quality or warrant. (p. XX)

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If this is the case then researcher/practitioners should reexamine disciplines as lenses for reading the world–different ways of knowing that are ideological in terms of their particular objects, meanings, and values. They are resources that foster but also shape students' learning. Transdisciplinarity attempts to provide an overarching framework of meaning to thematically related disciplines (Davis, 1995; Kockelmans, 1979).

Transdisciplinarity's attraction lays in the meaningful integration of knowledge, has been associated with general systems theory, and address questions of theoretical understanding (Petrie, 1992, pp. 304–305). Klein (1994) argues that transdisciplinarity is a response to the "complexity, hybridity, non-linearity, and heterogeneity" of post-modern culture of knowledge production (p. 1). In this way, transdisciplinarity shares much of interdisciplarity's warrant. Jantsch (1972), who called for a qualitatively different approach to disciplinarity, is often credited with the term. CIRET, the International Centre for Transdisciplinary Research, under the direction of Basarab Nicolescu, was founded in 1994; since then, four conferences have been held.

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Similarly the Academy of Transdisciplinary Education & Research (ACTER) was founded at the University of Texas to "create an environment for global collaborative efforts in transdisciplinary education, research and training and to facilitate the development of transdisciplinary programs and processes (Ertas, 2000). Yanz's (2006) review of transdisciplinary theorizing to date notes that there is variation (some of it seemingly contradictory and subject to Klein's paradox) in how the term has been described and applied in projects. But, he notes that the general argument for transdisciplinarity runs:

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> It is not enough to simply encourage disciplinary cooperation without an intellectual framework, and an epistemology that direct this. It is not enough to simply hold onto the twin goals of efficiency and progress, and find ways that disciplines can mine the resources of other disciplines to achieve their goals. And, it is not enough to predetermine the nature of conversation between disciplines by establishing an over-arching "meta-discipline." What is

needed is a way of preserving the particularity of disciplinary knowledge, while at the same time finding the underlying rationality. (Yanz, 2006, p. 4)

While the substantive proportion of transdisciplinary theorizing has been in tertiary education and research, transdisciplinarity in curriculum design is just entering primary and secondary education. Following the conceptual lag that has historically occurred between tertiary, secondary and primary education, the transdisciplinary wave has just broke on school pedagogy and practice. Kline (2004) notes that Swiss primary schools have a long of transdisciplinary learning in environmental studies. Perhaps the largest transdisciplinary project so far has been the Queensland New Basics Project refers to the Rich Tasks, in Australia. The heart of this curricular innovation is described as transdisciplinary in nature (Luke et al., 2000). Currently UNESCO's (n.d.) Education for Sustainable Development Program links changes in ways of thinking about the challenges and changes facing the world with

transdisciplinary and inter-sectoral approaches that provide people with the tools to confront and adapt to the changes taking place around them; decision-makers with the information, skills, and will to make future-oriented choices; and the international community with a global commitment to a world of socially just and peaceful development. (p. XX)

Transdisciplinary Multiliteracies

A *trans*disciplinary model provides a way of structuring curriculum that takes into consideration school disciplines and their corresponding social fields. We consider multiliteracies curriculum to be fundamentally transdisciplinary, because it emphasizes the importance of critical language skills and social semiotics in school subjects.

Multiliteracies became a means for our collaboration to work together in constructing new transdisciplinary curricula. Multiliteracies, as first theorized by The New London Group (1996) and later more fully by Cope and Kalantzis (2000), provided an initial framework for curricular theorizing and practice that includes Situated Practice, Overt Instruction, Critical Framing, and Transformed Practice. This framework helps students locate themselves in texts, learn the tools and "grammars" for understanding meaning-making, and eventually use this learning to (re)construct texts and act on the world.

Moje and O'Brien's (2001) collection of case studies is useful in connecting critical multiliteracies work with transdisciplinarity. As Luke (2001) notes in the Foreword, some of the studies demonstrate how taking up new practices helps students engage with and contest disciplinary language,

practice, and ideology. He writes that students like ours live in economies and cultures that are

> ...complex, multiple, and characterized by rapid change, uncertainty, and complexity. The teaching of [multi] literacy is an introduction to semiotic economy where identities, artifacts, texts, and tokens are exchanged in predictable and unpredictable ways. (Luke, 2001, p. xiii)

We were compelled to reconceptualize our curriculum theory as a response to the implications of thinking about students' lives in the ways Luke suggests and how our students embody these literacies, as they take up positions within different social fields. We will return to the idea of "habitus," and related Bourdieusian understandings of social field later in the paper.

Connecting these two strands—critical multiliteracies and transdisciplinarity—Gee (1990), Lankshear et al. (1997), and Muspratt, Luke, and AU: not in REFs Freebody (1997), helped us think broadly of the challenges faced in conceptualizing this curriculum as transdisciplinary. For instance, considering constructivist pedagogies in subject English and science as similar is problematic. Morgan (1997) points out that instruction "tend[s] to de-emphasize the positions of students as subject to discourses and knowledge and the power these produce" (p. 110). Re-reading "traditional" progressive pedagogy and critical pedagogy, we see a rationale for rethinking educational disciplines as multiple literacy practices having different kinds of discursive power, and demanding multiple classroom approaches.

In the humanities and science curriculum—and to a smaller extent in mathematics—we introduced critical semiotic perspectives and modes of analysis. To connect the work in different disciplines, we cobbled together analytical strategies and approaches for purposes of "critique" and "design." Techniques such as reading strategies that make up "critique" are connected with "design" in the curriculum, as students apply strategies to their own productions, taking into consideration, for example, ideas about genre and audience. We conceptualize design as an integral part of assessing the kind of transdisciplinary multiliteracies work we are theorizing. In a transdisciplinary curriculum, design can be a way of assessing and understanding students' critical reading. The New London Group's (1996) explanation is helpful:

> The notion of Design recognizes the iterative nature of meaning-making, drawing on Available Designs to create patterns of meaning that are more or less predictable in their contexts....It is also important to stress that listening as well as speaking, and reading as well as writing, are productive activities, forms of Designing. (p. 22)

In a curriculum that privileges the role of language and discourse in shaping the school subject, the measure of students' work is really in their design of various texts—encompassing a variety of spoken and written discourses. That students are incredibly creative, able to draw on diverse uses of language in order to create cultural "productions," is a foundation of cultural studies and media studies work in education (Buckingham & Sefton-Green, 1994; Willis, 1990). The usefulness of the multiliteracies notion of "design" is that it makes the idea of production relevant for work in school subjects that might not seem on the surface to be related to popular culture.

Table 5.1 shows how, in a transdisciplinary curricular model, certain kinds of critique work might enable students' competency for design. We draw heavily on systemic functional linguistics (Fairclough, 1995a; Halliday, 1994; Martin & Veel, 1998) to think about grammars for facilitating design and production. For instance, work in systemics can inform visual critique and design, emphasizing text production and social uses (Kress & vanLeeuwen, 1996, 2001). In visual work, systemics connects to genre-based transdisciplinary curriculum (Kamler, 2001; J. Lemke, 2000; Unsworth, 2001), as students look at the relationship between grammars and the construction of different texts within and among disciplines. Multimodal and intertextual understandings of texts ideas from systemics to analyze the social issues related to the production and consumption of texts (Fairclough, 1995b; Kress & vanLeeuwen, 2001; J. Lemke, 2004; Peim, 1993).
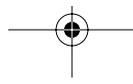
Some Examples

In science, students read two different texts about penguins, critiquing how a naturalist essay from *The moon by whalelight* (Ackerman, 1992) differs from a section in a science trade book. In the essay, the processes by which penguins stay warm and survive in the Antarctic is explained through descriptive language and active voice:

> A heat lamp, attached to each crib, bathed them in red light. In each crib, six chicks huddled together—gawky, rubbery, scruffy….They needed the heat lamp and their collective body heat to stay warm. In the wild, hundreds of baby penguins huddle, with those at the outer edges frantically trying to push their way into the middle…. (p. XX)

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In the trade book text, on the other hand, the emphasis is on diagrams and photos that explain the same concept. The emotional language is absent, and instead the penguins are referred to impersonally.

In doing a critique of these two texts, we worked with students to determine the positions of the texts through the language used, but also
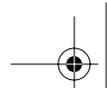
TABLE 5.1
Connection of Critique to Design

| Transdisciplinary Work	Critique Examples	Design Examples
Critical language work, for example: • nominalization • modality and mood • collocations • ordering	In science, students looked at the use of collocations in texts about penguins. They moved from language analysis to a consideration of how language is used in different science genres. In social studies, students considered the gaps and silences in texts around Chinese immigration and exclusionary legislation.	In humanities, students did argumentative writing about historical events (such as Japanese internment), using nominalization and modality to produce effective academic writing.
Investigating genres and intertextuality, for example: • gaps and silences • construction of authority • register and modality • degree of nominalization • cultural production of texts		In science, students drew on understandings of position and vectors to design water cycle diagrams. Through these diagrams, students communicated positions about water resource use, through their choices of information, placement of processes, use of size and color, and organization of vectors.
Visual and media grammars, such as: • vectors and positioning in visual texts • anchoring; relation of visuals to print texts	In social studies, students represented ways of reading propaganda from the Spanish-American War. They analyzed the use of vectors and placement of participants in the posters to front certain ideas of war and position the viewer.	
Multimodal work	In humanities and science, students investigated the ways in which textbooks, like online sites, invite particular ways to navigate, and thereby generate particular narratives and ways of reading.	In science, students adapted PowerPoint presentations about plate tectonics to interactive, non-linear websites that could be navigated by readers. In social studies, students wrote history textbook chapters about Chinese immigration history and racism. Responding to readings from common history texts, they integrated photos, images, and print texts to create paper and online chapters/sites that were critical of dominant representations of the Chinese experience in the United States.
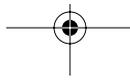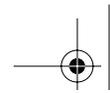
through the ideas not taken up. The trade book left out any mention of penguin survival or endangerment, instead taking up a more "neutral" position. But anthropomorphizing the penguins, and discussing their care and management in a wildlife center, the Ackerman essay created a different perspective. Often, in science curricula, the emphasis is so heavily weighted towards "getting the information" out of a text that students do not learn critical reading skills that utilize language and narrative analysis.

Finding gaps and silences in texts was an early from of analysis students used when reading historical accounts as well (Peim, 1993). As they read different history texts they looked for the excerpts that referred to the Chinese Exclusion Act and other legislation from U.S. immigration history, uncovering the gaps in these texts around Chinese immigration. Thus, instead of learning about Chinese immigration through a timeline of events, students looked at this history as it is constructed through text and discourse. The point in both of these examples of critique is that students were learning similar strategies for approaching and analyzing texts across the disciplines. In science class they were learning to distinguish environmentalist, narrative writing from "neutral" scientific writing, while in social studies they were looking at the construction of different views of history through the narratives in the text. We began to note how, through learning semiotic strategies, as in this examples, students might be able not only to re-position texts, but also become more critical and aware of science and history as disciplines and fields.

Another transdisciplinary example of students engaging in critique was their work with visual texts, which started as students were reading texts produced during the Spanish-American War. Students developed intertextual critiques of ideology construction around race and patriotism through binarisms of good/evil, civilized/savage, and clean/unclean. Then, students put together displays explaining these intertextual connections. These initial critiques showed an understanding of ideology working during that time period. After instruction in the reading of images through the grammar of visual design (Kress & vanLeeuwen, 1996)—specifically the significance of participants/circumstances, vectors, color, perspective, and framing—students reappraised their original critiques.

Similarly in science, students studying the uses of water represented their learning through water cycle diagrams. Most of these diagrams showed the general water phase changes—evaporation, condensation, precipitation—students learned about as they studied how water moves through the earth's atmosphere and lithosphere. These phase changes were shown with similarly sized vectors connecting the different parts of the diagram, although some of the events might take up more time or energy or matter in actual atmospheric interactions. The way students designed these initial water cycle diagrams indicated not only a shallow understanding of different
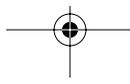
water processes in the Earth, but also a limited understanding of how to graphically show these interactions. These diagrams stand in stark contrast to the graphics students produced after some work with same visual grammars mentioned above. The diagrams show students' understanding of the relevant importance of different characteristics of water usage through the use of vectors and colors. Instead of showing a few major events, these diagrams showed different levels and types of events. This is not a minor difference, because this design work took students from critiquing other texts to using that critique for the purpose of what The New London Group (1996) calls *re-design*. The re-design reflected the textual work students had been doing with visual techniques across the disciplines, in addition to the specific work with water issues in science.

Multiliteracies as a theoretical framework connects this concept of redesign to *transformed practice*: "Transfer in meaning making practice, which puts the transformed meaning (the Redesigned) to work in other contexts or cultural sites" (The New London Group, 1996, p. 35). What does transformed practice look like in school? A group of students involved in this research designed a website as a part of a competition (the *ThinkQuest Challenge* http://www.tqnyc.org/NYC030395/); in this website they worked with modes of analysis and critique they had used in school social studies (the Available Designs). They took the Available Designs that they had learned from working with school texts, and particular ways of thinking about social history, but they put them to work in a new, web-based context. For instance, they re-located popular musicians (like Naz and Eminem) within discourses of protest in social history.

We wonder about how "transformed practice" functions differently in social studies and in science. Even in constructivist models of science instruction, the emphasis is often on students "discovering" science truths; in social studies, on the other hand, the idea of what students are to "discover" is less clear. We take this to be an indication of the stronger connection between academic field—the truth of science—and school discipline in science as compared to social studies. The questions of academic field, of the types of identities students are to inhabit as they become "literate" becomes as important as the critical and design work involved in multiliteracies.

ISSUES OF FIELD, HABITUS, AND CAPITAL
IN STUDENT DESIGN

It is important to ask the question whether pedagogy and critique can come to permit disciplinary knowledges to be transmitted, but transmitted in ways which are accountable to critique. (Yeatman, 1997)
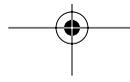
Teaching and learning in science and humanities classrooms does more than employ decontextualized texts and techniques. In each, commitments are made to different understandings about the kinds of knowledge that are most valued, what it means to know something, what subject positions are enacted in the pedagogical exchange, and what vision of social relations is privileged. Pedagogy is about subject formation. It is an intervention in the lives of subjects and in the spaces they inhabit. Curriculum and instruction access linguistic and literate markets which represent social spaces that regulate particular forms of capital (Luke & Freebody, 1997).

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School subjects are differentially related to the intellectual field. Science instruction may be more closely connected to the scientific field while humanities classrooms appear to have a looser relation to a number of fields (English Studies, History, Geography, etc.). The relative autonomy of a field can be measured against its capacity to retranslate and interpret the demands of overlapping and intersecting fields on its own terms, especially within the field of power. Sciences' autonomy is reflected in its ability to legitimate existing social relations within itself through a defense of its doxa, reason, and value (Swartz, 1997, pp. 126–127). Highly autonomous fields acquire forms of symbolic power to regulate the exchange of capitals within them. The humanities are less autonomous, subject to greater outside influence upon the relatively contested value of capitals within them. From our research, we will explore two examples of this differential relationship. We have already mentioned Con <--> Texts, a student-designed website arguing for the use of multi-modal documents to understand music as social protest. The other example comes from an earth science activity in which students designed graphs to represent different interpretations of experimental data about the heating and cooling rates of sand and water. Negotiating how to represent evidence graphically in a way that could make a certain point—and often students were trying to re-design the data to uphold the science concept of specific heat—students took up modes of discourse and argumentation specific to science as an academic field.

The intellectual field constructs particular dispositions and habitus. Fields may be conceptualized as structures of provisional balances within which the various forms of power circulate. As fields and the powers that shape them are made explicit, they point to possibilities for reshaping them in different ways. Bourdieu defines habitus as "a set of historical relations 'deposited' within individual bodies in the form of mental and corporal schemata of perception, appreciation, and action" (Bourdieu & Wacquant, 1992, p. XX). Luke notes that, "For Bourdieu (1988; Bourdieu, Chamboredon & Passeron, 1991), the basis of learning is the habitus, the derivative, structured and structuring location of learning, sensibility, taste, knowledge, and practice [within the subject]" (Luke, 1995, p. XX). Habitus is the unconscious dispositions of a subject to act in certain ways. Habi-

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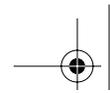
tus has a limitless capacity for generating concepts, insights, texts and actions. These, though, are constrained by the historically and socially situated contexts of their production. The habitus has a range of action that lies somewhere between unrestrained creativity and possibility and deterministic conditioning and reproduction. Students continuously (most often somatically) evaluate learning, which leads to new experiences and responses within the pedagogical field and related disciplines.

Bourdieu's metaphors illustrate how students within each school subject face established structures of expectations and are positioned within various contexts of chance and possibility, shaping their interactions with teachers and texts. Cultural capital can be embodied in knowledge, skills, and practices enacted in the hexis/body of the subject. It can be objectified in material goods and institutionalized in academic and professional accreditations. Forms of capital associated with particular fields and disciplines are produced discursively in classrooms. Discourses function as socially accepted associations among ways of using language—of thinking, feeling, believing, valuing, and acting—that identify one as a member of a socially meaningful group or "social network," or to signal that one is playing a socially meaningful role (Gee, 1990, p. 14). Pedagogies that are only [AU: not in REFs] vaguely aware of how practitioners and students as subjects are incorporated, "enfleshed" in some discourse every time they speak and act (and how discourse is disciplinary) may not be as effective in helping students understand the values and conventions of capital accumulation available in school subjects, disciplines, and related fields.

Bourdieu defines field broadly as an "area of production, circulation and appropriation of goods, services, knowledge, or status, and the competitive positions held by actors in their struggle to accumulate and monopolize these different kinds of capital" (Bourdieu & Wacquant, 1992, p. XX). The intellectual field, as noted above, is constructed through the [AU: pg nos. for direct quote] contest of artists, writers and academics across many institutions. Fields span institutions such as homes, schools, universities, publishing, professional bodies and the state. It lies within and between institutions that are tied to unequal and different positions of power within the field (Bourdieu & Wacquant, 1992, p. 132). Intersections within the intellectual field and related disciplines are formed in conflicts over academic rigor, theoretical versus practical knowledge, research versus pedagogy, etc. Bourdieu notes that there is often an unacknowledged or misrecognized complicity in accepting the rules of the game in fields (Bourdieu et al., 1991, p. 45). Students, being initiated into various texts and text practices, are constructed in this presupposed acceptance.

The design of the Con <--> Texts website and the science graphs to represent sand and water cooling both display students' differential discursive resources as embodied cultural capital, in differing academic fields (Luke,

1995). In the case of the website design, the construction of the website is mediated by students' available capital and illustrates the laws of conversion of capital within and across different social fields. As we worked with students, the cultural capital students acquired—skills and dispositions—and its recognition brought out the significance of linkages between habitus, capital, life trajectory, and field. This is an example of the range and complexity of possible social fields the students could participate in, and the interrelationships between cultural, economic, social, and symbolic capital. In the case of our students' analysis of temperature data, the range of possible social fields is more constrained. The ways the students were able to make generalizations, create data sets, and explain data analysis in the context of a classroom discussion about specific heat and climate are useful discursive practice in the field of academic science and applied mathematics. At the same time, these discursive practices are related to reading popular science and quasi-science texts (such as the El Niño article from *Popular Science* mentioned earlier), but in those situations the ideology of science as a separate field with a certain "mystique" around it (Lemke, 1993) further complicates the connection between school and academic fields.

PRACTICE ISSUES IN A TRANSDISCIPLINARY MULTILITERACIES CURRICULUM

While developing students' critical practices that work across disciplines made sense on a theoretical level and opened up new ways of looking at curriculum, several areas of difficulty became evident. These difficulties in understanding, we noticed, reflected students' uneven transitions to understanding school subjects in relation to academic field, and to using critique and design strategies in ways that reflect the unique demands of different subject areas. This highlights our concern that learning to do transdisciplinary design, as a shift in a student's habitus or academic dispositions, is not an easy process; it contests available ways of thinking about knowledge. Therefore, understanding the workings of habiti and academic field are central to a transdisciplinary multiliteracies curriculum.

It is difficult to assess the degree to which they connect critique practices to the academic field or disciplinary knowledge, even when students can carry out particular strategies well. For example, when discussing the differences among different science texts about El Niño, one student wrote the following:

> Well maybe texts give you different information, because they are probably using El Niño as an example or a main topic.... There are many things to talk about and the people writing the article decides what to write and what
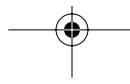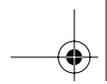
not to write. Some writers find some topics more interesting than others. . . .
Most text have a lot of different information because people have different
information and different things the want the reader to know about.

This student can determine gaps and silences in these texts—an impor-
tant aspect of the intertextual work. But her analysis does not acknowledge
the ways in which differences between the texts are not simply a matter of
preference, but reflect the demands of academic versus popular science.
So as much as the critical semiotic practices made sense to this student, it
did not add up to metacognitive reading involving disciplinary differences.

We learned to pay particular attention not only to the way strategies can
be used in similar ways across the disciplines, but to the ways texts struc-
tures and reading practices differ from one subject to the next. In the con-
text of a group interview, students showed that they do not always translate
critique into an understanding of how authority, persuasion, or argumenta-
tion operates differently from one subject to the next.

Teacher 2: What about the difference between the El Niño stuff and,
say, the Teddy Roosevelt stuff?

(. . .)

Student 1: Well, the whole El Niño thing is just facts. . . . And some-
thing like Teddy Roosevelt, you can put any opinion you
want in it. So that puts a little more work in humanities,
actually. But it's easy.

Teacher 2: So all the texts you read about El Niño were the same?

Student 1: Yeah

Student 2: Mostly.

Student 1: Yeah, I think so.

Student 4: Well, mostly, but not all of them are the same.

Student 5: Most of them were (??) about disasters.

Student 1: Yeah, all you do is pull out the cause and effect from El
Niño, and like, for humanities there's more work to it,
cause of the opinions, and what the author is trying to say.

Student 5: But in the movie we were watching, it gets into politics.

Student 2: Oh, like, everybody knows that El Niño's bad, cause, like—

Student 5: No it isn't.

(students debate about whether El Niño really is bad.)

Student 4: . . . it doesn't always cause disasters, and then. . . . It doesn't
always cause disasters!

Student 1: It can help us. Like we read that magazine. I forgot what it
is *Science Thing? Science World?* I don't know. The one I read
had some . . .

Student 2:   You see, like, Yong here has been brainwashed. (everyone laughing) That El Niño is just bad, but then . . . you can't only trust one source. You have to read a lot of different . . . you have to read both sides. Then you make your (??) . . .

In this exchange, students are struggling to figure out what to do with contradictory notions of reading science. That is, their experiences of finding real ideological differences—expressed through emphasis and ordering in the text—in the various El Niño texts do not match up with their expectations of science as not having opinions. Reading a science text against a humanities text, their emphasis is on uncovering bias, as though anything other than factual information is somehow skewed, trying to brainwash the reader. The idea that texts may present a phenomenon like El Niño differently because of disciplinary issues is harder to grasp. Perhaps this is because students have learned to master, since they were very young, finding fact and opinion in texts. The way this binaristic mode of analysis has taken hold is evident in many of our discussions with students about texts. It overshadows other, more significant disciplinary differences, as students are limited in their approaches to reading:

Student 6:   Also, like, even though science, it has facts, they could also brainwash you, because it's like they write the articles, but then they could also brainwash you with those facts because they pick certain facts to put in those articles. So it's like . . . pretend like if they want you to know like El Niño is really bad. Then they wouldn't put something that's really good. Or they will, like what last time James said, they could try to do bad thing . . .

Student 4:   This is just like the Hakim [social studies] text . . .

Student 6:   . . . They pick certain facts about the incident, so it kind of brainwashes you.

Student 3:   So it's just like humanities, right?

It might be possible to argue that the work in humanities *is* just like the work in science. But the students are not framing the similarity in terms of disciplinary knowledge/practice, in the ways authors' choices are manifestations of genre and register. These examples show us that students struggle with overcoming traditional categories for reading texts—fact versus opinion, biased versus truth, objective versus subjective—that make it difficult to see how disciplines construct opinion or truth or objectivity. Addressing ideological and discursive differences, and contesting students' notions of disciplinary knowledge, is central to transdisciplinary multiliteracies.

CONCLUSIONS

We are excited by the potential of transdisciplinary multiliteracies for developing students' learning of disciplinary knowledge and discourse. Recently, Unsworth (2006) has recently argued the adoption of

> . . . a systemic functional semiotic perspective in outlining a range of different types of such meanings in different kinds of texts, suggesting the significance of such meanings in comprehending and composing contemporary multimodal texts, and the importance of developing an appropriate metalanguage to enable explicit discussion of these meaning-making resources by teachers and students . . . (p. 55)

similar to the one we have advanced in this chapter. Such developments we have argued allow students to analyze, discuss, re-create and produce texts with particular awareness of language and ideology, using strategies taught across disciplines. Students' facility in working with scientific representations such as tables and graphs, posters, collaborative responses to narrative using Flash technology, book chapters, web pages, etc, grew from the semiotic tools they were taught and their personal interest in computer mediated design.

Much multiliteracies-related research is just emerging from the formal discourse of pedagogical theorizing. Cope and Kalantzis (2007) cite examples of current Multiliteracies projects in such diverse locations as South Africa, Australia, and the United States. How it may look in practice, and issues influencing its implementation, need greater exploration. Our research was initiated under this warrant. Similar to researchers investigating new literacies (Lankshear & Knobe, 2003; Alvermann, 2004), we felt the superficial implementation of a multiliteracies pedagogy in schools had the likely potential to produce unproductive skill and drill activities. Instead, we envisioned using multiliteracies pedagogy because of its vast potential for meaningfully integrating print, multimodal and digital design practices in schools in a way that transforms learning. Imagining multiliteracies pedagogy may be frustrated by traditional print-privileging curriculum and undervaluing students' online or out of school literacy practices (Chandler-Olcott & Mahar, 2003; Young, Dillon, & Moje, 2002). The tensions surrounding the implementation of multiliteracies pedagogies are similarly reminiscent of both the tensions surrounding the infusion of art into education and the case against standardization of the curriculum. Those who resist redesigning traditional or progressive pedagogies to allow from more relevant student-centered learning are most likely displaying similarly resistant discomfort to both art-based and internet communication-based education and often resort to skill and drill approaches and standardized test preparation. We worked within school disciplines while
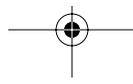
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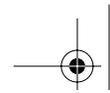
situating curricula in students' subjectivities as poor urban Asian youth and competent users of Internet technologies. Lankshear and Knobel (2003) use the terms *newcomers* and *insiders* to categorize what they see as two different mindsets about new literacies or youth multiple literacies. The newcomers affirm these literacies the same as before, only they appear on screen rather than on paper and the insiders affirm new literacies as radically different. Like insiders, we sought to move away from traditional forms of pedagogy and incorporate the out-of-school literacy practices of our students as a result of their engagement with new technologies and resulting social and economic shifts in their life worlds. Even in the poor, urban community where we situated this research, it was possible to enact a multiliteracies practice.

As artful actors within semiotic systems, these students were able to meld disciplinary knowledge with the strategic employment of design, adapted to the particular discursive demands of a variety of academic tasks (Newman, 2003). As teachers and researchers, the open-ended set of transdisciplinary semiotic tools permitted us to investigate a multiliteracies pedagogy that elided school/non-school and official/unofficial literacy binarisms. Some of the humanities and science curriculum engaged students in representational tasks connecting their technical expertise with valued school genres. In this sense, this research attempted to respond to New Literacy Studies' call (Hull & Schultz, 2001) for research explicitly addressing classroom practice. Yet, projects related to multiliteracies and, especially, transdisciplinarity theorizing remain in their infancy in secondary and primary education. Their development will necessarily include discussions about how to their place within systems of assessment and accreditation.

The recognition of the generative value of students' contexts and personal literacy practices needs to be framed within understanding the disciplined nature of knowledge and practice. This transdisciplinary multiliteracies curriculum allows us to move away from a limited and even "ghettoizing" idea of how to teach a linguistic/ethnic minority group like students in Chinatown. The social and cultural capital associated with literate practices in disciplines and their social fields is central in multiliteracies research. Student success in terms of grades, accreditation, or personal satisfaction in school is in part determined from how well they can strategically navigate the knowledge, discursive, and design requirements as they are introduced in various disciplines. Using identity as a way into literacy, students' hybrid subjectivities allowed us to think about much of this work in more complicated ways. Rejecting the notion of a fixed diasporic, split-identity this curriculum centered designing the texts that make up their world and embodying the kinds of disciplinary practices they want to be a part of. The way we have theorized transdisciplinary multiliteracies, and the curricular examples we have discussed, demonstrates a clear way for lit-

eracy to move away from a fixed and reactive understanding of the significance of identity to literacy—instead favoring a framework that gives literate students more agency, more knowledge.

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