Letter from the Editors

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This issue of *Language and Learning across the Disciplines* has a distinct focus on writing instruction in disciplinary sites. "Inquiry as a Non-Invasive Approach to Cross Curricular Writing Consultancy" uses the Freirian approach usually associated with cultural studies to critique a too-easy application of composition theory to other contexts. Its author, Mark Waldo (University of Nevada, Reno), sees a danger of faculty from the English department imposing their own values on faculty from other departments. Ann Dobie and Gail Poirrier (University of Southwestern Louisiana), however, report on trying one of composition's favorite concepts, writing-to-learn, in a disiciplinary context, and liking it. "When Nursing Students Write: Changing Attitudes," supports traditional WAC claims that writing-to-learn humanizes the disciplinary classroom. Students who wrote journals appear less likely to give up the class altogether.

Deep in the disciplines now, "What's Love Got to Do with It? Scholarly Citation Practices as Courtship Rituals," by Shirley Rose (Purdue) focuses on the language of the disciplines, interpreting scholarly citation practice in opposition to current economic readings—which her theory requires her not to name. Courtship, rather than competition, is, she argues, the driving metaphor.

The penultimate essay, "Beyond Mainstream: An Interdisciplinary Study of Music and the Written Word," written by Thomas Strychacz from the English department and David Bernstein from the music department of Mills College, elegantly models an interdisciplinary undergraduate course in music and poetry that is based on Leonard Bernstein's reading of Noam Chomsky. And the final essay, "The Role of Written and Verbal Expression in Improving Communication Skills for Students in an Undergraduate Chemistry Program" by Brian P.

Volume 1, Number 3: August 1996 DOI: 10.37514/LLD-J.1996.1.3.01

Coppola and Douglas S. Daniels (University of Michigan, Ann Arbor) offers an account of the techniques they introduced into one of their courses to enhance student learning.

With this issue of *Language and Learning Across the Disciplines* we signal our thinking about what we would like to do differently, now that we have actually produced all of Volume 1. We will not settle into any one new format, as you can see by checking the inside back cover of this issue, where we provide a preview of the issues projected for next year. But in addition to research on language and learning across the disciplines, which has been the focus of the first two issues, we will include descriptions of practice -- the practice of language, the practice of teaching -- essays on that experience, and bibliographies and reviews.

To that end, we are providing you, our readers, with a list that simply notes books of interest to us in the context of this journal. In due time we expect to review them. If you would like to be the person who writes one of these reviews for us, please get in touch with Sharon Quiroz.

We will continue to experiment with structures that will allow us to address the fact that, as Joan Mullin at the University of Toledo has noted, people involved in writing across the university come to it from different places, and have progressed to different places. With this issue, *Language and Learning across the Disciplines* makes an even greater commitment to meeting those different needs.

We thank those of you who have supported us with your patience (and your subscription dollars) and given us encouragement as we worked to make this a journal that is both of the highest quality and truly interdisciplinary. We will be working especially hard in the coming year to ensure that the journal is produced and published in a more timely fashion now that many of the struggles of the first year(s) are behind us. Thank you all, once again, for your good wishes. We feel strongly that the best is yet to come.

Books of Interest

Bazerman, Charles and David Russell. *Landmark Essays on Writing Across the Curriculum*. Davis, CA: Hermogoras Press; 1994.

Berkenkotter, Carol and Thomas N. Huckin. *Genre Knowledge in Disciplinary Communication: Cognition/Culture/Power*. Hillsdale, NJ: Erlbaum; 1995.

Geisler, Cheryl. *Academic Literacy and the Nature of Expertise: Reading Writing and Knowing in Academic Philosophy*. Hillsdale, NJ: Erlbaum; 1994.

Charles A. Perfetti, M. Anne Britt, Maa C. Georgi. *Text-Based Learning and Reasoning: Studies in History*. Hillsdale, NJ: Erlbaum; 1995.

Petraglia-Bahri, Joseph. *Reconceiving Writing, Rethinking Writing Instruction*. Hillsdale, NJ: Erlbaum; 1995

Vipond, Douglas. *Writing and Psychology: Understanding Writing and Its Teaching from the Perspective of Composition Studies*. Westport, CT: Praeger Publishers; 1993.

Winsor, Dorothy. *Writing Like an Engineer: A Rhetorical Education. Rhetoric, Knowledge, and Society Series*. Hillsdale, NJ: Erlbaum; 1996.

Inquiry as a Non-Invasive Approach to Cross-Curricular Writing Consultancy

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In the concluding chapter of *Writing in the Academic Disciplines*, David Russell argues that WAC must find ways to harness the efforts of the disciplines—"where the faculty's primary loyalty and interest lie" (304)—in order to end the marginalization of writing and make it a part of the fabric of all majors. His recommendations conclude a study which demonstrates, from its introduction onward, the "drive [of academic discourse] toward increasing specialization" (22) and the writing pedagogy meant to cope with that drive. Writing instruction has largely failed to keep pace with this specialization, let alone serve the central place it could for learning within departments. His treatment of this situation is comprehensive, but he does not discuss its solutions, how this harnessing may take place.

In this essay, I propose the use of inquiry as a non-invasive approach to WAC consultancy for linking writing to the disciplines. After that, by way of a lengthy conclusion, I discuss such related matters as the place of freshman English in the writing enterprise, writing to learn versus learning to write, and the appropriateness of specialization. But for the next few pages I would like to establish that there is a problem to be solved.

As loosely affiliated language communities, disciplines have their own values, purposes, and forms for writing. WAC consultants should look for the values the disciplines hold and help instructors develop assignments out of them. Not doing so in their interactions with faculty, at its worst, may create the type of scenario Paulo Freire describes as extension agentry. The agent presses his or her values on other cultures: "His cultural historical situation which gives him his vision of the world is the environment from which he starts out. He seeks to penetrate another cultural historical situation and impose his system of values on

 DOI: 10.37514/LLD-J.1996.1.3.02

its members. The invader reduces the people in the situation to mere objects of his action" (113). The extension agent fails to engage the locals at their level of expertise, choosing instead to "'fill' [them] with 'knowledge,' technical or otherwise." This process, according to Freire, kills "in them the critical capacity for possessing it" (101). Starting out from their cultural historical situation, as experts in writing instruction, WAC consultants carry their community's vision for writing into communities which also have a vision—developed through many years of local participation. If consultants disrespect the writing they find, or urge their values on other communities (in order to stop the production of "automatons," as I heard one panel member observe at the 1996 CCCC), the situation becomes decidedly unhappy for WAC. Do conditions exist in WAC which might produce this situation? Judging from conference presentations, from literature in composition studies and WAC, the answer is "Yes."

Some composition specialists express a lack of respect for writing in the disciplines. Ed White, for example, is almost apologetic in describing the dilemma he faces: "I often work professionally with those in other disciplines, but I confess that my PhD in English literature has so confirmed a particular discourse community that I routinely . . . find it hard to respect the scholarship of nonliterary communities" (191). Being aware of this dilemma no doubt mitigates the problem for White, who appears highly conscious, even accepting, of the differences. Kurt Spellmeyer, however, implies no sense of apology or dilemma when he argues that "discipline-specific writing instruction encourages both conformity and submission" (266), leading to "a pervasive lack of commitment" (271) because it does not allow students "to enter a discipline by finding their own voices" (275). They might work hard to comply with the community's "rules and fulfill its expectations," but too often are left with "nothing of [their] own to say" (271). His emphatic tone makes it sound as if what he values for writing (to find authentic voice, demonstrate "essayistic introspection and digression," and express the "relationship between the self and the cultural heritage within which selfhood has meaning" 269) must become what everyone values. This attitude and tone would rightly offend many who do not share his vision. Applied to WAC practice, Spellmeyer's point of view would probably not have much lasting impact on faculty outside his cultural historical situation.

If how to teach, what to teach, and where to teach come from authorities within one department and extend to indoctrinateable others,

writing will remain marginalized. Such practices will push assigned writing to the edges of a department, concentrating it in a few professors or TAs (see Russell, "Historical Perspective," 391) whose views conform to those of the authority. Most often taking forms less noxious than simply telling colleagues what to do, superintendency has its advocates inside and outside WAC. The perceived expertise of English in writing practice and theory, and the perceived lack of expertise within the disciplines; the conception of writing as one set of "skills" shared by all disciplines; and the urge to let one department take responsibility for broadcasting those skills if it is willing to do so, all promote a supervisory model.

Robert Jones and Joseph Comprone propose a well-intentioned form of this model, in their "Where Do We Go Next in Writing Across the Curriculum," with WAC controlled by English or another humanities department. If it is not so controlled, they observe, "academic leadership (the supervision of courses and teacher training) is not effective: courses end up requiring uneven amounts of writing; [and] evaluation of writing is often inconsistently or ineffectively carried out" (62). For them, lack of evenness and consistency stems from ineffective "supervision of courses and teacher training," and this assertion most suggests the potential for too much influence by those who make the decisions. Who determines what "even," "consistent," and "effective" mean—teachers in classrooms or supervisors from English? Jones and Comprone also want to combine "journal writing, workshops, in-class free writing, expressive writing" with "discipline-specific discourse conventions" in "WAC classrooms" (66). On its surface, this proposed combination appears an affable compromise between WAC factions which argue "the primacy of writing to learn" and those which support the "power of discourse conventions in specific fields" (Kirscht, et al., 369). But beneath the surface it assumes that differences between communities are matters of "convention," not ways of thinking about and being in the world. It also accepts the merits of joining the two approaches without proving the union worthwhile or even possible.

The point here, however, is not that journal writing, free writing, workshops, and expressive writing are unattractive or ineffective; in some form or another, to some degree or another, they find their way into all of my composition classes. The concern lies, instead, with assuming that the combination of discipline-specific conventions and expressive writing, etc. belongs in all classes. If the WAC program supervisors insist on such a union, an unlikely scenario, then a serious form of

extension agentry will occur. If they urge without insisting, then some marginalization of writing seems likely: to those who see the value of the combined techniques, or those who agree with the values of supervisors, leaving many others within the discipline to carry on as they always have.

In an article suggesting a more extreme form of superintendency, Louise Smith argues that English departments should control WAC because of their "expertise in the study of the construction and reception of texts" (392). English faculty understand and care about the writing process more than other faculty do. They have informed themselves in composition theory and are "more likely to [apply similar assumptions and questions to both professionals' and students' processes of composing] than are faculty in other departments . . . . " (392-393). She describes the efforts of teachers in the disciplines to use writing as "blundering"—in the same way that those efforts were blundering for composition teachers two decades ago (391). Her audience for this piece is largely college English teachers, many of whom would be interested in WAC; and from their "cultural historical situation" they may view as givens what are actually untested assumptions about the value of expertise in composition theory and practice: such expertise is necessary for using writing well, teachers who do not have it will blunder, and English must be depended upon to provide it. The problem with Smith's argument lies not so much in outcomes as approach. If the authority sees those who need her expertise as blunderers, then the atmosphere would seem ripe for extension, for faculty to be "filled with knowledge, technical or otherwise," belonging to the authority and her community.

WAC supervision evidently assumes that all disciplines share the way they construct and receive texts, allowing one group of experts to train another group of experts. An expanding body of literature, however, counters this assumption, representing disciplines as language communities into which faculty have grown for many years as speakers, readers, and writers and into which they hope to usher students—communities whose construction and reception of text differ. Anthropologist Clifford Geertz, for example, asserts that academic disciplines, "more than just intellectual coigns of vantage," are "ways of being in the world." Maturing in a discipline evolves "varieties of noetic experience" or "forms of life" (155). To do the work of a discipline "is not just to take up a technical task but to take on a cultural frame that defines a great part of one's life" (155).

Many others, outside and inside the WAC community, support the idea that assimilating the language of a discipline largely shapes people's lives—how they think, write, speak, even feel. Thomas Kuhn argues as a major theme of *The Structure of Scientific Revolutions* that scientists must mature in the language of a particular community in order to think and do the work in that community; they "go native" in that language (204). Charles Bazerman describes how the speech and thinking of chemistry majors, like the speech and thinking of children in a family, develop through interactions with mentors and peers who recast the major's discourse to fit patterns acceptable to the community (304). External features of the language system go underground, in Vygotsky's terms, becoming the individuated and abbreviated code which allows the major to participate in the community. For Michel Foucault, the dominant purpose of higher education is to give students the "authority to speak" for their discipline—to designate them statutorily as those who have the right to make statements for the discipline (51). Educational systems ritualize the word; they fix roles for speakers (227). Numerous socialization studies treat this issue in ways more directly related to WAC. They too point to the general conclusion that "Developing communicative competence requires that [students] master the ways of speaking, reading, and writing which are indigenous to the new culture" (Berkenkotter, Huckin, and Ackerman, 230; see also Catherine Blair, Richard Rorty, and Tony Becher).

If the indigenous values, goals, and activities of the culture are so important to writing and thinking, the way in which WAC engages the disciplines also becomes very important. Insisting that students find their own voices (Spellmeyer), expecting to discover blunderers (Smith), or, less extremely, intending to merge composition values with discipline based conventions (Jones and Comprone) will probably include some degree of extension agentry—transmitting to other communities the elaborated knowledge of experts. This practice may impede the active learning and commitment of faculty in other disciplines who sense "the inauthenticity of superimposed solutions" (Freire, 28). If, on the other hand, cross curricular programs look for the values and goals for writing within the varying communities, they may enhance the active learning and commitment of faculty who sense the process of change is coming from within them, not without them. In the latter scenario, WAC consultants become question askers, collaborators, and listeners. They look for the vision of the writing world in the disciplines rather than insisting on their own vision.

How does a consultancy enter other disciplines without imposing its own community's values? At the University of Nevada, Reno, we have tried to do so through inquiry. Inquiry and collaboration are well established techniques for interaction with students, especially between peers in the tutoring process (Bruffee, Cooper, Freire, Harris). Perhaps it is less common to think about these techniques as appropriate for consulting with faculty. But they do hold the same advantages: they grant that faculty have grown in different language cultures, and those being equal, one culture's values should not prevail over another. They create an atmosphere for faculty to develop and refine their own ideas about writing—from what will be assigned to how it will be graded. They encourage faculty ownership of and authority for that which should belong to them: writing assigned within the context of classroom and discipline. (For further benefits of the techniques, particularly collaboration, see Lunsford, 38-39.)

Our first-year writing workshops at UNR, open to all and attended usually by ten to fifteen volunteers, began, for example, with five questions. Each was obvious enough, but their impact has been to shift the locus of expertise, and the responsibility for teaching writing, from us to them. The first question requires workshop participants to choose a class in which they would like to try a writing assignment, usually a class not including writing before. The second asks them to isolate one or two goals for learning in the class, i.e. if students were to take away a core theory, argument, or principle from the term's work what might it be? (In an upper division biology course in genetics, for instance, a goal for assignment design might be to help students understand the biological basis for heredity.) The third question calls for faculty to list concepts, problems, or processes important to understanding course material—those which perhaps have given students trouble in the past. (In a course in museum training for biologists, an assignment might ask students to explain how to collect sagebrush specimens for display in the Nevada State Museum.) The fourth question asks faculty to decide between goals or concepts, or some other cognitive or affective task, in designing their assignment, with the qualifier that assignments connected to goals often involve longer projects than those associated with concepts, problems or processes.

Several model assignments are then presented. An example of an assignment linked to course goals comes from Electrical Engineering 423, Integrated Circuit Engineering. It requires teams of students to invent a workable circuit, demonstrate the circuit's applicability to a

larger system, argue its merits over alternatives, and present a design strategy to potential producers. For senior students, the project takes all semester to complete and is the defining feature of the course. An example of a shorter assignment encouraging problem solving appears in Physics 101, an Introduction to Physics. It asks students to explain to their bright but unspecialized brother, a resident of New York City, "why you have to cook three minute eggs for longer than three minutes in Reno," with its connection to altitude, air pressure, boiling point, and heat transfer. The physics assignment, for lower division majors and nonmajors, requires three double-spaced pages and allows two weeks for writing. After discussing the models, in response to the fifth question, workshop participants write a preliminary description of their own assignments.

There are several more questions, including "what problems do you anticipate your students will have in completing the assignment to meet your objectives?"—questions which urge faculty to consider the developmental levels and academic interests of their students. Faculty collaborate with each other and with WAC personnel, but make all of the most consequential decisions about the assignment themselves. An immediate result of these workshops is usually a workable assignment in draft form. As a larger result, an environment is created in which people in the disciplines expect to be responsible for what they do with writing. This environment has carried comfortably over into many of our future interactions with faculty, including an extensive discipline-based assessment project (Waldo, Blumner, and Webb).

These general workshops no longer have the impact they did seven years ago. The faculty is simply too knowledgeable. They know their disciplines have individual frames for thinking and writing, and that the English department or any one department cannot teach their students to write. Their concerns become, then, how best to link writing to thinking expertly in their own fields. Our consultancy has itself specialized, occurring now almost exclusively with departments and individuals. But we have not given up the question asking and collaborative process with which we began.

We want to problematize (in the Freirean sense) parts of the curriculum by asking teachers questions about their classes, their disciplines, and their own experiences. With electrical engineering faculty, for example, we ask about the goals they have for learning in specific courses at advancing levels in the curriculum, the thinking strategies appropriate to those courses and generally to EE, the values

and purposes they share for writing, and the developmental levels of their students. We then work with them on linking their responses to writing within classes and across their department. At the same time we want to draw on their history of learning to write, from their deeper to more recent past, their positive to more negative experiences, in an effort to help them create an atmosphere for students to succeed as writers and thinkers. Internal review of assignments and grading becomes a regular practice: Does this assignment stretch students cognitively without breaking them? Does it produce the kind of thinking intended? Is the goal clear, and the context for writing one that will interest and challenge students? For which audience is the paper written? How may it be graded fairly? How does it predict writing they may do in the future? This type of review helps students to become better EE majors as faculty become better mentors of, build better frames for, writing in their classes and community. But this type of review, it must be appended, is only possible after years (six in our case) of work, evolving from an increasingly sophisticated vocabulary about writing developing from inside the discipline.

Consulting through inquiry does require leadership, a theoretical and literal center from which WAC operates. That leadership precludes supervision, however, if it means insisting on techniques compatible with the consultant's discipline but alien to other disciplines. Nonetheless, it is time now to admit the obvious, that we too have goals for our consultancy. We hope faculty will take active responsibility for what they do with writing, making the deeper language and cognitive structures of their disciplines more accessible to students through their assignment making. We hope they will design assignments which foster learning about purposes or concepts central to their classes and, clear in intention and expectation, offer engaging contexts for writing. We hope students will think critically within and about their disciplines. Finally, we hope assignments will put students in what Vygotsky terms their zone of proximal development, challenging them in ways appropriate to their cognitive levels and prompting them to collaborate with mentors and peers. Our questions admittedly encourage these outcomes, as do the model assignments we use during the workshops. The qualifier is that each of our goals, except perhaps the last, merges with the disciplines themselves. If anything happens, it happens because the faculty members want it to, believe it will improve their courses and help their students.

Our approach has led to promising results. During 1995-96, Writing Center personnel conducted a phone survey (appendix A) asking faculty a variety of questions about undergraduate student writing. One hundred twenty faculty from thirty departments have so far been contacted. Of those, ninety one percent have responded that they require writing of undergraduates at the lower and upper division. Sixty one percent require more writing of lower division students than they did three years ago; fifty four percent require more of upper division students. When faculty do require writing, it is most often linked to some critical thinking process (see table 1). As might be predicted but is rarely documented, large percentages of faculty (80%+) report that students improve in each of these areas between the lower and upper division.

Table 1. Percentage of faculty whose writing assignments require the following elements (n=120)

Category	*Percentage*
Analysis and critique	89%
Review and summary	68
Synthesis	89
Problem Solving	80
Examining multiple points of view	66
Arguing issues	65

(n) = number of faculty responding

Beginning in 1991 (two years after formal introduction of the WAC program), UNR has conducted extensive surveys into its students' impressions of their college experience, reported under the headings "College Student Experiences Questionnaire" and "Senior Exit Interview Report." These surveys confirm the faculty impression that students are making gains as writers and thinkers. In 1991, thirty six percent of entering freshmen ranked themselves as above average or in the top ten percent in writing ability. Sixty four percent ranked themselves as average or below. When the 1993 senior class was asked about "understanding and abilities" with regard to writing, ninety seven percent reported making gains in "effective and clear" writing, and for sixty eight percent the gains were "dramatic." In related areas, students

reported substantial gains in "learning on one's own" (ninety seven percent reported strength in such learning), "integration of ideas" (ninety six percent), and "analytical and logical thinking" (ninety five percent). Seniors interviewed in 1993 are admittedly not the freshmen surveyed in 1991; these statistics, nonetheless, suggest that UNR's seniors become surprisingly confident in writing and thinking abilities as a consequence of their undergraduate learning. We attribute these results, at least in part, to the form WAC leadership takes: using questions and collaboration, listening to what experts in their own fields want writing to do and then helping them figure out how to do it.

Common sense suggests that specializing, developing expertise, appropriating a discourse happen gradually, not abruptly. The process more closely parallels growing in a family or a culture than, say, entering military basic training. Over time, through interaction with mentors and peers, through reading and producing texts, students evolve increasingly complex language and thinking patterns within the context of the discipline. Many freshmen have not chosen majors. They need opportunity to do so, often after taking a variety of introductory courses offered by departments. And then they need to mature in their majors at paces which approximate their developmental patterns, growth in specialized language communities occurring more during the upper division than lower division years.

Composition courses taught in English departments may help with this process and provide a good, even compassionate, introduction to writing in the academy. Certain qualities—student writing as the primary text, revision as an expected part of the process, collaboration with faculty and peers as a pedagogic focus, acceptance of diverse languages and cultures—make these courses vital to the collective writing endeavor. They become additionally effective when inquiry plays a central role in developing cognitive strategies. But composition classes offered by English departments (at any level) do not teach writing and thinking in the disciplines as, for example, the Kirscht group claims (379). They may teach a form of writing found in the disciplines, but not the writing itself. They may encourage a type of thinking shared by the disciplines, but not the thinking itself. Claiming otherwise does more to exacerbate than to lessen the conflict between WAC factions, and between WAC and the disciplines. Unintentionally, it marginalizes writing to learn and learning to write to English departments, by implying that the experts from English can do it all.

Does learning to write in the format of the biology paper using the

conventions of the practicing biologist belong in composition or in biology? For most readers the answer would be emphatically the latter. Does writing to learn thinking strategies belong in composition or the disciplines? Most would probably agree that it belongs in both. Cognitive skills, however, like the languages which generate them, differ by discipline. Problem solving in physics is different, in obvious and subtle ways, from problem solving in philosophy. Writing to learn and learning to write should be acknowledged as occurring together in any classroom which uses assignments, differing between disciplines in increasingly complex ways as students progress. Students have to write to learn and learn to write within their disciplines in order to join them—with all that means to developing the cognitive strategies specific to certain communities.

Using these strategies is a crucial part of the faculty's teaching, research, and service; developing their use is a critical part of the students' learning, preparation for, and participation in the professions. Far from being disentwined, the languages which foster these strategies are likely to grow with the technology, manufacture, and service they make possible. And even if this fostering process could be halted or slowed, there is a compelling reason why it should not be. The tasks we face are just too immense, complex and sometimes threatening to ignore the need for discipline specific approaches shaped mainly by language.

Facilitating environmental clean-up; engineering canals, highway interchanges, sewage systems, water treatment plants, and maintaining them; designing buildings, mass transit systems, space shuttles, and constructing or repairing them; diagnosing patients with aids, cancer, and treating them; creating solutions to social problems and trying to implement them; engaging with texts, understanding and sharing them; constructing a nuclear waste repository in Yucca Mountain, Nevada, and insuring that repository is safe (the list goes on and on), all require specialized languages to get the job done as, arguably, any complex activity does. Some readers of this essay will argue that specialized languages created the problems specialized languages must now solve—a point which seems inherently true to me. However true, we have to deal with what is, not with what might have been; and specialized languages also make possible much that society values. Others will argue that because people with graduate degrees generate knowledge in their fields, undergraduates do not need to be specialists. But since graduates with bachelors degrees do most of the hands-on work that advanced specialists make possible, they too will need the language

that, as White remarks, "allows [them] to work as professionals" (191). Does my proposal negate the important work in faculty development that WAC has made possible during the last two decades? From my perspective, certainly not. Instead it argues for another stage, obliging WAC consultants to become expert question askers and collaborators with their faculty colleagues.

WAC's approach with the disciplines needs to be noninvasive because they are distinct communities with their own goals, activities and values for writing. If WAC is invasive writing will remain marginalized, because few will commit to it as part of the fabric of their courses and communities. One noninvasive technique is to use inquiry to draw on faculty expertise in designing and grading assignments. When faculty take responsibility for the way in which writing is used, students benefit because they more readily develop the cognitive strategies necessary to becoming experts within the field. More students will be able to enter disciplines of choice because more attention will be paid to smoothing the steps which make up the path.

Acknowledging the tribal differences between disciplines, Geertz proposes an "ethnography of thought" within them; and then, in order to improve the possibility "for people inhabiting different worlds to have a genuine, and reciprocal, impact upon one another," he suggests three steps to a language of interplay between disciplines: to accept the depth of the differences; to understand what the differences are; and to construct some sort of vocabulary in which they can be publicly formulated (161). Projects such as Yucca Mountain, requiring the focused efforts of several specialties, will not succeed without disciplines being able to talk to each other. It is also fundamentally clear, however, that they will not succeed without each discipline having the language to frame and solve the problems presented to it. Through inquiry-based approaches, WAC has the extraordinary opportunity to encourage the former with the latter.

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Appendix A
Writing Center Phone Survey

Gathering data campuswide on the kinds of writing required of students, and faculty perceptions of the quality of student writing

1. Do you generally teach upper division, lower division or a combination of these during an academic year?

2. Which of the following types of writing do you require in at least one of your classes? Please reply yes or no to the items on the following list:

a. writing that analyzes or critiques information	yes	no
b. in-class writing excluding exams	yes	no
c. essay exams	yes	no
d. writing reviews or summaries of information	yes	no
e. writing that demonstrates problem solving	yes	no
f. writing that requires argument or persuasiveness	yes	no
g. writing that requires the synthesizing of information	yes	no
h. writing that requires considering multiple points of view	yes	no
i. lab reports	yes	no

3. In how many of your lower division classes do you require at least one of those types of writing?

All More than half Less than half

4. In how many of your upper division classes do you require at least one of those types of writing?

All More than half Less than half

5. Over the last three years, have you required more writing from lower division students, less writing, or the same?

6. Over the last three years have you required more writing from upper division students, less writing or the same?

7. Do you feel that upper division students in general are better writers than lower division students? yes no

8. To be more specific about which areas upper division students in general show more capability than lower division students in writing, I'm going to read a list of writing abilities. For each item on the list, please tell me to what degree upper division students demonstrate more competence than lower division students:

degree of improvement (optional)

a. ability to problem solve in writing

great moderate small none

b. ability to reflect your assignments' requirements in their writing

great moderate small none

c. ability to assert an argument in writing

great moderate small none

d. ability to support an argument in writing

great moderate small none

e. ability to achieve sentence level correctness (punctuation, spelling, grammar)

great moderate small none

f. ability to reflect complex thought in writing

great moderate small none

g. ability to write logically about a subject

great moderate small none

h. ability to synthesize information in writing

great moderate small none

11. In general, do you see any writing improvement by your lower division students over the course of a semester?

yes no

12.In general, do you see any writing improvement by your upper division students over the course of a semester?

yes no

(My thanks to Scott Johnston for permission to include the survey.)

When Nursing Students Write: Changing Attitudes

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There is no shortage of lore circulated among those involved in writing-across-the curriculum programs. Practitioners talk of students saved and reformed, for example, but their enthusiasm is usually born more of hope and faith than of fact and reason. This is not to say that the stories are specious or untrue, only that in most cases they lack verification by a recognized means of assessment.

The shortage of formal evaluation of WAC programs is not surprising. As Sarah Freedman points out in "Evaluating Writing," an entirely satisfactory method of determining the effectiveness of instruction either by large-scale testing or classroom assessment is yet to be found. Some efforts have yielded interesting results. For example, in a study of the composite effects of taking three or more writing-intensive classes at the University of Hawaii at Manoa, Hilgers, Bayer, Bergh, and Taniguchi interviewed 82 randomly selected seniors, 83% of whom reported that WI classes helped them understand and retain course material (71). Despite such positive responses, the researchers refrain from making claims of any direct evidence of connections between the WI instructions and students' learning. Because they did not make classroom observations or take samples of student writing, they are reluctant to conclude that students who have had writing-intensive classes recall and comprehend course material better than those who have not (78).

Identifying the causes of improved student attitudes and performance is equally difficult. Identifying, isolating, and defining the reasons for attitudinal improvement is fraught with problems, and the degree to which they impact student work is even more resistant to measurement. The result is that teachers tend to use anecdotal rather than statistical evidence to verify the positive effects of using writing to

 DOI: 10.37514/LLD-J.1996.1.3.03

assist learning. They often draw conclusions based on their own well-honed sense of the situation.

This study, a culmination of three years of attempting to determine the effect of using writing-to-learn strategies in freshman nursing classes, did not replace all of the available lore. It did not even provide answers to all the questions the researchers set out to find. The quantification they sought about the impact of writing to learn on student mastery of course material, for example, remained elusive. Whether students thought more critically and analytically about their future profession after writing about its issues and concerns could not be verified. Like other researchers who have sought to evaluate the success of specific pedagogies, such as Ruie Jane Pritchard ("Effect on Student Writing of Teacher Training in the National Writing Project Model"), they found that drawing valid conclusions from situations filled with variables—i.e., classrooms, is exceedingly difficult.

The three-year study did, however, confirm several significant effects of using writing-to-learn techniques in the nursing classroom. Specifically, it provided evidence of three areas of positive impact: (1) improved student attitudes towards writing and learning, (2) strengthened student-teacher communication, and (3) increased student retention. As a result, the findings create a strong rationale for including writing to learn in the freshman nursing curriculum, and perhaps for instituting it throughout the entire nursing program.

Research Methods

The initial stages of the study were the result of a collaborative effort on the part of the instructor of Nursing 114, a required second semester freshman course, the head of the undergraduate nursing program, and the university's WAC director. Working together, they chose and designed writing activities deemed likely to have a positive effect on students' personal involvement in subject matter, data comprehension, and critical thinking. In the end they selected eleven different interventions, including admit and exit slips, micro-themes, listing, brainstorming, free writing, comparisons, focused writings, buddy exchanges, unsent letters, and responses to dramatic scenarios. In an effort to improve students' critical thinking, ample time was provided to complete each exercise. As Freedman points out, "higher-order thinking occurs when there is an increased focus on a writing process which includes encouraging students to take lots of time with their writing, to think deeply and write about issues in which they feel some investment . . . ("Evaluating Writing" 4).

The use of specific strategies was dictated by the objectives of the lessons(s) of the class on a given day. For example, when studying community health, students were asked to respond to a hypothetical letter from a disadvantaged caregiver inquiring about wound care procedures that broke all rules of asepsis. To answer, students were called upon to present complex knowledge about practical application of wound care in simple lay terms. They had not only to use their technical knowledge, but also to exercise an understanding of members of the community. To develop a sense of professionalism, they were asked on another occasion to do focused writing (timed, non-stop writing on a specific topic) on such issues as the meaning of health, ways in which nurses demonstrate ethical codes of behavior in practice, or the use of self in establishing therapeutic nurse-client relationships. By limiting the length of the response to the information that could be recorded on a 5x8-inch card, the instructor pushed students to clarify their thinking about important and difficult issues in their field.

Evaluation was designed to assess changes produced by the interventions, particularly as they affected students' attitudes and academic success. (As noted earlier, the former proved more amenable to measurement.) The instruments included a Writing To Learn Attitudinal Survey (WTLAS) [See Appendix 1] administered in a pretest-posttest design, scheduled interviews, and final course grades. (The WTLAS survey was based on other similar surveys, classroom writing histories, and Daly & Miller's [1975] writing apprehension test.)

Following the explanation of the project and collection of consent forms on the first day of the course, the Writing To Learn Attitudinal Survey was administered as a pretest to the 131 students enrolled in Nursing 114. In eleven class meetings throughout the remainder of the semester, the nursing instructor presented writing-to-learn activities appropriate for course unit objectives that dealt with concepts such as nursing trends, socialization and roles, research, politics, theories of nursing, health and illness, health care delivery systems, ethical and legal issues, nursing process, growth and development, stress and adaptation, and grief, loss, and death. On the last day of class, the same Writing To Learn Attitudinal Survey was administered as a posttest to all participating students.

Two weeks before the end of the semester, a disinterested instructor (not previously involved in the study) conducted twenty-minute interviews with twenty students who volunteered as representatives of the sample population. Questions were designed to elicit responses

about student acceptance of the writing strategies—e.g., whether they were used in other courses, how well they were understood, if they were deemed to be helpful, etc. The answers were taped and transcribed (using no names) by the interviewer.

At the end of the term, data analysis included use of the paired t-test (alpha = .05) for the WTLAS. Interviews were interpreted. In addition, final course grades were examined to compare the course attrition rate with that of the previous semester's class.

Findings

The paired t-test was used to determine the significance of differences between pretest and posttest scores on the Writing To Learn Attitudinal Survey. Examination of the data revealed that students responded more positively to the statements on the WTLAS as a posttest—i.e., after they had received writing-to-learn educational interventions, than they did as a pretest. The scores on the pretest and posttest were significantly different ($\underline{t} = 9.17$, $\underline{p} = .0001$).

At the time of the pre-test, thirty-six percent (36%) were uncertain as to whether impromptu focused writing in class helped them to solve problems or clarify concepts, whereas forty-three percent (43%) agreed by the post-test that it did. Forty-five percent (45%) of the students on the pre-test admitted having feelings of nervousness when asked to write as compared to thirty-six percent (36%) at post-test time.

In all three phases of this investigation the WTLAS provided an easy and reliable means of collecting and describing student attitudes about writing. Consisting of nine (9) negative and twenty-one (21) positive statements about writing, it was designed to cover basic psychosocial apprehensions and positive and negative perceptions about writing. During all pretests of the first and second years' study and the pre-and-post-test sessions of the third, it demonstrated the same positive and negative attitudes and perceptions held by students about writing. When used in a pre-test-and-post-test design, the WTLAS provided a means for categorizing data in terms of positive and negative differences in attitudes and perceptions about writing. Having demonstrated its validity in these ways, the WTLAS could be used by other researchers to compare levels of information about the writing attitudes of different groups, identify negative perceptions and attitudes, determine the effects of courses or training materials, and measure changes in attitudes over time.

The interviews, different from the WTLAS in form, content, and administration, provided complementary information. Yielding generally positive responses, they provided subjective confirmation that the statistical data of the WTLAS were valid. They also provided material not available in the Attitudinal Survey. For example, the interviewer, without expressing an opinion of any sort, asked the volunteer students to talk about such questions as the following:

1.Do you feel the in-class writing exercises have helped you to understand the course content? How and why?

2.Which exercises were the most helpful in understanding course material? Cite an example of a successful writing experience.

3.Comment on the following statement: "Writing is necessary for success."

4.Do you use any writing strategies in other courses? If so, which ones?

5.How will your experiences with writing in this course help you in other courses?

6.Which writing exercises were the least helpful ones?

7.What are your attitudes now about writing as opposed to your attitudes at the beginning of the course?

8.What differences have you observed between making objective responses and extended written ones?

In answer, the students indicated that they found writing to assist learning. They had positive feelings about the writing experiences in class and deemed writing skills to be necessary for success. (See Figure 1 for selected student comments to the interview questions.) The responses agreed with the findings of Hilger et al, whose interviews (with seniors who had had three or more WI classes) found that 89% of the intervieews perceived that these classes had helped to prepare them for future career writing tasks (73).

A third way of evaluating the impact of the writing activities on students' attitudes and academic success was to make a comparison of the attrition rate of the experimental group and that of another section of the same course taught without the interventions. The comparison, like the WTLAS and the interviews, confirmed that writing had had a positive effect on student performance. In fact, it yielded what was probably the most dramatic evidence of the positive influence of writing activities found in the third study. Confirming the data collected in earlier stages of the research, the attrition rate for the writing intensive

QUESTION #1: Did the in-class writing exercises help you to learn course content? How and why?

-opens up one on one communication between teacher/student
-gives you release, a place to ask questions
-did not learn as much from "buddy answers"
-did show students that they shared common concerns
-helped to generate ideas
-no, because based on opinion rather than fact

QUESTION #2: Which exercises were the most helpful in understanding course material? Cite an example.

-finding your own community of resources
-writing your own philosophy
-buddy assignment
-agency assignment
-hearing other students
-in answering, sends one back to the textbook

QUESTION #3: Comment on the following: "Writing is necessary for success."

-writing expresses feelings, "get it out"
-putting questions on paper makes you think
-by writing, you start to understand your own mind
-increases organizational skills
-helps one to further generate ideas
-if you can't communicate on paper, it may be a problem

QUESTION #5: How will your experiences with writing in this course help you in other courses?

-increase strategies in essay biology tests
-getting in the routine of writing and formally putting down your ideas will help you generate ideas
-brainstorm in English

QUESTION #7: What are your attitudes now about writing as opposed to your attitudes at the beginning of the course?

-worried that intense writing course would be time consuming—luckily it wasn't
-important to be able to organize your ideas and opinions
-because it wasn't graded, I had a more positive experience
-I didn't panic when teacher said to get out piece of paper
-liked to write about topics they knew about
-feel like writing in English is unrelated to their major, but that this writing related to current issues in the nursing profession

QUESTION #8: What differences have you observed between making objective responses and extended written ones?

-essay—you can expand on the little you do know instead of having to know everything
-I like to be able to give the accurate answer—if you say what you know, its more beneficial than A, B, C
-prefer essay and writing exams because I got to write down everything I know, everything I learned
-objective responses are just "this one" or "that one"
-in the process of writing, you find out what you know
-a better way of testing students—instructors know what students know based on what students write

Figure 1: Selected responses to interview questions

classes ran at twenty-seven percent (27%) as compared to forty-nine percent (49%) in a section of the same course taught in the traditional manner. While attrition has many causes—e.g., work schedules, teacher-student conflicts, and family emergencies, the higher retention rates of the classes using writing in all three years of the study point strongly to its positive influence.

Several aspects of the writing program may have influenced the higher retention rates. The improved student attitudes, for example, may have encouraged students to remain in the course, and, ultimately, perhaps, to stay in the curriculum. Another factor could be the involvement called for by the activities described earlier. By becoming an active participant in their own learning through frequent writing, students may have acquired better understanding and more complete

recall of newly learned material as well as improved comprehension of theory and process. As Harvard researchers discovered:

> [T]he relationship between the amount of writing for a course and students' level of engagement—whether engagement is measured by time spent on the course, or the intellectual challenge it presents, or students' self-reported level of interest in it—is stronger than any relationship we found between student engagement and any other course characteristic. (Light qtd. in Hilgers et al.)

The instructor's approach to student writing also seems to have been a positive force. Although she did not grade the writing-to-learn assignments, within a week she responded to each student's work with positive suggestions or reinforcement that related the individual's performance to a desired goal or course objective. As Freedman points out in *Response to Student Writing,* timely response from the instructor is more important in helping students learn to "think deeply about their experiences and communicate those experiences to others" (157-9), than is grading. The secondary, but no less valuable result of the instructor's responses was the improvement in student-teacher communication. The instructor had information that allowed her to understand the learning level of the class as a whole, as well as a way to know individual students. In a traditional lecture class of 131 students, needless to say, neither of these desirable outcomes is likely to occur.

In addition, the variety of assignments gave students opportunities to exercise a number of different types of thinking—defining, problem solving, analysis, evaluating, and others. The nursing students described micro-themes, listing, brainstorming, free writing, and comparisons to be particularly effective in helping them to master course content and develop personal insights.

Future Research

Many questions remain to be answered about the effectiveness of using writing-to-learn activities in technical disciplines. Do the students who begin their study of nursing (or chemistry or biology) in a writing intensive course continue to use the techniques it introduces them to? Are they in the long run more successful than their counterparts who are not given such strategies? Will similar results be found in other scientific and technical fields?

The three-year evaluative study reported here is only a beginning, but its findings can form a basis for future inquiries. To that end, it has

found that intense incorporation of writing-to-learn strategies in a required introductory nursing course helps students who begin with negative attitudes about writing to become more positive. It indicates that using writing strategies strengthens student-teacher communication, and helps to lower attrition rates. With better tools to measure the impact of writing-to-learn in nursing and other classrooms, a more definitive answer will in time emerge. So far, however, a limited number of positive outcomes can be identified that may have a ripple effect on other aspects of student learning and thinking.

* The researchers are indebted to Stephanie Muller for her assistance in interviewing students from the two nursing classes.

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Appendix 1: WTLAS Test

The College of Nursing is trying to determine the effectiveness of using writing to improve student learning and success. Would you please complete the following survey to help us gather information that will be important in designing courses for other students?

NAME: STUDENT ID NUMBER:
COURSE: DATE:

Below are a series of statements about writing. There are no right or wrong answers to these statements. Please indicate the degree to which each statement applies to you by marking the appropriate number on the Scantron form with a pencil as follows: (1) strongly agree, (2) agree, (3) uncertain, (4) disagree, or (5) strongly disagree with the statement. While some of these statements may seem repetitious, take your time and try to be as honest as possible.

STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE
1	2	3	4	5

1. Expressing ideas through writing seems to be a waste of time.
2. Impromptu focused writing in class helps me to solve problems or clarify concepts.
3. I get nervous when I am asked to write.
4. Handing in written questions about lectures and reading assignments helps me understand course material.
5. I like to write my ideas down.
6. I feel confident in my ability to express my ideas clearly in writing.
7. Informal notes and letters to classmates about course material help me to understand difficult material.
8. I enjoy writing.
9. Brainstorming, freewriting, or listing ideas before writing helps me find out what I know and think about a topic.
10. I have a terrible time organizing my ideas in writing.
11. Admit slips make it easier to begin thinking about what will be covered in a class.
12. I like seeing my thoughts on paper.
13. I avoid writing if possible.

14. I would enjoy submitting my writing to magazines for evaluation and publication.
15. I like to have my friends read what I have written.
16. I never seem to be able to write my ideas down clearly.
17. Writing micro-themes (brief summaries) makes me aware of the most important points in reading assignments.
18. I don't think I write as well as most people.
19. Critiquing a classmate's writing for conceptual clarity results in increased understanding for both of us.
20. Writing personal experience pieces makes me see connections between what I am learning and my own life.
21. I'm no good at writing.
22. Writing to different audiences makes me aware of how much the reader or listener affects the way I state information and concepts.
23. Good writers make better grades in college than poor writers.
24. It's easy for me to express my ideas in writing.
25. The technical aspects of writing (punctuation, spelling, etc.) are more important than other aspects (concept formulation, clarity, etc.).
26. I don't like my writing to be evaluated.
27. Writing skills are necessary for success.
28. Exit slips help me to remember the main points covered in a class.
29. Discussing my writing with others is an enjoyable experience.
30. I use journals to enhance my understanding of course materials.

What's Love Got to Do with It? Scholarly Citation Practices as Courtship Rituals

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Inexperienced academic writers, would-be members or initiates of scholarly disciplines, deviate from accepted practices for citing the literature of a particular area of study in a number of ways familiar to teachers of undergraduates and beginning graduate students. They often rely too much on their sources; they often do not provide necessary citations, do provide unnecessary citations, or provide incomplete ones; they are unlikely to integrate these cited sources into the context of their own work adequately or effectively; and they frequently use an unconventional citation style. Teachers of these inexperienced writers may find it difficult to explain precisely why these deviations from the conventions of their discourse communities are so troubling or exactly how they might be corrected to conform to the expectations of experienced readers in the discipline.

In this essay, I argue for adopting a rhetoric of identification for explaining citation practices, viewing scholarly citation as a courtship ritual designed to enhance a writer's standing in a scholarly discourse community. The terms of this rhetoric challenge, without completely displacing, the capitalistic economic terms that currently prevail in textbook discussions of quotation, paraphrase, and other means of incorporating ideas from one or more texts into another. Adopting this rhetoric of citation practice has a number of implications for teachers of writing across the disciplines.

Inadequacies of Typical Handbook Advice

Faced with student writers' deviations from typical scholarly citation practice, teachers might refer students to style manuals such as those of the American Psychological Association or the Modern Language Association to remedy unconventional formatting, punctuation,

 DOI: 10.37514/LLD-J.1996.1.3.04

and abbreviation practices, but these manuals rarely address the most significant deviations from accepted citation practice. The advice offered in college writing handbooks and research manuals is usually inadequate as well. These texts, which are typically designed for use in introductory writing courses enrolling students from diverse areas of study, are not only short on guidelines for making informed choices about when, where, and how to refer to which existing literature in any field of study; they also, in their attempts to be comprehensive, are limited to offering only the most generalized advice. Further, as I will demonstrate below, these handbooks often present scholarly citation in terms limited to a view of ideas as intellectual property and of scholarly productivity as a factor in a capitalistic economy. Though these terms are familiar to educators, they are nonetheless troublesome to those who are themselves involved in research projects more compatible with post-modernist and post-structuralist critique.

In the section which follows, I've provided an illustrative sampling of the explanations of citation practices from several widely-used handbooks designed for college student writers. After briefly reviewing what is said about citation in general and about plagiarism, I will concentrate on discussions of word-for-word quotation, as space constraints for this essay do not allow examination and discussion of paraphrasing and summarizing sources[0] (see Arrington, 1988), introducing and framing citations, providing footnotes versus parenthetical citations, or following conventions for punctuating and abbreviating documentation. (In the following passages I have italicized words and phrases for emphasis.)

On the nature of citation in general, the following statement is typical:

> A research paper requires a thoughtful balance between *your own* language and the words and sentences you *borrow* from other sources. (Marius and Wiener 422)

Because words and ideas are widely regarded as property in our capitalistic economy, our college handbooks for writers often place somewhere near the section on citations a few choice words about plagiarism:

> You commit **plagiarism** whenever you present words or ideas *taken from* another person as if they were your own. . . . The prose

> we write ourselves is so individual that when we write something in a striking way or express a new idea, we have produced something that always *belongs to us*. To call someone else's writing your own is wrong and foolish. (Marius and Wiener 464-465)

> Plagiarism can result from not *giving credit* to the person who thought of an idea, calculated statistics, made a discovery. You cannot pass off as you own another person's work. (Carter and Skates 482)

> [T]o plagiarize is to give the impression that you have written or thought something that you have in fact *borrowed from* someone else, and to do so is considered a violation of the professional responsibility to acknowledge *"academic debts"* ("Statement on Professional Ethics," *Policy Documents and Reports* 1984 ed., Washington: AAUP, 1984, 134.) . . . Even without considering the penalties of plagiarism, the best scholars generously acknowledge their debts to others. By doing so they not only contribute to the historiography of scholarship but also help younger scholars understand the process of research and discovery. (Achtert and Gibaldi 4-5)

Handbook advice about what ideas and information must be cited presents quotation as a strategy for *borrowing* authority:

> [Reserve] direct quotation for material that is especially well stated or for points that might require the clout of a respected authority's exact words. (Leggett, Mead, and Kramer 486).

> You should depend on other people's words as little as possible, limiting quotations to those *necessary* to your argument or *memorable* for your readers. Reasons to use direct quotations include the following.
>
> *To incorporate a statement expressed so effectively by the author that it cannot be paraphrased without altering meaning
>
> *To contribute to your own credibility as a writer by quoting an authority on your topic
>
> *To allow an author to defend his or her position in his or her own words

> *To use a striking quotation for effect
> (Lunsford and Connors 588)

If individual knowledge is capital, according to the handbooks, group knowledge is not. For example, in explaining what information does not need to be cited or "common knowledge," *The Scott, Foresman Handbook for Writers* offers an elaborate discussion which employs terms suggesting the notion of "public property." Authors Hairston and Ruszkiewicz explain that there is no need to cite

> facts, dates, events, information, and concepts that belong generally to an educated public. No individual owns the facts about history, physics, social behavior, geography, current events, popular culture, and so on. . . . What the experts know collectively constitutes the common knowledge within the field about the subject; what they assert individually—their opinions, studies, theories, research projects, and hypotheses—is the material you must document in a paper. (546-47)

Metaphors of property and product are used to talk about the nature of language and thought. Words and ideas are "owned" and "borrowed" as though they were capital. Writers "give credit" to other writers. This handbook version of the nature of responsible scholarly citation practice seems to have made an impression on students: Barry Kroll's study of 150 college freshmen's attitudes toward plagiarism identified fairness, individual responsibility, and ownership as the three major ethical issues.[1] "Credit," "credence," and "creed"—property, authority, and belief—are obviously closely bound together in the prevailing set of values.[2] Treating language and thought as *object*, as a product of individual labor, is therefore certainly legitimate in an academic culture deeply imbedded in a tradition of capitalistic economic values. However, explanations such as these obscure an understanding of language and thought as collaborative *action* as well. Teachers who hope to offer explanations and advice more consistent with their own ideological positions and writing practices in post-structuralist, post-disciplinary academic cultures at the end of the twentieth century will need to draw on the resources of a rhetoric of citations that accounts for intertextuality in the construction of knowledge.

De-termining a Rhetoric of Citation

While there is a large and growing body of scholarship in citation studies,[3] relatively little of it until recently has addressed developing a rhetoric of citation practice.[4] Of this recent work, Charles Bazerman's 1988 work, *Shaping Written Knowledge* is probably the most familiar to readers from disciplines other than library and information science. In *Shaping Written Knowledge* Bazerman examines the ways citations in scientific articles refer to, invoke, or respond to the context of the already existing literature of a field in order to establish a relationship with that literature. For Bazerman, citation practices are clues to the "cognitive structure" of knowledge in a discipline. The length of a literature review, the specificity of summaries of earlier work, evaluations of connections between the current work and previous work, and the distribution of references throughout a scientific article are all indicators of the size, structure, and maturity of the discipline of which it is a part (166-67).

Bazerman's constructivist project has gone a long way toward demonstrating that scientific knowledge is discursively constructed, and his conclusions are easily generalized to include other disciplines, since the sciences have been assumed to be the disciplines least susceptible to or dependent upon rhetoric for the creation and dissemination of shared knowledge. However, given that his analytical approach best suited to exploring textual and contextual features, Bazerman's exploration of writers' motives is necessarily limited. A complete rhetoric of citations must be able to address writers' motives and purposes, for these cannot be taken for granted without risk of reducing them to simplistic terms.

Such a rhetoric of citations is suggested by Kenneth Burke, whose language philosophy has influenced a wide range of disciplines in the humanities and social sciences. For Burke, reality is linguistically "determined"—that is, the terms which describe a situation delimit and define the way that situation can be understood. Yet Burke's brand of linguistic determinism does not discount the importance of the human will, for, according to his rhetoric, human motives have governed the choices of the terms. As the "symbol-abusing" animal, humans' use of language is what gets us into trouble, but it is also our chief resource for getting out of that trouble.

In *A Rhetoric of Motives*, Burke argues that a rhetoric of identification is better suited than a rhetoric of persuasion to describing those "ways in which the members of a group promote social cohesion by

acting rhetorically upon themselves and one another" (xiv). In the following passages from *A Rhetoric of Motives*, Burke has developed this rhetoric of identification by playing with the terms "cooperation" and "cooperative":

> [Rhetoric] is rooted in an essential function of language itself, a function that is wholly realistic, and is continually born anew; the use of language as a symbolic means of inducing cooperation in beings that by nature respond to symbols. (43)

> In society, as a going concern, the network of cooperative practices is matched by a network of communicative symbols. "Communication" involves the interdependence of people through their common stake in both cooperative and symbolic networks. (234)

Working with these two terms, Burke explains his earlier assertion that communication is "the area where love has become so generalized, desexualized, 'technologized' that only close critical or philosophical scrutiny can discover the vestiges of the original motive" (19). If love—pure identification—is the original motive, discourse can be viewed in terms of *courtship* in a rhetoric of identification that represents discourse as essentially collaborative action.

Burke's rhetoric of identification, providing the terms for viewing discourse as collaborative action, suggests that the ultimate discourse enables us to achieve the "good life," characterized by "construction, to channelize the militaristic by 'transcendence' into the co-operative" (256). This cooperative or collaborative rhetoric has important implications for a study of academic discourse—especially the practice of scholarly citation. Just as we can speak of the rhetoric of citation (a microcosm of the academic discipline as a scene of collaboration) in a Burkean rhetoric's terms of "Love," "Knowledge," and "Authority," we can understand academic discourse in general (a macrocosm of discursive collaboration) in these same terms:

> Love, Knowledge, Authority: three basic ideals, variously embodied in structures of power, and all liable to such transformations as make of them a mockery. As translated into the terms of social organization, they are necessarily somewhat at odds. But in moments of exaltation, ideally, we may think of them as a trinity, standing to one another in a relation of mutual reinforcement. (*Grammar* 124)

If we recognize academic disciplines as more or less cohesive social groups, we can view activities that promote the cohesiveness of these groups as courtship rituals. Burke has thus provided a rhetorical theory of disciplinary discourse that views academic disciplines as not only scenes of collaborative actions, but also outcomes of collaborative action that is substantially discursive. For Burke, the substance of rhetoric is the collaborative work of language: "substance, in the old philosophies, was an *act*; and a way of life is an *acting-together*; and in acting together, men have common sensations, concepts, images, ideas, attitudes that make them *consubstantial*" (p. 21). Thus, while discursive interaction is the *sub*-stance of scholars' collaborative action—that is, an essential condition of their work—their collaborative action is the substance or subject of their discourse. Scholarly writers' implicit understanding of the correlative nature of these two processes, discourse and collaboration, informs the choices they make when citing other scholarly works, incorporating others' texts into their own.

If the process of scholarly citation is, then, a microcosm of the academic discipline understood as both scene and outcome of cooperative action, the act of citing—collaboration between the author and other authors and between author and reader—serves as a representative anecdote of all written discourse as collaboration. The use of the terms "collaboration" and "love" does not imply a vision of the discourse community as a context without conflict. Indeed, discourse arises out of conflict. As Burke notes,

> In pure identification there would be no strife. Likewise there would be no strife in absolute separateness, since opponents can join battle only through a mediatory ground that makes their communication possible, thus providing the first condition necessary for their interchange of blows. But put identification and division ambiguously together, so that you cannot know for certain just where one ends and the other begins, and you have a characteristic invitation to rhetoric." (*Rhetoric* 25)

Such ambiguity is especially evident in citation practices.

Adopting this Burkean perspective, the scholarly use of citation can be understood in terms of *identification* and *division* or *courtship* and its partner term *battle*. Though it is tempting to elaborate this discussion of citation practices as courtship rituals by exploring the metaphorical potential of "love notes," "tokens of affection," "strokes,"

and "lovers' quarrels," or "identifying and eliminating potential rivals" and "establishing compatibility," I will rely instead on the less fanciful but ultimately more suggestive terms "identification" and "division" in the following discussion.

The scholarly writer's rhetoric builds her identification with both her readers and the other writers she cites in her text as she negotiates for a place in a relatively small and well-defined community. When she incorporates words, ideas, and conclusions which have already appeared elsewhere, she does not present these because they are unfamiliar to her readers so much as she presents them as a reminder to the disciplinary colleague of knowledge they presumably have in common. Thus the citation is a means by which the reader may identify more fully with the writer. The writer, by citing other literature, implies a narrative of the process by which she has arrived at her own ideas or new information,[5] suggesting (perhaps with a hint of coercion), "this is what we already have believed, this is how I propose to challenge or further develop our belief, and you, dear reader, will believe this new way too."

This Burkean rhetoric of citation practice implies a particular way of reading citations. When a reader of scholarly literature encounters citations of work with which she is not familiar, the citation promises her that she can achieve closer identification with the author and the rest of the disciplinary community by reading that source. If a reader is already familiar with the cited literature, the author's reference to that work serves to reinforce his identification with his scholarly community. If readers are in a critical, gate-keeping frame of mind, they may dismiss a writer (whether they do so legitimately or not) as "not of the community" if he or she fails to cite a work they consider important or does cite a work they do not respect. Thus the citation choices meant to foster identification have the potential for creating division.

The number and scope of citations introduced also contribute to the process of identification. Profuse citation implies depth or breadth of familiarity or both: the author who is able to create identification with a large number and a variety of sources makes a strong claim for membership in one or more disciplinary communities. At the same time, however, a reader may infer from profuse citations that the author is not familiar enough with the community to make the necessary discriminations and distinctions about what is theoretically hip, politically correct, or factually relevant that characterize the community insider. Or the reader may suspect that the writer is simply showing off. In either case, the gesture intended to create identification becomes instead a gesture of division.

Other characteristics of citation practice are equally ambivalent. For example, reliance on citations that are all relatively recent may indicate an author who is up to date. But it can also betray an author who is not aware of the tradition or history of the community's inquiry. Conversely, reliance on citations which are all relatively old might suggest that the author is not familiar with the current "work" and thus is not able to identify with the community's ongoing efforts.

The more elaborate the attribution—that is, the more data that is presented as new information to introduce the source—the less authority conferred upon the source. For example, only an inexperienced writer in English would take pains to explain that Shakespeare was an Elizabethan poet and dramatist or that *Romeo and Juliet* is a play. Such elaboration suggests that the recognition of the source and acceptance of his or her authority will not be shared among the readers, since the more widely shared the knowledge of the source, the greater its authority.

Thus, our concepts of authorship and authority are intricately entwined. Burke, noting that the sense of *auctor* as "ancestor" and as "maker" contributes to the sense of *auctor* as "head" or "leader," has called authority the "principle of group cohesion, and of cohesion among groups pitted against the group" (*Grammar* 23). Authorship binds the groups together, for employment of a common language creates group cohesion.

Deviations from accepted citation practice by inexperienced academic writers demonstrate that this process can go wrong in several ways. When they rely too much on their sources to develop ideas and support points, they are attempting to achieve identification with the community exclusively by calling upon other members; their sources' standing is enhanced rather than their own. When inexperienced academic writers provide unnecessary citations, they demonstrate that they do not recognize what is shared knowledge, thereby dividing themselves from the community they wish to join by revealing that they do not know what everyone knows and therefore possibly do not know what they need to know to function within and contribute to the community. Conversely, when they do not provide necessary citations or provide incomplete citations, they create a division from the community because they do not know what everyone does *not* know, essentially failing to establish the context for their work that would identify it as a valuable contribution to community life. Likewise, they fail to compose an identity in the scholarly community when they ineffectively integrate

cited sources into the context of their own work. Inexperienced academic writers' sources are not integrated into their texts, just as they themselves are not integrated into the academic community. Similarly, inexperienced writers create a division from the community with which they seek to identify when they use an unconventional citation style, betraying either their lack of familiarity with the customs of the community or their lack of regard for those customs.

Perhaps all of these "failing" citation practices, typical of many student writers, could be read as intentional gestures toward establishing division from, rather than identification with, the scholarly community. Indeed, feminist writers such as Luce Irigaray and Rachel Blau DuPlessis have exploited unconventional citation styles to signify their rejection of some traditional values in scholarly writing. Irigary's extensive quoting of Plato without commentary in "On the Index of Plato's Works: Women" and DuPlessis' collage of quoted material and her own words in her essay "For the Etruscans" function as emblems of their alternative perspectives on the community of literary criticism and its discourse conventions. When academic readers assume writers have not used these divisive citation practices intentionally, they tend to interpret them as failures to identify with the scholarly community.

The Research Paper

Seen from the perspective of a rhetoric of identification employed to collaboratively construct community, the obligatory college research paper can be understood as a courtship ritual. This traditional assignment, long used by teachers across the curriculum to teach students to evaluate and synthesize information and ideas[6] is also a way to familiarize students with the shared values of their disciplinary communities. Within the context of disciplinary community discourse, rules for paraphrasing and summarizing, like those for quoting, do not seem so arbitrary as they necessarily are when the research paper is taught in the isolation of a composition class that is not integrated with the rest of the student's curriculum. In order to learn how to select effective strategies for incorporating others' writing into their own, students must have some stake in the community, some motive for rhetorically negotiating identification with the disciplinary community. The best guide and model for learning how to do this negotiating is a teacher who is herself a member of the disciplinary community, with a record of successful courtship as demonstrated by her own writing.

Since teachers of the introductory composition courses for which "the research paper" is a required curricular component[7] cannot hope to be simultaneously members of all the various disciplinary communities their students are presumably preparing to join, they cannot themselves offer such a model for every student. However, students and teachers in lower-division writing courses do have a number of options that will allow them to nevertheless productively study rhetorical strategies for research writing. Students in these courses can write for an audience of other students in the same major or related disciplines and teachers can include peer review by these readers in their evaluation measures; or students and teachers might invite faculty in various disciplines to offer "second readings" of research papers. Both of these options provide student writers with readers who represent, to varying degrees, disciplinary communities other than the composition teacher's.

Teachers and students can exploit a composition class' potential for becoming a mini-discourse community by using a set of shared readings—sometimes called a "casebook"—that serves as the principle sources for research papers. Students can then compose research papers that argue genuine positions on real issues for an actual audience of their peers rather than an imagined one. As a further refinement, these casebooks readings could be selected from the disciplinary discourse of composition studies, thus providing a set of materials that clearly address relevant "content" for a writing class, illustrate some of the important points about scholarly writing, and represent the composition teachers' area of disciplinary expertise.[8] Each of these approaches allows teachers and students to examine scholarly citation practice as a matter of making strategic decisions about "siding with" or "opposing" other members of a disciplinary community.

In closing, I will offer an initial contribution to developing a set of citation practice guidelines based on a rhetoric of identification. The following rule of thumb for one citation practice, quotation, while still very general, may be more useful than the standard handbook advice: repeat another writer's words only in order to achieve the maximum degree of identification with the writer or to secure maximum division from that writer. In quoting to identify with another writer, one constructs a bond of mutual support by both speaking the others' words and allowing the other to speak for oneself. Quotations which divide writer from writer allow each to speak for himself or herself, thus the quoting writer need not use her voice to articulate the ideas of the quoted writer. The difference in these two rhetorical motives and desired

outcomes indicates the critical importance of effectively introducing and commenting on quoted materials.

My own citation practice in this essay has followed the Burkean rule of thumb I've proposed. I have used direct quotation extensively, both for maximum identification with Burke and for maximum division from the textbooks and style manuals. The corollary to this rule of thumb, of course, is that over-reliance on quotation undermines the author's authority, suggesting that she has no independent identity, is unable to use her own voice to articulate and shape her community's values.[9]

Credible citation practice is more than a matter of selective quotation, fluent paraphrase, accurate summary, avoidance of plagiarism, and precise punctuation. It is an act of building community, collaboratively constructing shared knowledge. The rhetoric of disciplinary discourse in the Burkean terms of *identification* views disciplinary discursive practices as rituals of love and courtship that work to create group cohesion in academic disciplines. Though "courtship" is not a dimension of discourse we customarily consider from a scholarly point of view, and "love" is a motive infrequently ascribed to professional academics' interaction, these may be terms that make good sense to those whose role as students positions them as outsiders longing for the embrace of the disciplinary community and to those whose role as teachers positions them at the gate, empowered to grant or withhold access to that embrace.

Notes

[0] For a discussion of the rhetoric of paraphrasing, see Arrington.

[1] Kroll's results may have been affected to some degree by the definition of plagiarism the student participants were given at the beginning of the questionnaire: "As you probably know, plagiarism involves presenting another person's words or ideas as if they were your own, without acknowledging the source" (205). Kroll classified students' written responses to the question "Why is plagiarism wrong?" according to a "set of categories that emerged during the process of examining the responses and formulating categories that accounted for the majority of reasons students gave" (206).

[2] In "What Do Citations Count?" Susan Cozzens argues that citation is only secondarily a reward system. Primarily, it is rhetorical—

part of persuasively arguing for the knowledge claims of the citing document.

[3] For a recent review of bibliometric approaches to citation studies, see White and McCain.

[4] See Gilbert, Latour, Cozzens, Small, Swales "Citation Analysis," and Berkenkotter and Huckin.

[5] See Berkenkotter and Huckin's account of one writer's use of citation to construct a narrative of her research and reasoning process.

[6] See Kantz's discussion of the tradition of the research paper.

[7] In 1982, Ford and Perry reported that instruction in writing research papers was included in 84% of lower-division composition programs and in 40% of upper-division composition programs.

[8] See John Swales' recommendations for a set of reading and writing assignments for graduate students who are non-native speakers of English, "Utilizing the Literatures."

[9] George Dillon's Bakhtinian explanation of the use of scare quotes or shudder quotes, "My Words of Another," provides a parallel to my Burkean explanation of the use of extended quotations. Dillon observes that shudder quotes, which iterate a key word or phrase used by someone else and enclose it in quotation marks, allow one to use the language of another without actually making it one's own: "Finding one's voice is thus not just an emptying and purifying oneself of others' words, of the perverted commas, an askesis, but also an admitting, an adopting, an embracing of filiation, communities, and discourses" (p. 71).

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Beyond Mainstream: An Interdisciplinary Study of Music and the Written Word

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In a radio interview a few months before his death in August, 1992, composer John Cage aptly described the wonderful diversity of life at the turn of the twenty-first century:

> Today our experiences more and more are populated with more and more people and more and more things that strike our perceptions. We live in a time I think not of mainstream but of many streams or even, if you insist on a river of time, that we have come to delta, maybe even beyond delta to an ocean which is going back to the skies. (Cage interview)

Cage's "ocean" may be an accurate metaphor for our time as our knowledge of the world and its histories expands exponentially. Fiber optics technologies have begun to revolutionize the way information is processed and disseminated. In the future, the entire world may be linked by a massive global telecommunications network that will allow us to transfer information at incredible speeds into every home. These technologies have the potential to break down the world's geo-political boundaries. Marshall McLuhan's vision of a "global village" may soon become a reality; or, more pessimistically, we might envisage a situation where everyone has access to a diminishing fragment of the whole.

Institutions of higher learning and their epistemological paradigms are not exempt from these profound cultural changes. "Undergraduate education," write the authors of *Strong Foundations: Twelve Principles For Effective General Education Programs,* already "strikes students as a bewildering introduction into diversity, different bodies of knowledge, modes of inquiry, ways of knowing, voices, historical periods and cultures" (Association of American Colleges 12). In finding their way through that plethora of material, viewed and interpreted from a wide

 DOI: 10.37514/LLD-J.1996.1.3.05

array of cultural perspectives, today's college students attempt an incredible task—a task that is exacerbated in a situation where teachers find themselves bewildered by what and how to teach. The rapid growth of knowledge and the resultant emphasis on specialization has proceeded at a feverish pace, while the introduction of diverse and hitherto unheeded voices into the academy has placed in question the notion of a stable canon. In literary studies alone, Stephen Greenblatt and Giles Gunn note, "[a]s the parameters of individual historical fields have been redrawn and new theoretical and methodological orientations have been devised, the possibility of a unifying, totalizing grasp of our subject has, for all but the very few, receded" (2). The very ideal of universal knowledge is no longer fashionable, for scholars have questioned the validity of meta-narratives in a wide variety of disciplinary contexts. The academy is fragmented—or better, "balkanized." We seem, to invert the optimism of Cage's metaphor, to be lost among the multiplicity of streams of an ever-widening educational delta.

If we are not all to drown in something like what Allen Ginsberg referred to in *Howl* (1956) as a "total animal soup of time," our college curricula and the epistemological assumptions that underpin them must rise to the challenge. The field of general education is where these issues are being examined and most fruitfully engaged, partly because it directly shapes an institution's curricular structure but more profoundly because it tackles the issue of epistemological coherence. The authors of *Strong Foundations*, for instance, argue that although "exposure to diversity is an essential component of general education," an equally essential component is the "counterbalancing centripetal pursuit of coherence" (12). As the title of that booklet implies, the pursuit of coherence is itself far from a new idea. From the beginnings of higher education in the United States, educators have valued what John Henry Newman termed the "integrative habit of mind." Newman viewed the university as a place where students and teachers join together in the pursuit of universal knowledge. He envisioned the college curriculum as a coherent and organically unified whole and described the university according to its classical designation as a *Studium Generale* or "School of Universal Learning" (1856, 6). More recently, as Ernest L. Boyer and Arthur Levine argue in *A Quest for Common Learning*, each successive attempt to implement general education reforms has occurred in an era of "social drift and personal preoccupation," necessitating a new focus on "shared values, shared responsibilities, shared governance, a shared heritage, and a shared world vision" (17).

Those objectives are not easily achieved, and still less so because the consensus today is that previous curricular models for general education—notably "cafeteria-style" distribution requirements—are no longer satisfactory. Distribution requirements maximize students' exposure to materials from diverse disciplinary contexts and have the potential to counterbalance the pursuit of depth of knowledge gained in the major with the breadth resulting from studies in a broad range of areas. But in practice this strategy commonly results in a series of courses that are so narrow in focus that breadth of knowledge is scarcely attained. Even more importantly, distribution requirements frequently do not provide students with a coherent and unified understanding of disciplinary relationships, let alone the world around them. As Ernest L. Boyer has explained, "Students move from one departmental requirement to another, rarely discovering connections, rarely seeing the whole" (*College* 90).

Making connections across disciplines thus seems essential. Interdisciplinary courses, which seek to investigate common material through a variety of disciplinary lenses, offer a promising method of working toward more holistic ways of knowing while respecting the specific languages and protocols of each discipline. Potentially, they provide students with models and methodologies with which to decipher the complex world around them. But not every interdisciplinary connection is meaningful, as Hermann Hesse suggests in *The Glass Bead Game (*1943), a prophetic novel that describes the ultimate exercise in interdisciplinarity—a game based upon the sum total of all human knowledge. Hesse writes about a period in the history of an imaginary scholarly community called Castalia during which working across disciplinary boundaries yielded laughable results. This era, which he named the "Age of the Feuilleton," was a time where intellectual freedom and ardent individualism led to a superficial and narcissistic academicism. Literary works such as "Friedrich Nietzsche and Women's Fashions of the 1870s," "The Composer Rossini's Favorite Dishes," and "The Role of the Lapdog in the Lives of the Great Courtesans" are some examples of Castalian interdisciplinarity run amok (18ff).

As we plan interdisciplinary courses for our general education programs, it is crucial to avoid the sorts of superficial interdisciplinary connections mentioned above, even though few educators today would question the value of interdisciplinary curricula in the area of general education. At Mills College, a small liberal arts college for women located in Oakland, California, faculty have been working to reform the

College's general education program by instituting several interdisciplinary components, in part to address the problem noted by the AAC in *A New Vitality in General Education* that "most of us who teach undergraduates do not ourselves engage in the sort of integrative learning across fields we expect of our students" (48). At Mills, interdisciplinary seminars are now required for all entering students. Our own team-taught interdisciplinary seminar entitled "Music and the Written Word" has been offered for four consecutive years. Our latter-day Castalia, Mills has turned out to be a fruitful proving-ground for contemporary educational and curricular practices.

This article summarizes the educational philosophy, content, and pedagogical methods employed in this seminar. Though a success, the course has always posed for us challenging questions about the theoretical and pedagogical underpinnings of interdisciplinary study. From the beginning, we were particularly concerned with two problems that seem to us endemic to interdisciplinary study today. First, this course confronted us with the problem of how to bridge disciplinary boundaries. Should we attempt to negotiate a common ground or find a new and uncharted territory between the disciplines—a kind of virtual space that would change its form and function as the semester progressed? Second, the course brought forcibly home to us a problematic relationship between the aspirations of general education and the tenor of postmodern thought, which is in some of its aspects profoundly at odds with the centering and integrative spirit of general education. Cage's metaphor of what happens beyond the mainstream frames the problem neatly, if ambiguously, for it makes a great difference whether one conceives of the field of knowledge in terms of a single (though limitless) ocean or in terms of the multiplying streams of a delta.

Addressing issues like the value of interdisciplinary work in a postmodern age in a seminar intended for entering students may seem a tall order. Yet we found that these issues arose spontaneously as a function of our pedagogical strategies, which ended by problematizing the very principles that shaped them. From that point of view alone we felt this essay worth writing; and it is our hope that this discussion with provide a useful model for others engaged in planning—or questioning—interdisciplinary general education curricula.

* * *

From the outset, looking for interconnections between poetry, narrative, and music seems natural, since language and music are easily

related forms of human expression. Oration and music were virtually inseparable in classical antiquity; Homeric epic poetry was invariably sung or chanted. There is a rich history of literary/musical genres, such as opera, *Lieder*, sound poetry, madrigals, melodrama, motets, oratorio, and chant. Since ancient times the theory of music has incorporated terminology from rhetoric and poetry, while poets have just as often theorized about the musicality of their work—a traditional relationship that has continued to the present day. A recent, much-acclaimed monograph on musical structure and perception, for instance, has been authored by a music theorist working in collaboration with a linguist.[1]

Such connections, however, still left open the question of what kind of interdisciplinary activities would serve as our goals, particularly in light of the AAC's warning that an "[i]nterdisciplinary synthesis is achieved not by arraying disparate subjects sequentially before students" (*Reports* 66), or, as Steven S. Tigner has argued more recently, "[c]onnecting disciplines to create interdisciplinary learning is more than a process of course blending" (5-6). "Music and the Written Word" began with a provisional assumption gleaned from Leonard Bernstein's *The Unanswered Question*—which is the published version of the Norton lectures he delivered at Harvard in 1973—that "the best way to 'know' a thing is in the context of another discipline (3). This seemed an ideal strategy for a course combining music, narrative, and poetry. Students invariably come to a seminar like "Music and the Written Word" with far more background in language and literary works than they do in music, for linguistic competence develops almost from the moment of birth while musical skills are acquired years later, and, in most cases, develop at a markedly slower pace. The concepts and vocabulary we develop supply us with a way to look at music that transfers our students' linguistic abilities to musical contexts.

Posing the rather monumental question "Whither music in our century?" (269), Bernstein's six lectures range provocatively from music to poetry to the transformational grammar of Noam Chomsky, whose account of linguistic deep and surface structures inspires Bernstein's own attempts to fashion a satisfying theory of musical deep structure. Chomsky posits a universal linguistic competence that allows all human beings to generate an infinite variety of linguistic performances (the surface structure) from a limited number of grammatical elements and forms (deep structure). For Bernstein, the overtone series comprises a musical analogy to Chomsky's concept of deep structure in that it represents a universally acquired language—a "worldwide,

inborn musical grammar" (7)—whose presence makes possible the tonal system that structures and makes comprehensible all musical performances. Bernstein claims, moreover, a connection between transformational grammar and music (119). Using Chomsky's descriptions of the transformational rules common to all languages, Bernstein seeks to identify some of the complex rules (such as processes of transposition, deletion, conjoining) that govern the emergence of any unique composition from universal materials and forms.

The concept of deep structure developed in *The Unanswered Question* allowed us to solve several pressing pedagogical problems. First, it grounded our discussions within a conceptual framework capacious enough to include both disciplines. Although Bernstein's technical vocabulary (derived from Chomsky) proved unnecessarily complicated for our first-year students, his often witty demonstrations of how both poetry and music might relate to the operations of transformational grammar prevented the course from having to rely on the language and strategies of one discipline—or, just as problematically, from having to rely on two separate hermeneutic languages. Using Bernstein's book circumvented (though perhaps did not solve) the problems faced by students as they become, in Lucille McCarthy's terms, strangers in strange lands: heir to multiple discourse communities that seem confusingly different in the strategies and languages they privilege (McCarthy; see also Bartholomae).

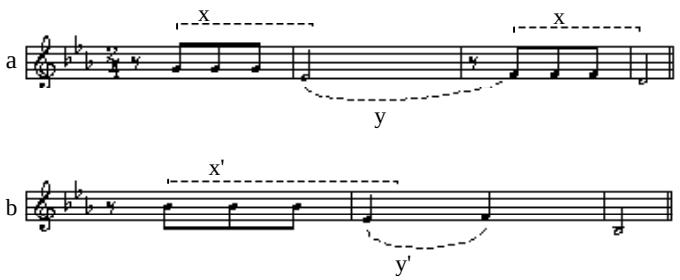
We found, for example, Bernstein's discussion of metaphor in music and poetry particularly helpful. In poetry, metaphor is a wonderful way of establishing connections between ideas, people and things, that are, at least on the surface, differentiated. A metaphor like "Juliet is the sun," to use Bernstein's example out of Shakespeare, equates a person with abstract properties like radiance or life-giving capacity. Most importantly for Bernstein, a metaphor is *configured language*. A metaphor like "Juliet is the sun" conforms to a structural relationship whereby "this equals that, where *this* and *that* belong to two completely different and incompatible orders" (123). In a deep structural sense, "Juliet is the sun" is precisely similar to "Henry is a lion" or "Jeremy trashed my car."

Turning to music, Bernstein distinguishes usefully between two kinds of musical "metaphor" which he terms *extrinsic* and *intrinsic*. In extrinsic metaphor, musical sounds bear a relationship to extra-musical ideas and feelings. A famous example is Beethoven's *Pastorale* Symphony with its musical portrayals of birdsong, thunderstorms, and

country dances. Our examination of this type of musical relationship presents an opportunity for students to share their personal responses in both written and verbal form to a wide variety of musical works, ranging from the overture to Wagner's opera "The Flying Dutchman" to recent works by composers at Mills, including Maggi Payne's "Subterranean Network" (an electronic work depicting the horrors of tunnel fighting during the Vietnam War) and Alvin Curran's "Notes from Underground" (a sound/installation work with music rising up from speakers buried beneath the ground, portraying the outcries of horror and mourning by victims of the holocaust.). Our students discuss the extra-musical images invoked by these pieces in class—a challenging form of hermeneutic analysis requiring a creative response that translates abstract musical information into metaphoric language.[2]

Intrinsic metaphor, according to Bernstein, results from the development of a motive. As a result, certain musical configurations bear a relationship to each other and thus yield a "metaphoric" (or "this is that") correspondence. For example, consider the well-known opening of Beethoven's Fifth Symphony (Ex. 1a):

Example 1



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The theme consists of a four-note motive (x) whose repetition is separated by a rising step (y). Later on in the movement, at the beginning of the second theme (Ex. 1b), the listener encounters new material. But the new theme also contains the motivic building blocks from the opening (x' and y'). Thus, despite their surface dissimilarity, the two themes are, on a deeper level, equivalent. We might say that Ex. 1a is a metaphor for Ex. 1b. This sort of equivalence is not trivial, for it is an example of the musical organicism that lies behind the formal structure of many eighteenth- and nineteenth-century musical works. And students can learn to appreciate and recognize these sorts of connections when they are taught to extend their knowledge of more familiar

materials (i.e. poetry and its use of metaphor) to more abstract musical situations. The results of pedagogical strategies such as this have been startling. Our students have been able to understand and write about music with a level of sophistication that would not have been possible without this interdisciplinary framework.

The kind of common ground based on structural resemblances that Bernstein has in mind can always be disputed, and he himself hints that his theory of metaphor, like many of his connections between music and language, is meant to be understood metaphorically—as a provocative analogy rather than as intimations of a universal aesthetic language. On the other hand, one cannot see the point of or dismiss his analogies without first beginning to think in interdisciplinary fashion. The heuristic value of terms like extrinsic and intrinsic metaphor in music is apparent only when they are conceived of in relationship to a discussion of linguistic metaphor; they are useful for our interdisciplinary purposes because they are not self-explanatory nor terms commonly used in the discipline of music appreciation. While we and our students often critique Bernstein's arguments, therefore, his methodology seems to us pedagogically sound.

The concept of deep structure proved to be still more productive once we began to explore possibilities only latent in Bernstein's lectures, such as a consideration of meter, which creates another kind of deep structure in music and poetry. As one might expect, our complementary discussions of musical and poetic meters helped students grasp the mechanics involved. More importantly, the interpretive framework of deep structure helped them grasp the idea that metrical forms possess profound historical and cultural significances. We studied, for instance, the ways in which several major poets in English have employed various meters, particularly iambic pentameter, in order to enter and revise centuries-long literary traditions. John Milton's *Paradise Lost* (1667) exemplifies the elevated tone and epic qualities of a metrical form associated with Shakespeare and Chaucer; Alexander Pope's *The Rape of the Lock* (1714) calls upon the inherited meanings of the metrical form in order to satirize the pretensions of his subjects, transforming epic possibility into mock-epic actuality; and William Wordsworth's *The Prelude* (1850) transforms the cultural significance of the form again by placing its associations of grandeur at the service of an individual's life and aspirations. Caribbean poet Derek Walcott, who chooses to write his contemporary epic *Omeros* (1990) in unconventional hexameter, provides an intriguing foil, for his metrical form

allows him to step outside an English tradition of epic in poetry while reminding us of still older forms: the hexameter, for instance, of Homeric epic.

Our discussion of metrical forms culminates in a more intensive analysis of innovative works like Igor Stravinsky's *The Rite of Spring* (1912-13) and T.S. Eliot's *The Waste Land* (1922). Stravinsky's rhythmic innovations were perhaps his most important contributions to twentieth-century music. Throughout the *Rite* his musical setting works against the bar-line and strongly undermines the listener's sense of metric regularity. In many passages meter is no longer an element of this work's "deep structure"—a feature that distinguishes the *Rite* from works stemming from previous musical traditions and shows one of the ways that this work responded to *fin-de-siècle* political and social disintegration.

In *The Waste Land* the irregular meter of the first 18 lines of becomes problematic at the very moment when the emergence of a new, prophetic voice suddenly returns us to iambic pentameter:

> What are the roots that clutch, what branches grow
> Out of this stony rubbish? Son of man,
> You cannot say, or guess, for you know only
> A heap of broken images, where the sun beats,
> And the dead tree gives no shelter, the cricket no relief (ll. 19-22)

In response to the poem's own rhetorical question about clutching roots, two lines of iambic pentameter (ll. 19-20) reflect what has been lost: a tradition in which stable metrical patterns intimated order, grandeur, and continuity both social and cosmic. Subsequent lines, keyed by the post-war pessimism of "you know only/A heap of broken images," slip back into increasing irregularity (11 syllables, then 12, 14). As if further to mock the return to a metrical deep structure, the next occurrence of iambic pentameter falls ironically on "Madame Sorostris, famous clairvoyante" (l. 46), whose "wicked pack of cards" provides a bathetic modern counterpart to ancient wisdom.

The above mode of inquiry focuses upon structural or syntactic similarities between the languages of these two disciplines and also begins to explore how works from different disciplines relate to similar social, political, and historical contexts. Our studies of nineteenth- and twentieth-century music, poetry, and fiction have proved an extremely productive approach to this latter pursuit—the "business" of intellectual

history. In "Music and the Written Word," works from the romantic, modernist, and postmodernist periods compose the body of the course. Several lectures on romanticism examine the basic tenets of transcendental philosophies and how they are reflected in paired works like the *Prelude* and *Liebestod* from Wagner's *Tristan und Isolde* (1865) and Coleridge's *The Rime of the Ancient Mariner*, or Whitman's *Out of the Cradle Endlessly Rocking* (1859) and Charles Ives' Fourth Symphony (1916). Our early discussions of the romantic predilection for cosmic unities and universals allow us to explore the concept of deep structure anew in a specific historical context.

In discussions of several works from the early twentieth century, our students learn about relationships between modernist aesthetics and social and intellectual upheavals at the turn of the twentieth century. Our examination of T.S. Eliot's *The Waste Land* accompanied by lectures on Stravinsky's *The Rite of Spring* introduces the class to modernist techniques of fragmentation, discontinuity, and allusion, and demonstrates how music and poetry composed with these methods reflect the political, moral, and social climate during the years prior and immediately following World War I. Virginia Woolf's experiments with different types of fictional time in *To the Lighthouse* (1927) supplies a connection to composers whose experiments with musical time run from the discontinuities of Stravinsky to the more recent minimalism of Reich, Riley, and Glass. Similarities in form and technique lead, however, to questions about these artists' social and political intent, particularly in reference to the changing roles of women in early twentieth-century society. Close readings of the female characters in Woolf's *To the Lighthouse* (Mrs. Ramsey and Lily Briscoe), Alban Berg's 1922 opera *Wozzeck* (Marie), and Eliot's *The Waste Land* provoked much thought among our students with regard to the ways in which experiments in form affected—or were affected by—the portrayal of women.[3] Building on these socio-political considerations, we subsequently compare Allen Ginsberg's poem *Howl* with the "Free Jazz" movement and explore some of the ways in which artists reacted similarly to the social and political situation of the McCarthy period and its aftermath.

The final section of the course investigates postmodernism with the rather ambiguous goal of unifying our thinking about deep structure while beginning to characterize a postmodernist aesthetic of structurelessness and decenteredness. Here again, Bernstein's lectures, which always invite readers to reflect on historical continuities and

transformations, have proven extremely useful. *The Unanswered Question* is as much a polemic about the perceived demise of tonality in music in the twentieth century as it is an interdisciplinary inquiry into relationships between language and music, and in its former guise Bernstein's argument unfolds historically. According to Bernstein, the nineteenth-century's growing obsession with chromaticism in music leads to a twentieth-century crisis—indeed, a "life-and-death crisis in musical semantics" (263)—whereby the rise of nontonal music threatens the universality of the harmonic series and thus the "deep structures implied by, indeed inherent in, these notes" (289). Bernstein thus resists what we might be tempted now to call a postmodernist fascination with the loss of the universals and deep structures that made powerful, in Jean-François Lyotard's terms, "*les grands récits*" of Western culture. His lectures actually tap into some of the most contentious philosophical issues of the last forty years.

These ideas are taken up as the seminar begins to move from modernist to post-modernist musical and literary works. Early in the semester, we compare tonality—an ordered system of tension and relaxation based on the tonic/dominant relationship—to the effect of orderly rhyme schemes and meters in poetry, and place such music and poetry in the context of the philosophical and religious suppositions of their age. Seen through Bernstein's lens, the breaking of tonality in the twentieth century anticipates what we often call the postmodernist turn in writing, an idea we introduce by looking briefly at the literary experiments and aesthetic assumptions of Gertrude Stein. In her 1912 portraits of painters ("Cezanne," "Picasso," "Matisse") and her still more radical *Tender Buttons* (1914), Stein freed words from their semantic obligations. By exploiting the aural and visual aspects of language, Stein disrupts the word/thing (or signifier/signified) relationship that underpins most people's linguistic assumptions. The "A Box" section of *Tender Buttons*, for instance, begins "Out of kindness comes redness," a statement that seems nonsensical until it is read as a statement about the aural play that pervades Stein's work: the piece goes on to discover the possibilities of the "ness" motif as it modulates to "rudeness" (which itself becomes "rudimentary"), or splits into alliterated pairs like "something suggesting" and "substance strangely." Stein's writing could thus be called nontonal in the sense that it eschews the word/thing relationship that seems to center and stabilize all linguistic systems.

In music, similarly, John Cage was concerned with "letting sounds be themselves." He wrote works employing chance operations so that musical materials could exist independently within a given work without forming the organic connections that were so highly valued in the music of earlier periods. Cage was fascinated by the randomness and the musical potential of noise. In an essay entitled "The Future of Music Credo," he rejected the distinction between "noise" and so-called "musical sounds."

> Wherever we are, what we hear is mostly noise. When we ignore it, it disturbs us. When we listen to it, we find it fascinating. The sound of a truck going fifty miles per hour. Static between the stations. Rain. We want to capture and control these sounds, to use them not as sound effects but as musical instruments. If the word "music" is sacred and reserved for eighteenth- and nineteenth-century instruments, we can substitute a more meaningful term: organization of sound. (Cage 3)

Ironically, Cage's composition without sound, a work entitled *4'33"* (1952) did more than any other work to alter our definition of music so that it could include noise as well as any other possible sound. During each of the work's three movements the performer simply sits motionless in front of the piano. As one might expect, there was quite an uproar after the first performance. One irate audience member even stood up and said "Good people of Woodstock, let's drive these people out of town."

Our seminar includes a live performance of *4'33"*, and fortunately we have not yet experienced a similar reaction. After a few moments of uneasy silence, the students begin to listen to the sounds around them, from the croaking frogs in a nearby pond to the muffled drone of the freeway outside of the campus. In fact, the description of *4'33"* as a composition without sound is misleading. According to Cage, any combination of sounds, whether they are "musical" sounds, noises produced by percussion instruments, or the ambient sounds of our environment, can be aesthetically pleasing. In this way, the materials available for a musical work are virtually unlimited and Cage rejoiced in the existence of these infinite possibilities.

4'33" allows us to explore forward-looking aspects of Cage's musical aesthetics. Cage's position within the history of twentieth-

century music is very much like Stein's in the way that he anticipated the postmodernist aesthetic tradition. He rejected several basic musical assumptions: the need for musical relations (i.e. syntax and organic form) and the necessity for criteria used to determine the sounds that are appropriate for musical works. Cage thus joins Stein in the de-centered, level "playing field" of the postmodernist aesthetic arena.

Our course and our discussions of postmodernism conclude simultaneously with the work of contemporary composer Robert Ashley, who has recently completed an extraordinary trilogy of operas, *Atalanta* (*Acts of God*), *Perfect Lives*, and *Now Eleanor's Idea*. Ashley, a composer in the American experimentalist tradition, was a founder of the legendary *Once Group* —an interdisciplinary arts collective that flourished in Ann Arbor, Michigan in the 1960s. He is known for pioneering a new form of operatic production based on a collaborative multi-media presentation and a form of vocal delivery somewhere between speech and song.

In some ways, Ashley pays homage to his modernist antecedents. The introduction to the libretto of *Improvement (Don Leaves Linda)* (the first part of *Now Eleanor's Idea*), for instance, contains an elaborate chart, strongly reminiscent of James Joyce's famous schema for *Ulysses* (1922), detailing categories like "Idea," "Technique," "Theme," and "Code" for all four parts of *Now Eleanor's Idea*. In *Improvement*, the character of Linda supposedly represents "The Jews," Don "Spanishness," and the Airline Ticket Counter "The Inquisition;" its "Code" is 1492, signifying the beginning of America and the expulsion of the Jews from Spain. Such complex schemas do indeed remind us of the desire of a Joyce, Pound, or Yeats to compose vast cosmic and historical allegories. One critic, Charles Shere, likens Ashley's work to Joyce's *Finnegan's Wake* for the way his operas invoke a "universal resonance" (Ashley xii) in each particular, an interpretation that Ashley himself supports when, in an interview, he refers us to the Neo-Platonic idea that "the whole thing is contained in the smallest detail" (Burch 118).

But Ashley's operas—each one designed for that nontraditional yet quintessentially postmodernist medium, the television—constantly force us to rethink these analogies to modernism. Consider, for instance, the dialogue at the Airline Ticket Counter (the Inquisition), featuring Carla and Carlo (alias Don):

Where was your wife when you left her?
She was in the toilet at the turn-off.
She went into the toilet and you left her?
Yes.
You took her baggage and the rented car?
Yes.
You left urgently to meet another person?
Yes.
That person is a woman?
Yes.
Your wife will be angry and jealous.
No.
How is that possible? (Scene II, 30-36; Burch 124-5)

Ending on a ne'er-answered question, Scene II puts in doubt the very nature of our reading (and listening) experience. The echo of an interrogation, we might argue, lends ominous overtones to an amusing situation. Or is it that what might have been an ominous allusion surrenders to a kind of tabloid narrative (wife abandoned at a toilet), so that the whole piece becomes a kitsch version of James Joyce? The question is whether Ashley's own exegeses and self-conscious pontificating ("For the sake of argument Don is Spain in 1492/and Linda is the Jews," [Act I, 35-36]) can be taken seriously, or whether the entire opera becomes a jokey parody of modernist techniques. Like Cage and Stein, his work opens up discussion about the viability of the modernist project—in particular, its quest for interconnectiveness and universality.

* * *

The foregoing discussions of music and poetry may seem too sophisticated for many first-year students. But this has not been the case, for our seminar has been well received by both our students and those involved in assessing our efforts. The key to this success is the kind of interdisciplinarity achieved by our seminar, in which different disciplinary languages allow our students to approach complex issues and ideas from several perspectives, but also in which the disciplinary languages themselves are reframed (and revitalized) by each other. Moreover, as we move back and forth from poetry to music (and sometimes narrative) throughout the semester, our course consistently maintains a common ground of inquiry established on the historical

circumstances shared by writer and composer but also, crucially, on Bernstein's account of the historical fate of deep structure in the context of the harmonic series.

Bernstein's lectures played multiple roles in our course. They facilitated the acquisition of skills like understanding metrical arrangements in poetry and music. More importantly, they provided a kind of deep structure to our own course: a continuing interest in the fate of a concept like deep structure, beginning with a Romantic predilection for transcendental unities, moving to a modernist yearning for (in Eliot's phrase) "roots that clutch," and concluding with a postmodernist celebration of decenteredness. Various concepts of deep structure loosely organized and provided a subtext to the chronological format of the greater part of our course, which thus allowed students to approach the relationship between writer and composer sychronically (in terms of common historical affiliations) and diachronically (in terms of their affiliations to the way an important concept has unfolded over two centuries).

But what made Bernstein's work so pertinent to our course was the way in which its narrative of a growing disenchantment with deep structure embraced our own interdisciplinary aspirations. Our final discussions of a postmodern fascination with decenteredness and syntactic rupture forced us and our students to confront a series of productive ironies within the very construction of the course: that our ideas, conceived within the syncretic and centering spirit of general education, had also to entertain an aesthetic and a philosophy that questioned the very premise of needing a core or center; that our final disagreement with Bernstein's insistence on musical deep structure extended and completed a discussion of deep structure that in important ways unified the course; that an ideal of integrated knowledge collided with our sense (as Aronowitz and Giroux argue in their Postmodern Education) that "postmodernism asserts no privileged place" (13) for the observer and educator. A pedagogical strategy that encouraged students to think beyond the disciplinary mainstream was therefore implicated in what many have seen as the problematic, even the scandal, of the desire for universal, "centered" knowledge.

The relationship of our method of interdisciplinary investigation to general education was therefore a vexed one, for our method raised questions about the ideal of integrated knowledge even as we collectively provided the means of that questioning. But we found these ironies stimulating rather than destructive. Our course did not achieve

interdisciplinarity, if by that we mean the product of two disciplinary perspectives or the discovery of an ur-language (in our case based on Bernstein's reading of Chomsky). But it did foster a process of interdisciplinary inquiry—a kind of restive dialogism—that was more open-ended and less conclusive than we originally intended. In so doing, we argue, interdisciplinary investigation was liberated as a tool for probing rather than establishing connections between the disciplines.

In the end, the educational objectives behind general education courses such as "Music and the Written Word" go beyond course content and skill acquisition. They involve goals that look past the syllabi of specific courses and toward transforming the student populations of today into the responsible citizenry of tomorrow. During the final classes of the semester we focus upon the fact that today such notions as deep-structure and universal truth are often viewed with suspicion and that these epistemological assumptions may be the basis for many of today's social, political, and moral dilemmas. At the same time, we explore the question of—if a class like "Music and the Written Word" has any validity—what kind of common ground of inquiry and what kind of (in E.D. Hirsch's term) cultural literacy might prove valuable in our age. Our discussions of Eliot, Stravinsky, Stein, Cage, Woolf, and Ashley therefore introduce our students to several vital issues in late-twentieth-century intellectual history and try to come to an understanding of how these crucial issues may help us find new ways to adapt to a rapidly changing, complex, and diverse society. In this respect, the fact that those discussions themselves refused to come to closure seems less to be lamented than a sign of how far we have come "beyond mainstream."

Notes

[1] See Jackendoff and Lerhdahl.

[2] For a homework assignment, students write essays about the extra-musical images invoked by several musical selections on tape.

[3] An accompanying "literary letters" assignment, in which pairs of students were asked to assume the role of Eliot/Woolf or Woolf/Berg and correspond about their respective works, proved to be a lively and challenging way for students to articulate their thoughts about modernism.

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The Role of Written and Verbal Expression in Improving Communication Skills for Students in an Undergraduate Chemistry Program

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Thought Takes Shape Through Expression

Proofreading, editing, and critique, the customary assessment tools scientists use to evaluate professional journal articles, grant applications, and any other writing, can be applied equally well in introductory science instruction. Such feedback is, in fact, crucial to growth and development. When learning anything new, students and faculty alike rely heavily on sources other than themselves ('external editors') to assess their understanding as they develop self-assessment skills (or 'internal editors'). Although they rarely describe it in these terms, faculty nonetheless assume that students have developed and refined their internal skills by the time they take examinations and write term papers. Unfortunately, science instructors traditionally provide little meaningful assistance or rationale for students to get to that point. This is in part because we faculty have already developed and deploy our professional skills so tacitly. To a degree, individuals who become faculty members probably follow paths of least resistance, the ones along which they were successful by virtue of their 'natural aptitude'. What some instructors intend to be their best advice to students can be wholly inadequate if it only reflects on the surface aspects of what they did as students: "do lots of problems," "write lots of prose," "sit alone and wrestle with the ideas."

One of the things we faculty do quite naturally in our professional lives is to rely on external input. Having developed any idea to whatever limit we are able to achieve sitting alone in our workplaces with our internal editors and our reference sources, we next try out the ideas on

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 DOI: 10.37514/LLD-J.1996.1.3.06

our colleagues. Expressing our understanding to others is always a teaching activity since we are revealing our interpretation of some aspect of the world to another individual, testing the interpretation against another's point-of-view. Faculty share a common experience that they describe in familiar terms: "I never really learned it until I had to teach it." Perhaps what we also mean is that we actually think about our ideas in new ways when we are consciously aware of the fact that we need to describe them to someone else. In writing as well as speaking, attention to the needs of the audience is critical to clarity in the expression of meaning through the use of information (*1*). Learners learn differently, perhaps even more effectively, when they anticipate the need to express their understanding to someone else. For students, the most common example of this type of anticipation is in preparation for a written or oral examination. This perspective is not at all limited to expository writing and speaking, the usual modes of expression in the physical sciences; revealing internal perspectives represents +expression+ regardless of its modality, and does not favor writers and orators over thespians, pianists, painters, ballerinas or chanteurs.

The concept of expression is not limited to cultural discourse. In the late 1950's, biochemists needed to describe their new ideas about the transmission of genetic 'information' (mediated by DNA and RNA) and the construction of its corresponding 'meaning' (in the form of proteins, biochemical and physiological phenomena). The terms used by Jacob and Monod (*2-4*) have persisted in the biochemical jargon: *transcription* (for the appearance of DNA's genetic message in RNA, which also includes the terms 'proofreading', 'editing' and 'reading frame'), *translation* (for the appearance of a genetic message in a different language, that of proteins) and *expression* (an old biological term that refers to how genetic information is manifested, or 'understood', in whatever matrix originates it). These terms were drawn from and intended to reflect the metaphorical context of language with which they are naturally associated.

Maasen, Mendelsohn and Weingart have outlined the prominent use of metaphors shared between sociological and biological cultures (*5*). We find Dawkins' notion of 'memes' quite philosophically compelling (*6-8*) as a way to think about the transfer of information, the construction of meaning, and the process of learning (*9-10*). As a unit of cultural information, a meme sits at the analogical level of a gene. In our view, the term memetics, which has been recently coined (*11-13*), points to underlying processes by which cultural information is trans-

ferred, including information such as the 'culture' of chemistry or the process of its intellectual pursuit. Formal education, as a constructed tool, is an activity in memetic engineering. Like genetic engineering, memetic engineering is a technology, a product of human design and invention that results from an understanding of a natural process: learning, in this case. In its fundamental metaphors (*14*), the rhetoric of genetic transfer (transcription, translation, expression) has already and unknowingly borrowed from memetic transfer! We see this view as the closing of a circle, where the cultural world is reintroduced to physical world (*5*, *15*).

Inasmuch as we recognize the indispensable role that *transcription* plays in education, we readily acknowledge its limited utility in the development of critical skills. Understanding relies strongly on the constructivist (*16-19*) notion that learners *translate* their current understanding in the context of their prior experience when they need to integrate new information. Ultimately, it is the *expression* of a 'teacher's' understanding that is perceived by a 'learner'. What we expect from a virtuoso pianist is an expression of mood or emotion that this maestro has translated from a transcript of lines, bars, note symbols and clef marks. We would be surprised, disappointed and uneducated if this pianist were to simply hold the sheet music out to the audience and exclaim, "Isn't that just beautiful!" As learners, for example, we appreciate Peter Schickele's ('P.D.Q. Bach's') musical ability as well as his lessons precisely because he can be within the performance and then in an instant be standing alongside of it, guiding his listeners in the composer's art. The less experienced we are with interpretation, the more appreciative we are when an artist steps outside of a performance and draws our attention to meanings that might escape our more naive perception. Teaching is analogous to such a performance where naive learners develop their own abilities to express their knowledge. The processes that underlie preparing for a successful act of expression not only rely on transcription and translation skills, but also the relationship between knowledge of the subject matter and its connection to how its understanding can be expressed; that is, a performance resulting in memetic transfer.

Collaborative and Cooperative Learning Require Expression Skills

We all participate in a variety of groups as part of our daily lives, from families to social and work communities. As chemists, we are part of our colleagial departments, our professional societies, our research

groups, and so on. In graduate and undergraduate school, some of us formed peer study groups in response to the demands of those other groups that we were a part of: our formal courses. We know we are not unique in this. The popular culture, at least, is filled with portrayals of medical, law, and business students who must divide responsibility for learning a daunting amount of course material and who then teach one another as a part of their learning. Graduate research groups in chemistry are generally highly structured by their research directors where community issues are involved (group meetings and assignments, shared equipment, and representatives who obtain specialized skills such as crystallography or mass spectrometry), but move towards a less authoritative structure when developing individual initiative is the goal. Individuals depend on (and learn with) one another in all kinds of educational situations. In order to emphasize this idea, Bruffee (*20*) advocates the use of a phrase attributed to John Dewey: "living an associated life." As Bruffee describes it, formal education in America has been based on a philosophy of associated learning since at least the time of Benjamin Franklin. We all live and learn in an associated way. Differences in interactions vary according to the nature of a group's structure (and sometimes, although not as often, to an individual+s degree of dissociation from the group).

The current renaissance in promoting structured group learning as a part of formal post-secondary coursework in science is approximately 15 years old. It is an outgrowth of recommendations for engaging students in more "active" (as opposed to "passive") learning environments (*21-24*) as well as of a great deal of pioneering work done in undergraduate engineering education (*25-28*) and in the precollege "Cooperative Learning" movement (*29, 30*). Structured peer group work has been a constant feature in disciplines that involve a great deal of writing, where there is an expectation for students to learn from one another. Not surprisingly, chemists have a long tradition of designing group laboratory experiments for undergraduates (*31-37*), even if they are used infrequently and do not dominate laboratory textbooks in the same way that lists of individual exercises do. Before 1980, published examples of group work in chemistry lecture courses are rare, although noted educator Frank C. Whitmore described an example as early as 1925 (*38*). The current cycle of designing and using group work is defined by the introduction of the terms *collaborative learning* and *cooperative learning* (*20, 39*), which have been embraced by individuals in and beyond the chemical education community (*40-55*).

Neither "collaborative learning" nor "cooperative learning" are intended to be interchangeable euphemisms for "having students work in groups." Individuals are still wrestling, however, with the distinctions between and usage guidelines for these terms (*20, 27, 39, 56*). We have also added our voice to this discussion (*10, 54*). We have posited that many have framed their ideas on the false assumption that cooperative and collaborative learning represent a dualistic system (comprised of opposites, where characteristics of one attribute can be used to define the other) rather than a synergistic one. To resolve this, we view the issue of how group work is structured as the context in which separate cooperative and collaborative dimensions arise. Collaborative issues are related to the organization of the "labor.". *Collaboration* relates to the structure of the knowledge that is needed to accomplish a given task, and the benefit that comes from individuals organizing themselves so that responsibilities within a task are matched to specific skills. The organizational opposite of this collaborative sense is a "commutative" one (or perhaps "equalitarian" is a better word choice) where each participant is (can be) held equally responsible for every part of a task or outcome. *Cooperative* issues arise that are related to how individuals "operate" in group situations. Cooperation versus competition is a familiar dualism that is used to characterize the spectrum for how individuals operate within a group.

Specific examples of both cooperative and collaborative learning tasks can be found in the chemical education literature or adapted from other disciplines. As chemists and chemistry instructors in our own classes, we are ultimately responsible for deciding which of our instructional goals are best suited to what sort of teaching method (hence the importance of a rational and well-articulated set of goals). The cooperative tradition embodies an externally imposed structure. The collaborative tradition is based on the valuing of an internally developed structure and the contributions from individuals. The difference in outcomes from tasks structured to reflect these different values and skills represent the kinds of effects that all instructors should be interested in promoting during the course of a student's education. Do we want students to be well-informed about the existing dogma? Do we want them to be able to make improvements within the context of existing knowledge? Do we want them to achieve in ways that go beyond our traditions that are nonetheless founded on the strengths of what has come previously? The answer to all of these questions, naturally, is yes. As instructors, we need to assess the desirability of a

given kind of outcome with respect to our instructional goals when designing educational tasks. If we want our students to achieve in a particular way and not in another, then the structure of the task plays a significant role. Indeed, the most sophisticated skills to develop for doing group work are (1) how to match a problem with the kind of organization that is most effective, and (2) how to turn an existing yet ineffective organization into a more productive one. In education, advocates for group work have provided a blueprint for enabling students to develop all of these skills by carefully considering the effects of group structure, task design and the synergistic dimensions of collaborative and cooperative learning.

An Example of Progress in Practice: "Who Has the Same Thing as I Do?"

As faculty, graduate and undergraduate members of the chemistry department at The University of Michigan restructured the undergraduate chemistry curriculum, we also took a fresh look at the nature of the laboratory experiences that would accompany the new courses. In creating these courses, we wanted to capture the essence of a research experience: the design, implementation and evaluation of an experiment with an uncertain outcome. This plan allows students in an introductory course to construct their own understanding of a solution to a problem without requiring instructors to direct 2500 research projects a year with very inexperienced individuals (an intimidating notion!).

We devised the following criteria as guideposts for our thinking about the first term laboratory course.

● **Make problems comprehensible.** If student learning is to be subject-centered and based on prior experience, then the tasks must be comprehensible to the novice. One common complaint from students in traditional laboratories is that they are simply following directions and not engaged in activities with any intrinsic meaning to them.

● **Embrace imperfection and promote improvement.** We are committed to let experience lead, whether it is observing solubility phenomena or recording an infrared spectrum. We want students to experience phenomena and to have a chance to develop their abilities through repeated practice. An hour of careful discussion and preparation for what is to be observed is a symptom of an upcoming laboratory activity that a student is not yet ready for, or for which an instructor is taking too much preemptive responsibility. Students should not be

expected to master an unfamiliar activity the first time that they do it threatened with the disincentive of a grading penalty if it is not done correctly.

● **Use techniques as tools to solve problems.** We wanted to emphasize the variety of techniques that chemists use routinely in order to collect information about substances. To these ends, we see no purpose in any discussion of "cookbook versus discovery," because this is a false dichotomy. Cookbook and discovery are not opposites on a linear spectrum, but rather they are related to each other on intersecting axes. Chemists generally begin with known procedures and strategies (cookbook) in order to make discoveries.

● **Promote collaborative laboratory work.** Whereas cooperative learning strategies tend to create environments for group responsibility in task management, the process of collaboration maintains individual responsibility within any group effort. We hold that a collaborative learning task promotes individual responsibility within the context of a group task that is solvable only by the contribution of each participant.

Collaborative Identification of Unknown Materials

Whether by consulting a reference text or using our recall of physical, chemical, and spectroscopic properties, we compare the data we collect in lab with some set of standards in order to answer the question "What is this?" Rather than provide inexperienced students with an explicit algorithm for making an absolute identification of a substance, we have taken the core of this activity and created a problem in relative identification that is at once a simple, honest inquiry and a vehicle for developing technical and communication skills.

Who has the same solid that I have? On the second week of college, students in each section of a 22-student *Structure and Reactivity* laboratory course are presented with a box of 30 vials, numbered in sequence, that all contain a few grams of a finely powdered white solid. In addition to referencing parts of a techniques manual where melting points, solubility tests, thin layer chromatography, and infrared spectroscopy are discussed, students are provided with the following information (*54, 57*):

> Most scientists collaborate and cooperate with each other in making scientific discoveries. Modern science involves a lot of team work. Many times, also, the same discovery is made at the same time by different scientists in different parts of the

world. They then have to exchange data and samples of chemicals or biological specimens to prove that they are indeed dealing with the same substances.

In this experiment you will be attempting to solve a puzzle together with your classmates while you learn basic techniques used for the analysis and identification of organic compounds, as well as getting to know your classmates. We hope that this will be the beginning of a habit of working together in learning your lecture material as well as in the laboratory.

The puzzle is simple. Chemists define substances on the basis of an accumulation of observable properties. For example, when we say "water," we mean "that clear, colorless, odorless liquid with a boiling point of 100^{o} C, freezing point of 0^{o} C, a density of 1 g/mL that dissolves substances like salt, that upon electrolysis gives a mixture of hydrogen and oxygen gases in a definite ratio"...and so forth. Using our molecular model of matter, itself a result of the collective imagination of chemists, we say that "water" is "H_2O," and we mean to indicate that whole accumulation of information behind that simple symbol. Thus a fundamentally important skill is to accurately determine and compare the physical properties of substances.

You will obtain a sample of an organic solid. You will determine properties such as its melting point, its infrared spectrum and how it moves on a thin layer chromatography plate in one or more solvent systems using one or more visualization techniques. *Your goal is to find the other students in class who have the same compound as you do.* Comparisons of different samples may be made in a number of ways: (1) by spotting the samples side by side and co-spotting on a TLC plate; (2) by comparing solubility and appearance of the samples; and (3) by taking melting points and "mixed melting points," a melting point of an intimate mixture of the two compounds. If the two compounds are identical, the mixture will not melt any lower than the individual samples do. If the compounds are different, one will serve as an impurity in the other. Impure substances melt at lower temperatures than pure samples do.

Your laboratory section should work out a method for sharing and reporting your sets of individual data. Once you have identified yourselves with a particular compound, the group should affirm the predictions about who has the same

substance, and also confirm that there are no others in your lab room who belong with the group.

We provide ten sets of triplicates in the solid samples, which generally include a variety of aromatic hydrocarbons, ketones, and carboxylic acids. The most important practical aspect of setting up this laboratory is to ensure that the identification is based on the experimental data that are collected by the students. The activity is made less honest in a number of ways, so the following caveats should be kept in mind: do not use coding schemes that can be decoded, do not give out lists and samples of possible substances too early, do not give the lab instructor the master list (alternatively, hide yours!), do not permit colored substances and do not leave solids unpowdered. By using melting points (and mixed melting points), thin layer chromatography (with co-spotting), and solubility tests (5% aqueous hydrochloric acid, 5% aqueous sodium bicarbonate, acetone, and water) a class can easily group themselves and double check their observations within a few hours. One of the questions that spontaneously arises every term is what constitutes a valid comparison. The melting point data only group together rather than occur with exact duplication, so we always hear a version of the following: "Is 156-7°C on my thermometer the same as 152-5°C on yours?" A very productive iterative cycle occurs as the need for reproducibility causes students to revise their original reports in the context of new information. The experimental techniques are clearly seen as tools by which data are collected and from which a simple question can be answered.

Another unique aspect of organizing an activity around the "Who has the same substance that I have?" question is that collaboration requires communication. As a group, students in a lab section must establish procedural norms for collecting data, such as what proportions to use for solubility tests, and for reporting and exchanging data, which is required in order to solve the problem. On any afternoon, we can have eight sections of the *Structure and Reactivity* laboratory course operating with eight different sets of procedural standards and communication strategies. Finally, this is a *collaborative learning task* , as described above. After the entire group has established its common experimental procedures, individual students are responsible for collecting data from their own substance. As the information flows from individuals to the whole classroom community, smaller collaborations occur spontaneously as subgroups begin to gather around a common substance, along

with the need for building consensus about the properties of the substance they suspect they share.

For the next laboratory period, the instructions are geared for taking the relative identification to an absolute one:

> Once you have identified yourself as part of a group of students who all have the same substance, you should deal with the identification of that material. Consult a list of possible substances that your TA has in order to begin to make this decision. Samples of these compounds are available for performing TLC, melting point, and solubility comparisons between your unknown compound and the possible knowns. You should also record infrared spectra of your solids in order to make a judgment about what kind of functional group classification your compound falls into.
>
> When you think you have an idea about what compound you have, you should also select an appropriate chemical derivatization method for that functional group and prepare it. You can use both your unknowns and the known compounds (for practice) in this procedure.

The collaborative identification blueprint works for developing a variety of laboratory skills. We have used this technique with liquids, solutions of different concentrations, and as a novel modification of the traditional density exercise.

Extending collaborative activities to other courses, other grade levels, and other subjects.

As described above, we have used collaborative activities in many places in our curriculum. In addition to the preservice teachers course and the high school class, we have also used "Who has the same solid that I have?" for five years as part of outreach programs for middle school and high school students who visit our department for either a day or a week. Precollege students, using only solubility observations and melting point determination, routinely solve the solids problem in about an hour. For groups of very young students, we have simply placed common objects inside of a plastic film canister and had them answer the relative identification question based on comparisons of sound and touch. An imaginative adaptation of this idea was done by one of our colleagues in the mathematics department. At the beginning

of an introductory math class, every student in the class was handed a slip of paper on which a set of 4 numbers was written. These numbers were sequential portions from a variety of different series; the students' task: "Identify who has numbers from the same series as yours." Differential discriminations are made by individuals in every discipline, of course. Some of our other colleagues have reported their own adaptations of this idea to us: in art history ("Who has a painting from the same period that I have?"), in psychology ("Who has the same personality classification that I have?"), and in journalism ("Who has paragraphs structured the same way that I have?"). The collaborative identification of substances is a simple blueprint for any activity where related samples can be investigated by an appropriate technique. This activity gives a way for instructors to demonstrate the relationship between collecting experimental data and drawing conclusions, as well as how to make and evaluate comparisons. Students are also required to create procedural standards and to communicate within the context of a scientific problem in a natural and need-based manner. Collaborative identification is an honest inquiry that encourages students to combine technical and social skills, a goal of many reform-minded educators.

The Performance Studio for Expressing Science

We think it is useful for instructors to realize that we ask our students to teach us on our exams. This is a familiar idea to many instructors who understand that students teach us something about how effective our instructional practices have been, how well the intended lessons have been learned, in addition to a host of other lessons about learning in general (*58*). But, if we instructors design examinations to be most useful for the learners as well as for us, then we must also ask students to take on the role of instructors in our discipline. We must provide them with an opportunity to think about chemistry in a way instructors have already acknowledged to be the most useful: "I never really learned it until I had to teach it." Examinations are always structured for this role-reversal at any rate, differing only in how well the structuring has been done rather than in the presence or absence of it. In all cases, whether an exam is in written or oral format, an instructor takes on the student role as questioner and learner, while the student is the one who provides answers. Yet honest opportunities for students to build the skills for this role-reversal are not provided except at the exams themselves, and faculty tend to adopt the role of arbiters who judge rightness and wrongness. By pointing out to students that during examinations they are assuming the teacher's role, we allow them to confront the need to

learn how to express their understanding before the examination. We have actively promoted ways for students to practice their teaching (hence, expression) skills before the examination.

Our colleagues in disciplines that more openly acknowledge their reliance on developing skills for expression (writing, art, dance, theater) all rely on the performance studio in their instructional design. The studio is a place where the desired skills can be displayed to a peer group of learners, usually under the guidance of a more experienced individual who critiques as well as organizes peer review, and generally after some amount of solitary preparation has occurred outside of the studio (wrote a story, filled a canvas, or learned the lines). A great deal of high-value learning takes place in the studio because every participant has done something about a common task (write a story, fill a canvas) that carries the results of their individual efforts. Where is the comparable 'performance studio' for chemistry learners? Laboratories should fulfill this role, but there are many reasons why this is not true in practice. In any event, regardless of the design of laboratory courses, skill-building with those activities seems too far from the expected mode of expression on an examination.

We have, however, created an option for introductory science students that draws from the principles outlined above. In our structured study group program, a cohort of 120 first-year undergraduate Honors students, while taking standard coursework and examinations in a 1200-student course, earn their Honors credit by participating in extra weekly 2-hour sessions that are shaped, metaphorically, along the lines of a 'performance studio' in the Arts. Assignments, in the form of common (not identical!) tasks, are subjected to peer presentation and peer critique facilitated by upper-level undergraduate leaders. Unlike simply directing students to work in groups or only providing them with problem sets, both of which are productive and engaging (Hurley 1993), students in the structured study groups follow a detailed curriculum that helps them to develop the kind of skills that we believe are attached to a deep mastery of the subject matter in a format that encourages the students to also develop their more general learning skills.

During each session, the meeting time is typically divided between a number of activities. Each participant brings a duplicate set of his or her written assignment from the previous week. These assignments generally involve the creation of examples within a given context. In the very first assignment, they pick a C_{10}-C_{13} molecule from a chemistry journal (after learning, in their session, how to decode line formulas, what journals are, where they are found, and what proper citation format

looks like) and are directed to construct 5 rational examples of molecules with the same formula. They then propose rankings for their created molecules based on 3 of 6 properties, including, for example, magnitude of dipole moment, boiling point, and solubility. Later, a typical assignment might be to find an example of an S_N2 reaction in a chemistry journal and format it as a quiz problem appropriate to the level of the class. The students are always directed to provide a brief statement that puts the reaction in context, a copy of the journal pages from which the example is derived, and a properly formatted citation. At the beginning of the session, the students submit one copy of their work to their leader, and the other copies are redistributed to the class. One or two rounds of peer review follow. The reviewer does not correct the other student's paper, but rather answers a set of factual questions about the others' work: does the molecule or reaction fit the prescribed criteria (yes or no?); is the format and information appropriate to the level of the class (yes or no?); is the citation formatted correctly (yes or no?). During this time, the discussion within the group is free-wheeling, and it is the time of greatest learning for the students. Although the only duty is to mark off a "yes" or "no", the first round of peer review can take up to an hour. Only when faced with reviewing another+s work can the student deal with issues that were either incorrectly understood or that simply did not occur to them. These students have a structured opportunity to make, recognize, and correct their errors before they get to an examination. After the reviewing is completed, the reviews and the unmarked papers are returned to the originator, and he or she has a chance to decide whether any corrections are needed. This second set of assignments and the reviews are collected, and they form part of the basis for the leader's evaluation of the student's performance that day.

Strands of advanced topics also comprise part of the curriculum for the groups. During the year, spectroscopy, bioorganic chemistry, and work involving Frontier Molecular Orbital theory (electrocyclic, sigmatropic and cycloaddition chemistry) are introduced over the course of the group assignments. Some of these activities can be structured using practices that are common in language composition courses. During the last month of the first term, for example, the students examine 2 or 3 short publications written by a departmental colleague in order to develop a set of questions that one might ask of the author. Over the 4-week period, students review and refine written questions submitted by their peers for both content and clarity. At a last meeting attended by all of the group members, students meet with this

author after having studied his or her writing, and then ask questions from a set selected during prior group work. Case studies in research ethics are included in the second term's curriculum and allow us to study much about scientific practice in addition to factual information. Casebooks appropriate for undergraduate and graduate instruction are beginning to become available. In chemistry, Kovac (*59*) has produced *The Ethical Chemist*. The Association of American Medical Colleges has prepared a complete handbook for instruction (*60*). Casebooks for other disciplines are being developed at the Poynter Center for the Study of Ethics and American Institutions (Indiana University). During the last month of the second term, the students produce their own ethics cases, usually drawn from their experiences at the university. Over a 4-week period, three cycles of editing and peer review for both the content and the composition are included with the weekly group meetings.

While expression and peer review skills have been educational objectives for the student participants, the educational experience for the 7 or 8 undergraduate group leaders has also been profound. They, in effect, participate in an informal course in classroom practice and pedagogy every week during their regular leaders' meeting. The level of engagement and excitement that has been generated in this group of students, who are themselves in the process of making career decisions about graduate and professional schools, is quite extraordinary, and may be one of the most important outcomes of this process. Instructors at any level of experience will appreciate the most common reaction of our leaders during the first few weeks: "Boy, this is *really* hard!" About half-way through the term, the group leaders also develop the ethic of what they call 'active non-participation'. Their comments revealed that the teaching abilities of these student leaders evolved rapidly: moving the center of classroom activity from the role of "teaching to" their students to becoming authentic discussion facilitators in a group classroom. In large part, the tasks and the structure of the peer evaluation component encourage the leaders to shift into a more collaborative learning mode. Walters, and others, have reported similar outcomes for student leaders who assume authentic roles in the design and delivery of instruction to beginning students (*61*).

Conclusion

Our system of higher education sits in an uncomfortable position: it is both the tool and formal construct of disintegrated knowledge (*9*). Through the customary process of intellectual inquiry, disciplinary

specializations have emerged and separated from one another...as have the specialists. In the name of progress, we educators direct and identify young learners according to our assessment of their aptitudes for pathways we define and (continually) refine. If thinking about unifying educational objectives is to be useful, then it is important to recognize this as a reunification, less in terms of 'integration' and more so of 'reintegration,' where we take advantage of our hard-earned depth of understanding to rediscover our common purpose of understanding and expressing notions about the world to each other.

The consequences of disintegration on science education have been profound. Traditional scientific training neither encourages nor impels its students to develop effective communication skills for groups outside of the discipline...and yet it is precisely this inarticulation that must share at least some of the blame for the general inability of the general public to appropriately assess and evaluate technical issues with which they are confronted. Progress has led to physical and intellectual isolation of many disciplines from one another within universities. Every year, this same progress contributes to the concern to 'cover' the increasing amount of factual subject matter in science. This emphasis has exaggerated the dispassionate, objectivist vision of scientific practice. Separation has slowly stripped away the clearly value-laden dimensions of science from formal science education. The existence of historical, philosophical, sociological, linguistic, and moral considerations, if not ignored completely, are minimized as significant arbiters in decision-making (*62*). When history does appear, it often does so in neatly isolated and easily neglected textbook side-bars.

One goal of our teaching in introductory courses at the University of Michigan then, has been to integrate the historical, philosophical and linguistic aspects of science with the factual information. We recognized very early in the process of restructuring our undergraduate program, which began in 1989 (*63-66*), that this would involve a greater emphasis on writing (and other forms of expression). This writing needed to be in both the common language and the unique semiotic systems devised by chemists, and that this would involve creating organized group learning and guided peer review within some fairly traditional course structures. Effective written and verbal expression, and its review, critique and refinement, sits at the core of making yourself understood. Every discipline needs its participants to communicate well both inside and outside of the professional community. As the intellectual disintegration of the academy leads to rhetorical separa-

tion and isolation, the need to communicate meaningfully only increases. By making these perspectives a part of our teaching, we find that we provide a rich array of entry points through which students can make integrative connections in their learning. By emphasizing the fundamental narrative (story-telling) aspects of science, we have had our best success in demonstrating to new learners that they can, indeed, participate too.

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