Language and Learning Across the Disciplines

A forum for debates concerning interdisciplinarity, situated discourse communities, and writing across the curriculum programs.

WAC Meets the Ethos of Engineering:
Process, Collaboration, and Disciplinary Practices

Listening to Everett Rogers::
Diffusion of Innovations and WAC

On Writing Instruction and a Short Game of Chess:
Connecting Multiple Ways of Knowing and the Writing Process

Learning the Language of Mathematics

May 2000 Vol. 4, No. 1

Language and Learning Across the Disciplines is a forum for issues concerning interdisciplinarity, situated discourse communities, and writing across the curriculum programs.The journal will publish articles dealing with issues in learning theory, discourse analysis, participation in disciplinary discourse, and the social, intellectual and political locations of WAC programs. We welcome articles seeking to make connections among several such areas of inquiry. All manuscripts will be carefully reviewed by members of the editorial board and appropriate outside readers. You may expect to hear from us in two months. When submitting a manuscript please follow the current MLA or APA style sheet; submit three copies (3,000 to 7,000 words); print your name, address, telephone number and affiliation on a cover sheet, not on the manuscripts; and enclose sufficient return postage clipped, not pasted, to a self-addressed envelope. Send manuscripts to Sharon Quiroz and Michael Pemberton, Editors, *Language and Learning Across the Disciplines*, Illinois Institute of Technology, 3301 S. Dearborn, Chicago, IL 60616. Major funding for *LLAD* is provided by the Academic Resource Center of the Illinois Institute of Technology.

Logo designed by Amanda Grupe, cover design/layout by Roberta Militello

LANGUAGE AND LEARNING ACROSS THE DISCIPLINES

Language and Learning Across the Disciplines is a joint publication of Georgia Southern University and the Illinois Institute of Technology, and follows the NCTE guidelines for non-sexist language.

Letter from the Editor

Sharon Quiroz

This issue of *Language and Learning Across the Disciplines* is dedicated to articles that grow out of presentations at the *Fourth National Writing Across the Curriculum Conference* held at Cornell in June of 1999. The first such issue was Volume 2, Number 2, drawing on the *Third NWAC,* which took place in Charleston in February, 1997. The *Fifth National Writing Across the Curriculum Conference* is scheduled for May 31-June 2 of 2001, in Bloomington, Indiana, and *LLAD* looks forward to continuing this relationship. The *NWAC* Conference is unique in its efforts to reach out across the disciplines and literally take in other voices. Organizers of the Conference seek to invite presenters from very different positions within the field: differences are disciplinary, ranging from biologists to astronomers to sociologists. And differences include those between the new WAC professional and the more experienced, and between the new and old WAC professionals and the new and old practitioners. The voices of the conference and the voices of the journal are therefore multiple, which makes it more than a little risky to generalize about differences in the whole enterprise on the basis of articles that appear in these associated volumes of *LLAD.*

Still, I will make a provisional note. As I look at Vol.2, No.2, to compare it with Vol. 4, No.1, what strikes me as most different is the mode of presence of practitioners. In the earlier issue three articles talk about teams of one sort or another: team teaching, advisory boards, faculty readers. In the newest issue these other voices are heard at a greater distance, the relationship seems a little more theorized. Linda Bergmann's essay, "WAC Meets the Ethos of Engineering: Process, Collaboration, and Disciplinary Practices" and Stephanie Vanderslice's review "Listening to Everett Rogers: *Diffusion of Innovations* and WAC" take quite a distanced view of the community of the practitioners, with Bergmann explicitly critiquing WAC orthodoxy from an engineering perspective, while Vanderslice is more in the orthodox mode, emphasizing the WAC role as change agent. The articles "Does Writing Matter?" by Patricia A. Connor-Greene and James Murdoch and "On Writing Instruction and a

Short Game of Chess," by Mya Poe, also reflect values from other communities back onto WAC practice. Connor-Greene/Murdoch offers valuable research into the positive effects of writing-to-learn in an experiment that works with traditional disciplinary emphasis on testing and grading. Poe's article asks us to recognize "multiple intelligences," drawing on Peter Smagorinsky's argument that WAC needs to recognize other modes of composing that are the preferred tools of other disciplines. That argument resonates with Bergmann's call for recognizing, as rhetoricians, that engineering as practice is legitimately a site for our inquiry.

Joanna Tapper and Paul Gruba draw upon the disciplinary commitment to conferences as a means of disseminating knowledge in their article, "Using a 'Conference Model' to Teach Communication Skills in a Communication Across the Curriculum Program."

And finally we do, as often as possible, have at least one voice from a discipline speaking to all of us directly. The earlier NWAC volume included an article by an astronomer. This issue we have a mathematician, Robert Jameson, on "Learning the Language of Mathematics."

If these articles represent the field, rather than *LLAD*'s taste or that of the Cornell organizers, one might see a slight movement from structural and administrative concerns reflected in the issue from the Third NWAC Conference to perhaps slightly more discipline-centered concerns in the Fourth NWAC Conference. The theme of the Fifth NWAC Conference calls for us to consider "the context." It will be interesting to see what meaning for that term emerges.

Our regular section of program descriptions includes this time "Faculty Collaboration on Writing-Across-the-Curriculum Assignments: Linking Teaching and Scholarship," by a team from Washburn University made up of Margaret Stewart, Pat Mower, Dianne McMillen, Mary McCoy, Patti McCormick, Pam MacDonald, Donna LaLonde, Sarah Cook, and Gary Baker. Yvonne Merrill's "Anchoring WAC by Focusing on Rhetorical Analysis in First-Year Composition," describes a model for relating WAC and First-Year Composition, a topic we find endlessly engrossing.

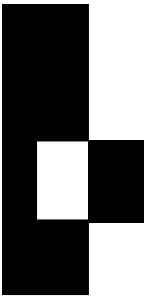
Some Changes Made

Language and Learning Across the Disciplines is extremely pleased to announce that Bill Condon has joined us as managing editor, bringing along with him Jerry Brown, a very capable business manager. We are all very grateful for this new energy and expertise.

And there's more: *LLAD* is now associated with **academic.writing** edited by Michael Palmquist at Colorado State University (http://aw.colostate.edu/index.html). Back issues of *LLAD*, plus subscriber and submission information, can be found at http://aw.colostate.edu/llad/index.htm. In the future *LLAD* and **academic.writing** plan to publish joint

issues, giving us all the advantages of both online and hard copy publication. The first joint effort will be a special issue devoted to writing centers and WAC.

And finally, *LLAD* gratefully acknowledges funding from the Academic Resource Center at Illinois Institute of Technology.



WAC Meets the Ethos of Engineering: Process, Collaboration, and Disciplinary Practices

Linda S. Bergmann
University of Missouri-Rolla

This paper considers some ways in which WAC theory can conflict with disciplinary practices in applied or technological fields like engineering, so that even though there is a significant demand in engineering education for improving students' communications skills, in many local institutional situations WAC theory and practices may have little actual effect on the kind of writing projects that are set up or on the ways in which students actually learn to write. This apparent failure to communicate or implement WAC knowledge between disciplines is hardly surprising, since a considerable amount of WAC theory, in the early days at least, was based on expressivist interest in personal writing and on the belief that students are given too few opportunities in school to use writing as a means of personal development and intellectual growth (Russell 278). WAC programs have conventionally promoted activities and ideas to generate "writing to learn" for students in all disciplines, very often without much inquiry into what other modes of learning are more common in those disciplines, or why this is so. Although we have made some progress in understanding the rhetoric of other disciplinary discourses (see, for example, Bazerman and Paradis), and although some programs call themselves "Writing in the Disciplines" in order to acknowledge their teaching of writing as disciplinary discourse, these are at best uneasy relationships. I still hear considerable frustration with "the engineering mentality" from writing people, and considerable suspicion on the part of engineers that "English" wants to determine their curricula. Departments "on the other side" of campus tend to buy into WAC not to foster students' general development as writers and learners, but in the hope that their students will learn—as quickly as possible—to write clearly and coherently and in what they perceive as a professional manner. When the process-driven theories of rhetoric and composition confront the product-driven practices and traditions of engineering and business educa-

tion, the resulting conflicts can lead these departments to modify writing programs and projects in ways that move them away from the principles of process and collaboration that are central to the WAC approach.

The accounts of writing projects in science and engineering that are published in venues like the *Journal of Engineering Education* reveal some of the ways in which WAC theory is adapted—and often ignored or effaced—by faculty in applied or technological fields.[1] My understanding is that this effacement occurs not because of the ill-will or ignorance of the faculty undertaking these projects, but rather because of their deeply-ingrained and often tacit assumptions about the nature of writing and of learning to write, assumptions that are bound up in the process of how disciplines like engineering actually produce knowledge. The disciplinary conflicts I am considering in this paper are hardly new; they are pretty much the same issues described by Toby Fulwiler over fifteen years ago in "How Well Do Writing Across the Curriculum Programs Work?" and are rooted in some fundamental differences in how different disciplines understand knowledge, education, and writing. But now that there are so many WAC programs, and so many writing projects in applied disciplines like engineering, these differences merit re-examination, particularly if we think that it is desirable to maintain those WAC principles even in WID programs in order to foster students' growth as writers and thinkers, and not merely to serve the narrowly-defined communication needs of particular disciplines. Learning to write, even for an engineering student, is not merely a process limited to learning to write an acceptable lab report.

In this paper, then, I am going to revisit three fundamental differences in assumptions between WAC faculty and faculty in applied disciplines. The first difference is that WAC looks at writing as a process, whereas engineering is heavily oriented toward products–dare I say "deliverables"? Engineers value processes–the writing process included–not for their own sakes, but only insofar as a particular process leads to a cost-efficient product. The second difference is that WAC looks at collaboration in the context of several decades of research into collaborative learning, which values the learning that results from a group of people working together. Engineering, on the other hand, conceives of collaboration as "teamwork," which has its own body of research and its own record of success. Engineers working on a project generally assemble a team of specialists, each of whom does what s/he does best, and who very often work apart from each other on different aspects of a project. Finally, engineering faculty seldom really understand that learning to write is a recursive and time-consuming process, that listing specifications is not the same thing as teaching a student to write; and WAC faculty seldom really understand that merely pointing out the limitations of this approach

is not sufficient to produce changes in deeply-rooted disciplinary practices.

I address the concept of process first, because the differences here are the most obvious, and perhaps also the most difficult to overcome. For example, in "How Well Does Writing Across the Curriculum Work?" Toby Fulwiler admits a note of exasperation in describing his work with a forestry professor:

> I've come to believe that you can only teach a writing process approach to process-oriented people. This implies first, that some colleagues, already on our wavelengths, are already doing some of the things we suggest and use workshops primarily for reinforcement. That's good. But it also implies that many others who attend have a rather product-oriented approach to the whole teaching business: students must learn that what counts in the real world is the final report, the finished letter, the completed project—not the evidence of effort as one struggles to get there. . . . For these teachers, no matter how much we stress techniques and strategies to *generate* good final products (journal writes, freewrites, multiple drafts, etc.), the workshop produces only superficial change in their attitudes or practices. (Six months after she attended a workshop and told us how much it meant to her, a professor who teaches in forestry said that the main things she looks for on papers are "spelling, style, and neatness." While we don't dismiss these items, her answer dismays us.) (56)

While Fulwiler is definitely promoting a process pedagogy, the writing process he proposed was directed at moving students toward producing "good final products"— indeed Daniel Mahala roundly attacked what he saw as the product and program orientation of Writing Across the Curriculum in his 1991 article, "Writing Utopias: Writing Across the Curriculum and the Promise of Reform." The published accounts of WAC projects in engineering and science programs suggest that Mahala was right, at least about WAC's non-progressive applications. Indeed, many of the projects that I've read about or been involved with demonstrate that when faculty in science and engineering incorporate the idea of process into their curricula and syllabi, that process tends to become not only a process toward a final product, but also a series of discrete products, each of which can be graded.

The following excerpt from a term paper assignment in General Chemistry at the University of North Carolina at Pembroke illustrates what hap-

pens: i.e., process pedagogy turns into a series of "current traditional" products with specific point values for easy accounting:

Dates and Deadlines

Friday Jan. 24	Topic (issue) due in writing in class.
Monday Feb. 10	Paper outline and preliminary bibliography due in class. For your preliminary bibliography, you may turn in printouts from the library's data bases indicating what sources you plan to use.
Wednesday Feb. 12	Peer review of organization and logic flow due in class.
Friday March 7	Rough draft due in class. Peer editing session in class.
Monday April 7	Final paper due in class.

Grading

The process of writing this paper, and the final product will each be worth 100 points for a total of 200 points. A partial breakdown of these points is:

Activity	Points
Turning in the topic *on time*	10
Turning in the outline and preliminary bib. *on time*	20
Rough draft with bibliography, *turned in on time*	30
Peer editing process (to participate you must have the proper document)	40
Final draft	100

(Roland Stout 4)

This may be a very useful writing assignment for the students in this class—Roland Stout claims that it leads his students to write better and think more clearly about chemistry, and I believe him— but it does not seem to incorporate "writing to learn" or any sign of what people in writing conceive to be progressive pedagogy. What it does incorporate are peer review and editing and the provision for re-writing; it sets up a process clearly designed to produce a better final product for the professor to read. If this is, as I believe it is, a typical example of how writing is incorporated into science, engineering, and business courses, it offers a good case study of how WAC ideas get diluted and undermined in practice.

Although we like to document WAC successes by counting the writing projects that are brought into courses in other disciplines, we also need to consider the extent to which they actually reflect WAC principles. We need to notice, at least, when WAC principles are ignored, misunderstood, or undermined—and perhaps we need to reconsider whether that is a bad thing, particularly when both students and faculty indicate satisfaction with the work they have done.

Although what we have in the example above is an outline for an assignment rooted in the product-oriented, current traditional pedagogy that WAC was supposed to surmount, I generally assume the best of intentions on the part of the faculty member who designed it. The faculty who undertake these projects and then write articles about them for professional conferences and publications are the *student-oriented* folks in the other buildings, the ones who come to us for help and who *care* that their students get practice in writing in their fields, the ones who may actually be willing to sacrifice time to work with student writing. They do not, however, see the writing process in the same way as we do, and I suspect that they experience it differently in their own writing. One of the reasons that what we say about the writing process does not fully communicate to this audience is that for faculty in science and engineering, themselves practitioners in their discipline and writers of their disciplinary discourse, much of what we think of as the writing process is embedded in the larger process of experimentation, which can take place over the course of years and may involve several kinds of oral and written discourse. They think in terms of "writing it up"—which is something quite different from the writing process proposed by most people in rhetoric and composition.

"Writing it up" may encompass only a small part of what people in WAC conceive of as the writing process; and the engineering faculty member may see the production of a report not as a process itself, but as a small part of a larger and more important process with research. For example, a chart that accompanies an account of a research writing project in aerospace engineering at MIT (Waitz and Barrett) visualizes the larger research process as a linear process, in contrast to the messy, creative, and recursive process WAC people tend to see writing to be. The research process has a beginning, middle, and end, punctuated with reports. The individual reports are seen as points, not lines, and a good bit of the thinking, discussion, and collaboration that *we* might consider prewriting is embedded in the research process itself, not in the production of the report. This view of writing also differs from commonplace WAC thinking because "writing it up" does not seem to include much discovery. The two fields conceptualize the production of knowledge differently. Engineers, for the most part, expect to discover knowledge through

experimentation, calculation, and oral discussions among team members, not through intellectual work that transpires mostly in the individual mind of the writer. Moreover, they do not expect to discover a form; the form of much technical writing is pre-determined by the publication or recipient for which it is destined. What I am suggesting here is that the process-oriented approach that WAC people bring to these projects from composition theory may not fit very well into the actual process that goes on in these applied disciplines. This disjunction may mean that much is lost in translating WAC principles to writing in engineering courses. The result may be a watered-down version of "writing in the disciplines," i.e., writing projects that merely teach the formats and surface conventions of technical writing. What I am suggesting, moreover, is that we may need more than simple translation to move from "writing it up" to "the writing process"; we may need to reconceptualize a larger process that is *not* a process of writing, but rather a process of producing knowledge.

The second problem this paper addresses, the slippage between collaboration and teamwork, is closely related to this product orientation. When writing people envision collaboration, they think of a bunch of people in the same room, working together—or these days, maybe on the same list serve or MOO. For example, as part of a national project of the Council of Writing Program Administrators, I've been involved in producing a series of drafts of a statement defining outcomes for first year composition. The resulting Outcomes Statement[2] has been composed collaboratively, through a recursive process of composition faculty meeting at various conferences and corresponding on at least two electronic discussion lists; this has been a process of throwing ideas at each other and playing with them until they work. I have high hopes for the final document, drafts of which have already proved useful in a number of articulation negotiations and similar situations. But while this collaborative process has worked well for this group of writing program administrators, it is not the way I have collaborated with engineering faculty. For example, I have been involved in writing a successful grant proposal with a group of engineering professors at my university. This collaboration involved a single meeting at which tasks (parts of the paper, budget items, contacts to be made) were distributed. Each team member sent his or her pieces to the Principle Investigator, who pieced them together, possibly with the help of a technical editor for some final tweaking. Each of us did our specialized part, and did it well enough to net our project a substantial amount of money. It would be hard to claim that this was *not* a successful writing project. But what we did was very different than the concept of collaboration defined by John Trimbur as "engaging in a process of intellectual negotiation and collective decision-making" (602).

Because engineering faculty think in terms of working in teams and bringing in consultants to ply their own specialties, they bring different expectations to collaboration than English faculty do. Again, I think it is useless to dismiss these differences as mere stubbornness or as submission to a corporate ethos. Because teamwork is a whole different way of looking at knowledge than collaboration, a perspective rooted in disciplinary assumptions, it is not going to be changed by the introduction of a few new pedagogical techniques. If we understand the centrality of teamwork and consulting to fields like engineering, we might see, for instance, why engineering faculty maintain the idea that the "English" in a paper can be separated from its "technical content" and its features assigned separate grades, even in the face of some twenty years of insistence by WAC people that this approach is futile or counterproductive.

Consider, for example, the following statement co-authored by a faculty member in chemical engineering, who has been a staunch advocate of Writing Across the Curriculum, and who has authored articles on writing and given presentations at WAC meetings and workshops. Despite—or perhaps because of—his involvement with writing projects, his department hires a writing consultant trained in English, and distinguishes technical content from "readability." We can see that his involvement with WAC has aroused some discomfort with the binary grading scheme, although not so much discomfort that the practice is abandoned:

> During the third year the students have access to a writing consultant who is available to help students with any writing mechanics or style. The writing consultant is an English instructor who is employed by the department to be available for student consultation for 10 hours a week. In addition, the consultant reads all of the student papers, makes comments (in a different colored pen), and grades the readability. The final report grade is a composite (80% Professor, 20% Consultant) of the two grades given. The consultant has an office in the department that is near the undergraduate laboratories. The students are required to meet with the consultant at least twice each semester. Most students find the consultant to be helpful and make several visits beyond those required.
>
> The idea of a writing consultant is a long time tradition at UND (about 15 years), however the job description and emphasis has changed over time from being an "English grader" to a "writing consultant." This change in emphasis is motivated by the argument that split grading of the "technical content" by the professor and the "writing mechanics" by the

> English grader emphasizes and acknowledges that learning in this course is somehow distinct from writing in it. Since this is contrary to the departmental philosophy that clear writing is an indication of clear thinking (and hence good learning), the emphasis has been placed on being a writing consultant more than just an English grader. Both the professor and the writing consultant grade the entire paper for readability and clarity. By necessity the professor checks the calculations and technical arguments, but also grades the presentation of the material. Another advantage of using a writing consultant is that it gives the students additional contact with a professional who is interested in helping them improve their writing skills beyond (but not replacing) the time given by the professor. (Ludlow and Schulz 166)

Despite the authors' philosophical move to the idea of unified knowledge and their semantic move from "English grader" to "writing consultant," this chemical engineering department preserves the underlying structure of distinct knowledge and split grades.[3] Moreover, the stated departmental philosophy that "clear writing is an indication of clear thinking (and hence good learning)" is decidedly *not* a philosophy of writing to learn, but one that locates "good learning" only in a successful written product. In trying to represent writing as a crucial part of the professional practice and education of chemical engineers, they are taking an unproblematized view of writing and its evaluation, ignoring, for example, the possibility that clear writing may indicate oversimplification rather than clear thinking, and ignoring the research that suggests that student writing often declines in clarity and organization as students move into more professional levels of discourse (Williams and Colomb). This slippage from WAC principles notwithstanding, however, the project is conceived of and written about as a successful project in teaching students disciplinary writing and presented as a model for other departments to imitate. And, having been involved in similar projects, I believe that the work may indeed be beneficial to the students and that the "Writing Consultants" may be well enough trained to bring into their consultations a process pedagogy with a less immediate product orientation than that articulated in the assignment, i.e., that they may bring to the team pedagogical practices that are not noted in the article. So even as I point out the slippage, I am willing to be persuaded that writing projects like this one—which by local accounts do indeed work—can be valuable experiences for students. My point is merely that the slippage should be noted and admitted, and that the argument for the project's effectiveness must be made.

The distinction between collaboration and teamwork points to the final difference that I am going to discuss in this paper. Probably all writing faculty have experienced the tendency of engineering faculty members to think of English departments as chiefly engaged in teaching and judging students' writing, and to think of good writing as consisting primarily of grammatical correctness (we may hedge and call it "clarity" or "readability"); thus, they tend to assume that we are neglecting our mission if we are not functioning as grammar police. Although we have been preaching to each other for some twenty years or so the idea that grammar instruction is not central to teaching writing, that idea has not filtered over to the other departments of the university to any noticeable extent. We have been much more effective at talking to each other about what constitutes good writing theory and practice than we have been at disseminating our current understanding of writing and writing instruction more widely across the disciplines. The misconceptions that Fulwiler's colleagues expressed fifteen years ago are *still* alive and well among the engineering faculty on my campus, and probably on many others:

> No matter how hard and lucidly (we thought) we explained the crucial distinction and relationship between the two functions of language, a number of faculty would never accept the idea that informal writing to oneself had anything to do with formal communication to somebody else—teachers, for instance. My School of Business friend tried to explain his colleagues' misconceptions: "I think the attitude of the School of Business for the most part is that . . . transactional writing has been replaced by expressive writing, poor sentence structure, and no concern for spelling" (Fulwiler 53).

The underlying feeling here is that the business department's rigorous writing initiatives are undermined by the laxity of the English faculty's approach to writing. Because engineering faculty tend to conceive of interdisciplinary work as teamwork rather than collaboration, and because they are highly product-oriented, it is hardly surprising that they would feel that English faculty in general and writing faculty in particular are not holding up their end of the deal if the students' writing does not immediately improve in demonstrable and measurable ways. As the engineers see it, *their* product is the research results, process, application, or thing that has been experimentally verified. *Our* product is the paper or report. Why don't we just teach students to *do it*?

Because English departments tend to justify their existence—or at least the existence of the required first year composition course—through an appeal to writing skills, it is hardly surprising that people in other fields

see teaching these skills as our primary job.[4] I know full well that I use a skills justification when I take my case to the university at large, even though I also know that writing skills are hard to define and difficult to measure. Even worse, WAC people know that their work is at best marginal to the activities, interests, and research of most of their colleagues in the English department; engineering faculty tend to conceive of teaching writing as being the crucial task of English departments, and simply do not understand that studying literature and meeting the needs of majors almost always take departmental precedence over teaching writing and providing general education. In universities noted for a primarily technological mission, these misperceptions are exacerbated by longstanding suspicions on both sides, resulting in an almost traditional ignorance and disdain for each other's professional assumptions and practices. There is obviously much room here for inter-departmental friction to eliminate the possibility of effective communication, not to mention to undermine the possibility of developing coherent and effective programs to improve student writing.

Because academics in all disciplines tend to look at their own discourse practices as naturally superior, much work has been needed to articulate the discourse practices of different disciplines. In a paper presented at the 1997 Conference on College Composition and Communication, Steven Youra argued for an anthropological approach to understanding and working with other disciplinary cultures, an approach that involves finding translatable points and working from them. In order to overcome interdepartmental ignorance and suspicion, WAC people working with departments like engineering, business, and other disciplines that focus on applied knowledge tend to seek out common assumptions, even if we do not share a common language—and maybe we are inclined to find similarities even where they do not exist. What I am saying here, though, is that we need to be equally clear about points of divergence, so that we can see and understand where our thinking and practices differ and even conflict. We need both to increase our knowledge of the disciplinary cultures that provide the context for their discourses, and to be aware of the tendency of faculty in particular disciplines to drift back to rather than re-think their disciplinary practices. And, finally, we need to repeatedly reassess the value of our *own* theories and practices, and to understand how they are embedded in the disciplinary culture in which we work.

Somehow, we tend to think that once an issue has been discussed, it is *settled*. But in academic dialogues in general, and in Writing Across the Curriculum in particular, this is simply not the case. Fulwiler described how faculty members, when they leave WAC workshops and go back to their disciplines, become re-immersed in their disciplinary expectations

and conventions, and how the WAC "mission" gets diluted in this disciplinary context. Moreover, individual faculty members within disciplines may well drift in and out of WAC initiatives, so that new voices must continually join the conversation and "old" discussions must be repeated and reiterated. And although Writing Across the Curriculum programs are by their interdisciplinary nature sites of negotiation and compromise, we need to maintain a steady awareness of when our principles and ideas are being modified, so that we can decide when to compromise and when to fight. It may be that interdisciplinary tension and even conflict need not and maybe should not be resolved; it may be that through these tensions, conversations, and occasional outbreaks, Writing Across the Curriculum sustains and renews itself as a vital academic force.

Works Cited

Bazerman, Charles and James Paradis, eds. *Textual Dynamics of the Professions*. Madison: University of Wisconsin Press, 1991.

Crowley, Sharon. *Composition in the University: Historical and Polemical Essays*. Pittsburgh: Univ. of Pittsburgh Press, 1998.

Fulwiler, Toby. "How Well Does Writing Across the Curriculum Work?" 1984. Rpt. in *Landmark Essays on Writing Across the Curriculum*. Ed. Charles Bazerman and David R. Russell. Davis, CA: Hermagoras Press, 1994.

Ludlow, Douglas K. and Kirk H. Schulz. "Writing Across the Chemical Engineering Curriculum at the University of North Dakota." *Journal of Engineering Education* 83 (1994): 161-168.

Mahala, Daniel. "Writing Utopias: Writing Across the Curriculum and the Promise of Reform." *College English* 53 (1991): 773-89.

Russell, David. *Writing in the Academic Disciplines, 1870-1990: A Curricular History*. Carbondale, IL: Southern Illinois University Press, 1991.

Stout, Roland. "Writing in the Science Curriculum: Methods That Work Both as Writing and as Science." Unpublished paper presented at the third WAC National Conference, Feb. 6-8, 1997, Charleston, SC. Quoted with permission of the author.

Trimbur, John. "Consensus and Difference in Collaborative Learning." *College English* 51.6 (1989): 602-616.

Waitz, Ian A. and Edward C. Barrett. "Integrated Teaching of Experimental and Communication Skills to Undergraduate Aerospace Engineering Students. *Journal of Engineering Education* 86 (1997): 255-262.

Williams, Joseph and Gregory Colomb. "The University of Chicago." In *Programs that Work: Models and Methods for Writing Across the Curriculum*. Portsmouth, NH: Heinemann, 1990. 83-113.

Youra, Steven. "Writing Across the Curriculum as Cultural Encounter."

Unpublished paper presented at The Conference on College Composition and Communication, 1997. Cited with the permission of the author.

Notes

[1] I am going to try to examine rather than defend what I see as the WAC position, because I am trying to understand the differences we face, not to win that conflict. In doing this, I run the risk of oversimplifying and over-generalizing: Even as I write "WAC thinks this" and "Engineering thinks that," I can see exceptions and arguments that I am neglecting. Nonetheless, I think that by looking at these differences, we raise the possibility of seeing the positions more clearly, and thereby we gain the opportunity of communicating effectively and of choosing where to compromise and where to hold the line.

[2] The Outcomes Statement and information about its development and potential uses can be found on the World Wide Web at the following address: <http://www.mwsc.edu/~outcomes/>.

[3] There are, of course, reasons other than epistemology for engineering faculty to hire graders to do the "English" part of their grading, reasons having to do with the institutional expectations that engineering faculty can and should spend their time generating and managing funded research.

[4] Sharon Crowley has recently offered a convincing critique of the appeals to skills and to general humanist culture as rationales for the composition requirement; I am afraid that we make similar claims for the more expressivist WAC practices.

Acknowledgment: I owe thanks to my colleague at the University of Missouri-Rolla, Dr. Larry Vonalt, for helping me to organize my thinking in the early stages of this paper.

Does Writing Matter? Assessing the Impact of Daily Essay Quizzes in Enhancing Student Learning

Patricia A. Connor-Greene and Janice W. Murdoch
Clemson University

One of the major challenges of teaching is finding ways to maximize student learning. The phrase "writing to learn" (Young, 1997), a central tenet of the Writing Across the Curriculum (WAC) movement, communicates the critical role that writing plays in thinking and learning. As a result of WAC's influence, faculty across disciplines have incorporated techniques such as freewriting, journals, multiple drafts of papers, and ungraded writing into their classes in an effort to improve higher order thinking and learning (Kalmbach & Gorman, 1986). Although ungraded assignments can be of great value in stimulating student thinking, it is equally important to consider the role that *tests* play in thinking and learning, especially if they constitute the bulk of a student's grade (Connor-Greene, 2000).

Even though teachers typically want their students to develop strong critical thinking skills, they may unwittingly test students in ways that assess and reward basic knowledge rather than higher level cognitive skills (Bol & Strage, 1996; Crooks, 1988; Gottfried & Kyle, 1992). Bloom's (1956) classic *Taxonomy of Educational Objectives* classifies cognitive skills into a hierarchy. From simplest to most complex, these skills are: knowledge (recall of information), comprehension, application, analysis, synthesis, and evaluation. To encourage students to develop higher level cognitive skills, tests must require and reward higher level thinking.

Young and Fulwiler (1986) point out that the way to improve student writing is to place it as the center of the academic curriculum. Tests are clearly at the center of the curriculum in many students' minds. Grades are one of the most salient aspects of a class for students, and consequently, tests play a critical role in fostering student learning. Students develop and modify their study patterns in response to the structure and demands of their classes (Thomas, Bol, & Warkentin, 1991). According to Elton and Laurillard (1979), "the quickest way to change student learning is to change the assessment system" (p. 100). To encourage students to come to class

well-prepared and ready to process information at a high cognitive level, tests must reward these behaviors.

This paper addresses the impact of brief daily essay quizzes as a strategy for simultaneously assessing and promoting student learning. Each quiz consisted of one or two questions that tapped several levels of Bloom's taxonomy (e.g., comprehension and evaluation) but could be answered and graded quickly (see Table 1). Quiz grades were based on content and clarity of ideas, not grammar or spelling (Connor-Greene, 2000). Students took the quiz at the first 5-10 minutes of each class. After turning in their responses, the quiz questions served as the catalyst for beginning class discussion. Given the importance of questioning in the role of critical thinking, beginning every class with questions is a pedagogically appealing way to initiate the process of learning (King, 1995; Ruggiero, 1998). Students are highly motivated to read and discuss the material because they want input into how their quiz is graded, which leads to richer class discussions. Furthermore, because the quiz question begins each class discussion, assessment becomes an integral part of every class session, eliminating the typical split between teaching and testing.

Results of anonymous surveys indicated that students perceived daily essay quizzes as enhancing both learning and class preparation. In contrast, scheduled tests at predictable intervals throughout the semester encouraged last-minute preparation (waiting to read the assignments until just before the test) and lower perceived student learning (Connor-Greene, 2000). Although perceptions and self-reports of behavior are useful pieces of information, they do not address the question of whether this test method actually enhances reading, thinking, and learning. In order to improve teaching, it is important that teachers conduct systematic research to investigate student thinking and learning (Walvoord, 1990).

On student evaluations of classes that had daily essay quizzes, some students described themselves as better readers and thinkers as a result of this test format. We wanted to test this empirically. Our study investigated whether students who took daily essay quizzes demonstrated better reading and thinking skills than students who took tests at regularly scheduled intervals. If writing is as a way of thinking (Fulwiler, 1986) and a way to teach students to think critically within their discipline (Nilson, 1998), students who engaged in regular graded writing in class (daily essay quizzes) should show better retention of information, better critical thinking and evaluation, and better clarity of ideas in writing about an unfamiliar scholarly journal article in their discipline of psychology than should students who had not engaged in frequent graded writing.

Method

Participants

We asked students in four upper-level undergraduate psychology classes to participate in a voluntary study, in exchange for five extra credit points on their final exam. Two of the classes had taken four scheduled tests (ST) over the course of the semester, composed of a combination of multiple choice, essay, definitions, and short-answer questions. The third class took weekly essay quizzes beginning halfway through the semester (a total of seven essay quizzes) in addition to the scheduled tests (ST/7EQ). The fourth class took essay quizzes every class day throughout the semester (DEQ) except for several days when a film or guest speaker was scheduled.

Procedure

All participants read the same research article from *American Psychologist*, the official journal of the American Psychological Association, at the end of the semester. The article addressed a topic that was not covered in any of the four classes, and none of the students had previously read the article. We distributed copies of the article to students and asked them to carefully read it in preparation for an essay quiz two days later. We constructed an essay question that tapped Bloom's levels of knowledge, comprehension, analysis, and evaluation. The essay page had a removable cover sheet indicating the student's class, which facilitated blind scoring of the essays.

Results

We graded the student essays using a pre-determined scoring criteria checklist. Our interrater reliability was .94. Differences in ratings were resolved through discussion. An analysis of variance (ANOVA) indicated a significant difference in essay scores among classes, $F(3, 54) = 3.86$, $p < .05$. The scores for the DEQ class were significantly higher than those of both of the ST classes, $t(26) = 2.87$, $p < .01$, and $t(25) = 2.47$, $p < .05$, and significantly higher than the scores for the ST/7EQ class, $t(25) = 2.67$, $p < .05$. There were no differences among scores in the two ST classes or the ST/7EQ classes. Individual scores ranged from 0 to 12. The means and standard deviations for each of the classes are listed in Table 2.

Discussion

The results of this study confirmed our prediction that students who took daily essay quizzes would show better retention of information, clarity of ideas, and critical thinking when asked to write about an unfamiliar article in their discipline than would students who did not engage in daily graded writing. These findings suggest that students who wrote daily essay quizzes went beyond simply learning the course material to

develop reading and thinking skills that generalized to a new assignment outside the realm of their class. Rather than just gaining mastery of ideas presented in the course, they appear to have become better readers and thinkers than did the students in the other three classes. The results suggest that the daily essay quizzes helped students learn transferable critical thinking skills.

The average essay scores for students in each of the three classes that took scheduled tests were extremely low. With a maximum possible score of 12, the highest average score for each of these three classes was 41%, which would clearly warrant a grade of "F." The average score of the daily essay quiz class, 68%, would earn a "D+." Because students participated in this study as volunteers earning extra credit, they may not have put as much effort into this task as they might do on a real test that was required. It is important to note that the article we chose for the study was a six page psychology journal article containing disciplinary jargon. Because we wanted to assess reading and critical thinking skills acquired in a psychology class, we chose an article that would be very difficult reading for students unfamiliar with psychology's disciplinary writing style. We selected an article from the *American Psychologist*, the APA journal, because we wanted to assess reading, thinking, and learning specific to the discipline of psychology.

The significant difference in scores between the DEQ and ST/7EQ classes and the lack of difference between the ST/7EQ and ST classes suggest that essay quizzes must be an integral part of every class, from the beginning of the semester, to have a noticeable effect on student reading and thinking. It appeared to take DEQ students several weeks to establish a "rhythm" of reading thoroughly for each class. Because there were only seven essay quizzes in the ST/7EQ class, students may not have sufficient time and practice to foster the same habits developed by the DEQ students.

Because the students did not take a pre-test at the beginning of the semester, it is possible that the students in the daily essay quiz class were better readers and thinkers even before taking the class. Given the similarity of essay scores between the other three classes and the fact that all four classes were senior level psychology courses this seems unlikely, but this possibility cannot be ruled out on the basis of this study. We will conduct further research assessing changes in student reading and thinking from the beginning to the end of a semester to directly address this question.

In this study, it was not possible to separate the effects of reading practice from writing practice. Did the students perform better because the daily quizzes encouraged them to learn to read more carefully, or because they learned to develop and articulate their written ideas with more clarity,

or a combination of the two? Although the assigned reading load and level in the four courses was comparable, it is likely that the daily quiz class completed more of their reading and learned to read more carefully and critically because they were tested every class period. If that is the case, the better performance of the DEQ class may be due, at least in part, to more practice reading as well as more frequent writing.

The results of the study suggest that tests play a powerful role in shaping student behavior and skills. These findings reinforce the need for further examination of the role of testing in assessing and promoting student learning and thinking.

Works Cited

Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives. Handbook I: Cognitive domain*. New York: David McKay.

Bol, L., & Strage, A. (1996). The contradiction between teachers' instructional goals and their assessment practices in high school biology courses. *Science Education, 80,* 145-163.

Connor-Greene, P.A. (2000). Assessing and promoting student learning: Blurring the line between teaching and testing. *Teaching of Psychology*, *27*, 84-88.

Crooks, T. J. (1988). The impact of classroom evaluation practices on students. *Review of Educational Research, 58,* 438-481.

Elton, L. R. B., & Laurillard, D. M. (1979). Trends in research on student learning. *Studies in Higher Education, 4,* 87-102.

Fulwiler, T. (1986). The argument for writing across the curriculum. In A. Young & T. Fulwiler (Eds.), *Writing across the disciplines* (pp. 21-32). Upper Montclair, NJ: Boynton/Cook

Gottfried, S. S., & Kyle, W. C., Jr. (1992). Textbook use and the biology education desired state. *Journal of Research in Science Teaching, 29,* 35-49.

Kalmbach, J.R. & Gorman, M.E. (1986). Surveying classroom practices. In A. Young and T. Fulwiler (Eds.). *Writing Across the Disciplines* (pp. 66-85). Upper Montclair, NJ: Boynton/Cook.

King, A. (1995). Inquiring minds really do want to know: Using questioning to teach critical thinking. *Teaching of Psychology, 22,* 13-17.

Nilson, L. B. (1998). *Teaching at its best.* Bolton, MA: Anker Publishing.

Ruggiero, V.R. (1998). *The art of thinking* (5th ed.). New York: Longman.

Thomas, J. W., Bol, L., & Warkentin, R. W. (1991). Antecedents of college students' study deficiencies: The relationship between course features and students' study activities. *Higher Education, 22,* 275-296.

Walvoord, B.E. & McCarthy, L.P. (1990). *Thinking and writing in college.* Urbana, IL: National Council of Teachers of English.

Young, A., & Fulwiler, T. (1986). *Writing across the disciplines.* Upper Montclair, NJ: Boynton/Cook.

Young, A. (1997). *Writing across the curriculum* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Note

We presented a portion of this paper at the National Writing Across the Curriculum Conference, Ithaca, NY, June 1999.

Table 1

Sample Quiz Questions Reflecting Bloom's Taxonomy

1. List the three approaches described by Teitelbaum that are used to assess bias in testing (knowledge). Which of these approaches did the author of the article you read for today's class use in discussing gender and the SAT? (application) Cite a specific example from the article that supports your position (knowledge, evaluation).

2. Describe Datan's reaction to the "Reach to Recovery" materials as expressed in the article you read for class today (comprehension). How well does her evidence support her interpretation? Explain (evaluation).

3. What do you see as the primary risks and benefits of Jane Elliot's approach to teaching children about prejudice? (evaluation) How would you modify her exercise to reduce risks while preserving benefits? (synthesis).

4. What are the major differences between a social constructionist and an objectivist approach to research? (analysis) Which term would you use to describe the author of the article you read for today's class? Why? (evaluation).

Table 2

Means and Standard Deviations of Essay Scores for Each Class

	n	M	SD
DEQ	12	8.17	3.76
ST/7EQ	15	4.87	2.67
ST	15	4.93	3.06
ST	16	4.19	3.53

Note. DEQ = daily essay quizzes; ST/7EQ = scheduled tests with seven essay quizzes; ST = four scheduled tests
Maximum possible score = 12

Listening to Everett Rogers: *Diffusion of Innovations* and WAC

Stephanie Vanderslice
University of Central Arkansas

In "The Future of WAC" (1996), Barbara E. Walvoord suggests framing the history and future of the writing-across-the-curriculum movement according to social movement theory (58), explaining that WAC qualifies as a movement because of its "change agenda and its collective nature—faculty talking to one another, moving to effect reform" (58). Consequently, she proposes that her evaluation of WAC's progress at the 25 year mark and her re-envisioning of its future within this movement frame will uniquely reveal its "characteristics, strengths, and problems in ways that may help us think creatively about them" (61).

Certainly creativity may be the order of the day as the WAC movement, in spite of its successes, struggles to maintain its vitality and visibility against the perennially resistant landscape of academe. Such resistance, educational reform scholar Parker J. Palmer reminds us, (though few at the front lines of the WAC movement need reminding) will remain an essential feature of the academy as long as teaching "retains low status... tenure decisions favor those who publish, [and] scarce dollars. . .always go to research" (10). These conditions result in a "constitutional gridlock" which breeds the "mood of resignation. . .and despair" so familiar to those seeking reform (10).

Walvoord's review of WAC's progress from a social movement perspective turns the literature in an important direction. By providing the template of social movement theory against which to examine their successes and failures, WAC proponents are forced to take a more analytical approach to their subject, an approach that transcends the more anecdotal "what works and what doesn't" scholarship that has dominated writing-across-the-curriculum, especially in its early and middle years. Specifically, it provides an entrée into the extensive network of sub-fields *within* social movement theory, one of which concerns itself with the spread of new ideas or "innovations" within systems, a category of study known as "diffusion" or "innovation theory." In fact, according to Daniel Surry, who writes about the application of social movement and innova-

tion theory to the field of Instructional Technology, "professionals in a number of disciplines from agriculture to marketing' commonly study diffusion theory in order to further change agendas" (1). Taking the lead from our colleagues in Instructional Technology, a close examination of the process of innovation diffusion can enhance the ability of WAC advocates to implement their own reform agendas.

The most widely recognized source for diffusion theory is Everett M. Rogers' seminal work, *Diffusion of Innovations*. Not surprisingly, Walvoord is the only WAC scholar whose work has recently referenced this volume, which synthesizes the last thirty years of diffusion research and distills it into a set of basic principles for the propagation of a new idea. Mentioning Rogers briefly first in "The Future of WAC" and later, in her longitudinal study of three writing-across-the-curriculum programs *In The Long Run*, Walvoord however, narrowly focuses her attention on one small portion of his expansive diffusion framework, describing how the "early innovation adopter" figures in her study. In fact, beyond this spectrum of "kinds of adopters," *Diffusion of Innovations* offers a solid, replicable framework for the process of moving an innovation through a social system over time. Diffusion theory is especially relevant to WAC efforts, moreover, because it examines "overt behavior change. . . the adoption or rejection of new ideas, rather than just changes in knowledge or attitudes (Rogers *Communication of Innovations* 12). *Diffusion of Innovations* can tell us a great deal, then, about how ideas are not just accepted but under what conditions they are most likely to be implemented.

While many would argue that WAC ceased to be an "innovative" idea in the late eighties (not coincidentally when most of the corporate and foundation funding had dried up), Rogers asserts that contrary to what its name implies, an innovation need not be a brand new idea but rather an "idea, practice or object that is *perceived* as new by an individual or other unit of adoption" (Rogers *Diffusion of Innovations* 11). Thus, perceived newness is often a more important element to recognize in the diffusion of a new idea than objective novelty. This factor is particularly salient to writing-across-the-curriculum as it proceeds towards its thirtieth anniversary and yet finds itself annually born and re-born at campuses across the country.

To be sure, "perceived newness" is also important when relating *Diffusion of Innovations* to the WAC movement, as the text was first published in 1962 and its latest incarnation in 1995, yet it remained undiscovered by WAC scholarship until Walvoord's 1996 article. Thus, I will argue that Rogers' close attention to the step-by-step process of spreading reform is not only perceptually new to the WAC movement but also holds valuable implications for the achievement of its reform goals.

To begin at the beginning, it is useful to examine, through the lens writing-across-the-curriculum, the ways in which Rogers pinpoints the general factors that attend the birth of any movement. Most movements are born of necessity, from a widespread recognition that a problem exists that is not easily rectified through established modes of operation (Rogers 132) or "when societies undergo structural strain, as during times of rapid social change" (Benford 1881) . Walvoord refers to the former condition when she dates the catalyst of the writing-across-the-curriculum movement to the now-famous Newsweek cover story of December 9, 1975, "Why Johnny Can't Write" ("The Future of WAC" 61). As composition historian David Russell details, this article sparked a shift in public perception that proved the unifying force between the separate strands of disciplinary writing theory drifting through higher education in the years that preceded it (276). It is important to note the influence of the latter condition as well, brought on by the strain of the open admissions movement of the late sixties and early seventies that ushered into academe tens of thousands of students nationwide who were under-prepared in such basic skills as writing. WAC is like many of the movements Rogers characterizes, then, in that it locates its origins in a dramatic shift in perception, in this case the perception of student writing ability in America. That WAC's early history fits the template of Rogers' diffusion theory bodes well for the rest of the patterns he describes. Even initial crises, however, may not be enough to ensure the rapid, universal and continued adoption of an innovation.

Diffusion of Innovations identifies five essential characteristics that enhance the rate and effectiveness of diffusion. The first concerns the relative advantage of the innovation over the "idea it supercedes" (15), underscoring the imperative to demonstrate that any new idea is more effective than the one it is replacing. The second characteristic concerns gauging compatibility of the idea with the "existing values, past experiences and needs of adopters" (15). Walvoord in *In The Long Run* and Kipling and Murphy in *Symbiosis: Writing and An Academic Culture* (1992), illuminate this characteristic by acknowledging that teachers work in a context embedded in a past that influences their outlook, philosophy and attitude toward change.

The third characteristic relates to level of complexity or the ease with which an innovation can be understood. Directly dependent on the efforts of advocates to keep a new idea "simple," little WAC research has actually examined the relationship between the levels of complexity at which WAC pedagogy is presented and the rate at which it is accepted and implemented, a relationship that could have valuable implications for the movement. Finally, the fourth and fifth related characteristics are described as trialability, or the degree to which adopters can implement an

innovation, for example, a "new" writing-to-learn technique such as exit slips, on an experimental basis (16) and observability, or the extent to which "results of an innovation are visible to others" (16). Both are connected to what *Diffusion of Innovations* posits as the "heart of the diffusion process" (18), that is, its essentially social nature. While Rogers' assertion that humans are inherently social beings who from infancy to adulthood learn through the modeling and imitation that face-to-face contact provides is hardly groundbreaking, his grasp of the relevance of human relationships and social structures to the diffusion of new ideas can offer a system for understanding and analyzing the essential social nature of WAC that has often been reported in the research.

Rogers divides the channels for information exchange into two main categories, mass media and interpersonal. While the former remains more significant for innovations targeted to large populations, such as AIDS prevention, smoking cessation, and so forth, the latter can especially help explain the diffusion of WAC in smaller, more self-contained social organizations such as colleges and universities. Likewise, mass media channels are more useful in *creating knowledge* about an innovation while interpersonal channels are more useful in *changing attitudes* about a new idea and subsequently changing behavior. *Diffusion of Innovations* reminds us that "face to face exchange between two or more individuals is extremely effective in persuading individuals to accept new ideas" (18). Accordingly, it is useful to note that when making innovation decisions, most people are not influenced as much by statistics or consequences as they are by word of mouth from others who have adopted the innovation (Rogers 18). In fact, a cursory survey of WAC scholarship bears out this observation; many initial successes of the movement can be attributed to the grassroots involvement of faculty. Nonetheless, beyond this attribution, WAC research rarely seems to scrutinize this phenomenon. WAC leaders such as Elaine Maimon, Toby Fulwiler, and Art Young seemed to intuit what Walvoord examines most closely in *In The Long Run* and "The Future of WAC" that, due in large part to their high autonomy, "colleague esteem" and "socialization" were especially essential to the innovation decisions of college faculty ("Future" 64). This emphasis on "individual . . .change" (63) through casual discussion groups, conferences, and the inimitable "WAC workshop" helped the movement to flourish. Certainly, a less intuitive and more concrete awareness of the complexities operating within the interpersonal elements of diffusing an innovation such as WAC can only enhance its effectiveness and staying power.

The interpersonal channels of any diffusion process are intimately connected to the social system through which the new idea moves, a system Rogers identifies as a "set of interrelated units engaged in joint problem solving to accomplish a common goal" (23). Further, he suggests

that gauging the characteristics and values of such a system and the degree to which the system may be, as a whole, favorable or unfavorable to new ideas is another essential consideration in diffusion theory. Such considerations may explain the relative ease with which WAC was diffused in Great Britain. David Russell notes that in the British educational system, teaching students to write in all disciplines was a "long tradition," so reformers did not need to reinvent the wheel when introducing writing-across-the-curriculum, "only. . .modify the kinds of writing and its pedagogical uses" (279). Thus, it would seem that as Rogers predicts and Great Britain's success exemplifies, the seeds of innovation more rapidly take root in a system that provides fertile rather than fallow ground.

Perhaps the aspect of Rogers' theory WAC and other change advocates will find most apt to their purposes, however, is his discussion of the optimal role models for innovation diffusion within a system. For example, while it may appear common sense to recruit the most innovative members of a social system to model innovation adoption, many would be surprised to learn that research has found that such innovators are often perceived as extremists and eccentrics, which naturally detracts from their credibility among their peers and limits their effectiveness in the diffusion of new ideas. The most liberal faculty members at an institution, therefore, may not be the best first models of innovation.

So who are the best models of innovation? Rogers calls them the "opinion leaders," key players in the interpersonal aspect of the diffusion process which also includes the change agent, or individual sent by a change agency to influence followers, and the various stages (early, middle, late) of adopters themselves. Rogers' characterizations of these leaders can help identify the best faculty allies in the pursuit of change. While opinion leaders have more credibility than their more innovative counterparts, they remain more receptive to change than their conservative peers. They are usually recognized in social systems for their "technical competence, social accessibility, and conformity to the system's norms" (27). In addition, compared to their followers, opinion leaders are generally "more exposed to external communication" and "more cosmopolite" (27). Walvoord classifies these leaders as horizontally-networked "early adopters" in *In The Long Run*, those faculty who over the years of her study "[came] to WAC partly because they like new ideas and are not averse to taking risks. . .that come to them through their broad social networks" (6) and additionally uses Rogers "change agent" label to describe the WAC advocate. *In The Long Run*, however, focuses much more closely (and in retrospect) on how faculty come to frame the meaning of their WAC experiences over time rather than how various categories of faculty adopters interact in the innovation process for optimal results. At a time when

WAC programs struggle against multiple obstacles, room exists for both kinds of conversations.

While exploring the opinion leader category, Rogers goes on to caution that in spite of their power to model change in a system, there are certain circumstances where opinion leaders can lose influence. For example, they can be perceived as "worn-out" if change advocates over-use them by asking them to sign on at the start of every new writing-in-the-disciplines initiative simply because of their demonstrated sympathy to the cause. Moreover, if opinion leaders are perceived as too close to change agents, other members of a social system may reject their influence. Walvoord begins to underscore the truth in this warning when she notes that WAC opinion leaders may easily "change from a 'we' to a 'they' in faculty eyes. . .becoming not helpers but enforcers" ("The Future of WAC" 66). *In The Long Run* further explores and attempts to de-emphasize the "we" versus "they" mentality that has emerged over the history of the WAC movement. *Diffusion of Innovations*, however, inspects the delicate balance between opinion leaders and interpersonal channels and provides a structure for the careful, consistent monitoring that such delicacy involves.

Perhaps the best and arguably most successful implementation of Rogers' principles may be found in the rise of the National Writing Project, which developed in the early seventies to improve writing instruction and promote WAC in primary and secondary schools. Revolutionizing the concept of "teacher development" the National Writing Project did not focus on what Russell calls top-down "teacher-proof" materials but instead provided an environment for gifted teachers (opinion leaders) to share their "insights and methods for using writing in the classroom" (280). Nonetheless, relative to its success, this national organization has received comparatively little scholarly attention, attention that might be augmented if the structure and philosophy underpinning it were more closely examined according to paradigms such as social movement and diffusion theory.

As the WAC movement enters into its third decade, it has become apparent that while an early, intuitive grassroots model was responsible for significant positive change in the teaching of writing-across-the-disciplines at many institutions, just as many schools labor to build viable WAC programs or are in the process of re-building programs that have withered or failed completely. Many theorists, like Palmer, view these failures as endemic to higher education, proof of a kind of institutional incompatibility between reform and the climate at American colleges and universities. Further, Russell notes that WAC programs meet organizational resistance because they demand the dismantling of departmental boundaries when there is "no specific constituence for interdepartmental

programs within the structure of the American university, much less for interdepartmental programs that *incorporate writing*" (298) [emphasis mine]. It is clear that as questions about the staying power of WAC arise once again in formal and informal discussion forums, the kind of re-envisioning of the writing-across-the-curriculum movement Walvoord advocates demands a paradigm shift away from the narrative, anecdotal emphasis in the scholarship and towards a more balanced approach, integrating a structural basis for change that *Diffusion of Innovations* and other key social movement texts can provide. Three years after the publication of "The Future of WAC" and *In The Long Run*, the lack of references to social movement and innovation theory in the field reveals that few WAC advocates consciously utilize or even seem aware of the existence of this rich resource. Diffusion research has the potential to not only inform the daily work of WAC advocates, but also to locate the narrative of writing-across-the-curriculum movement in the larger theoretical context of educational reform. At a very basic level, moreover, Rogers' work has the potential to inform the WAC field simply by acknowledging how challenging it is to introduce innovations into any system, an acknowledgement present in the first lines of the book, which state in no uncertain terms that "[g]etting a new idea adopted, even when it has obvious advantages, is often very difficult. Many innovations require a lengthy period, often many years, from the time they become available to the time they are widely adopted" (1). Thus, in addition to validating the resistance so frequently encountered by WAC advocates as an often "necessary evil,"[1] diffusion theory, especially the sheer volume Rogers synthesizes in *Diffusion of Innovations*, also reminds us that change is a highly complex process that might benefit from a more systematic framework. Consequently, if WAC is to survive the present academic climate well into the next century, its last best advocates would do well to take the lead from our colleagues in other disciplines for whom "diffusion theory" is a common term and Everett Rogers a familiar voice and prick up their ears.

Works Cited

Benford, Robert. "Social Movements." *Encyclopedia of Sociology*. New York: Macmillan, 1992.

Kipling, Kim J. and Richard J. Murphy, Jr. *Symbiosis: Writing and An Academic Culture*. Portsmouth, NH: Boynton/Cook, 1992.

Palmer, Parker J. "Divided No More: A Movement Approach to Educational Reform." *Change* Mar./Apr. 1992: 10-17.

Rogers, Everett M. and F. Floyd Shoemaker. *Communication of Innovations: A Cross-Cultural Approach*. New York: Free Press, 1971.

Rogers, Everett M. *Diffusion of Innovations*. 4th ed. New York: Free Press, 1995.

Russell, David. *Writing in the Academic Disciplines, 1870-1990*. Carbondale: Southern Illinois UP, 1991.

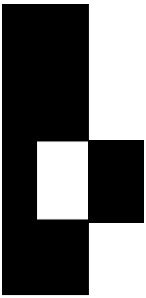
Surry, Daniel W. Paper presented at the Annual Conference of the Association for Educational Communications and Technology (AECT) 1997. http://www.hbg.psu.edu/bsed/intro/docs/diffusion/index.html

Walvoord, Barbara E., Linda L. Hunt, H. Fil Dowling Jr. and Joan D. McMahon. *In the Long Run: A Study of Faculty in Three Writing-Across-the-Curriculum Programs*. Urbana, IL: NCTE, 1997.

Walvoord, Barbara E."The Future of WAC." *College English* 58.1 (1996): 59-77.

Notes

[1] For a discussion of "resistance" as natural and productive, see also Jody Swilky's article "Reconsidering Faculty Resistance to Writing Reform in *WPA* 16:1-2, and Deborah Swanson-Owen's "Identifying Natural Sources of Resistance: A Case Study of Implementing Writing-Across-the-Curriculum" in *Research in the Teaching of English*, 20:1.



On Writing Instruction and a Short Game of Chess: Connecting Multiple Ways of Knowing and the Writing Process

Mya Poe
University of Massachusetts - Amherst

> Writing represents a unique mode of learning — not merely valuable, not merely special, but unique . . .Writing serves learning uniquely because writing as process-and-product possesses a cluster of attributes that correspond uniquely to certain powerful learning strategies (Emig 89).

Janet Emig's 1977 article "Writing as a Mode of Learning" has been one of the most influential texts in the modern writing-across-the-curriculum and writing-to-learn movements. WAC proponents have generally substantiated Emig's assumption that by putting ideas into words we distill or clarify our thinking. Composition and WAC publications are filled with articles documenting the success of writing-across-the-curriculum throughout the University. I'm not here to argue with the success of writing-across-the-curriculum. As a writing teacher, I'll be one of the first to argue for the link between cognition and writing. But as a writing teacher I always return to the question "How do I teach writing better?" If writing is supposed to help us understand difficult concepts in chemistry, for example, what's to help us understand difficult concepts in writing? What kind of heuristics will help students learn to compose with words? Does writing lead to better thinking about writing? Maybe for some students, but other students who are self-proclaimed "bad writers" or for those whose battle call is "I hate writing!" writing about writing seems an endless tautology. So what can help us teach writing to those students for whom words are not easy? Maybe chemistry? Or Architecture? Maybe the way of thinking spawned when sketching a design or constructing an equation is a more direct route to coming to writing for these students than trying to compose with words. Or maybe by translating concepts across ways of knowing, those self-proclaimed "bad writers" will find the seemingly foreign world of writing less strange and frustrating.

If we return to Janet Emig's "Writing as a Mode of Learning" and read a bit more carefully, we find that Emig does not say that other forms of composing are useless. Her reason for considering writing a unique mode for learning was that writing represented "the most available medium for composing" (89). She says that other forms of composing are more difficult to legitimate in the academy or more difficult for students to grasp:

> Most students are not permitted by most curricula to discover the values of composing, say, in dance, or even in film; and most students are not sophisticated enough to create, to originate formulations, using the highly abstruse symbol system of equations and formulae (Emig 89).

Emig was right that some forms of knowing are privileged over others in the academy, but that does not mean that they do not exist or that we should dismiss the potential they hold for learning. Secondly, Emig underestimates students' potential in composing with symbol systems like equations and dance. Within their various disciplines, students MUST learn to negotiate these abstruse symbol systems. For example, in order to think like an electrical engineer, you must become proficient in the language of equations and circuit diagrams. In order to begin to think like a dancer, you have to learn to compose in movement, not in words.

In "Multiple Intelligences in the English Class: An Overview" Peter Smagorinsky calls for us to expand writing-across-the-curriculum to "composing across the curriculum," and he encourages educators to consider "the potential for unconventional composing processes to enrich students' experiences in school" (15). The value of understanding other ways of knowing and composing is enormous for those of us who teach writing to students whose best way of understanding writing may be non-linguistic. By opening "composing" to other ways of knowing, we invite students to expand the boundaries of academic knowledge-making by deconstructing the myth that there is one right way of thinking and being "smart." Moreover, we ask them to become self-reflective about thinking. By becoming "metacognitive" about thinking and learning, we make them better problem solvers. For example, to explicate their own way of thinking and the role of words in that thinking process, they must question what it means to compose, to create ideas and put those ideas into action.

One of the first barriers to erase in order to expand the idea of "composing" is the division between academic and non-academic thought. Chiseri-Strater's case study of two students at the University of New Hampshire provides striking evidence of what happens when students' private and personal ways of knowing are fragmented. Nick and Anna, the two students in Chiseri-Strater's study, both struggle to maintain a personal aesthetic approach to academic work via art, music, and dance while devoting much of their time to the acceptable public rendering of those

ideas by "doing papers" (151). Chiseri-Strater attacks those like Harold Bloom and E. D. Hirsch who "encourage a very narrow view of what it means to know," finding that students' "singular ways of interpreting the world go unnoticed by educators as the lines are drawn between private and imaginative experiences and public academic expression" (xvii). Cheseri-Strater concludes that, "An expanded definition of what it means to know through aesthetic experiences invites students to bring their personal literacies into our classrooms to forage together for the intellectual nourishment of the group" (155).

Secondly, in order to expand ideas about "composing" we have to ask ourselves what ways of thinking are valued in our disciplines and professions. Cheseri-Strater notes that students are offered little holistic understanding of disciplinary epistemology, and yet there are major differences in the ways that various disciplines expect students to process and display information. In "Speaking of Knowing: Conceptions of Understanding in Academic Disciplines" Judith Langer asks "Are there essential similarities and differences in the ways various disciplines regard 'knowing'?" (69). Her answer is "yes," and she calls for teachers to reflect on discipline-specific ways of thinking. In a study of university professors, however she found that among the teachers she studied, "notions of discipline specific ways of thinking were mostly implicit" (Langer 84). Langer finds this void disturbing, arguing that "If teachers are to help students develop higher-order reading, thinking, and writing skills, they must be able to articulate the ways of knowing that are central to particular domains" (70).

In *The Reflective Practitioner* Donald Schon finds a similar phenomena in the professions and calls for an "epistemology of practice" (viii). While seasoned professionals often engage in "reflection-in-action," moments in which they reflect on their decision-making process, most "knowing-in-practice" is tacit (Schon 60). Through a series of vignettes, Schon shows how junior architects, psychiatrists, managers, and planners struggle to learn these tacit ways of thinking of their seasoned mentors.

What Langer and Schon show vividly is that as teachers and mentors we often fail our students by not making explicit the ways of thinking that are valued within our classrooms, disciplines, or professions. By analyzing our "reflection-in-action," we can begin to show students how we come to compose knowledge. In turn, by asking students to be metacognitive about their own thinking, we give them a powerful heuristic to understand the ways that knowledge is constructed. We challenge them to stretch their minds, ask questions, dispel stereotypes, and offer multiple perspectives (Armstrong 152). Secondly, by translating that understanding across disciplinary boundaries, we challenge artificial aca-

demic boundaries between departments to expand the limits of academic thought. Thirdly, in this translation process, we open disciplinary symbol and thinking systems to more creativity. Finally, by asking students to become metacognitive about their own processes, we make *them* better teachers one day.

Using Multiple Intelligence Theory

The work of Howard Gardner, Professor of Education and Codirector of Project Zero at Harvard University, gave me a conceptual way to think about multiple ways of knowing. Gardner's Multiple Intelligence Theory (MI) is a descriptive theory of knowledge that uses both biological and cultural paradigms to explain the concept of "intelligence." Originally trained as a neuro-psychologist, Gardner's life-long research with brain damaged patients at Boston area hospitals led him to question traditional notions of intelligence. What he learned through years of research was that the human mind is capable of many intelligences and that those ways of knowing are influenced by environmental and cultural experiences.

In his seminal book *Frames of Mind* Gardner defines intelligence as "the ability to solve problems, or to create products, that are valued within one or more cultural settings. Using a series of cognitive criteria, such as potential isolation by brain damage, existence of savants and prodigies, and susceptibility to encoding in a symbol system, Gardner outlines eight intelligences. These intelligences work in a complex matrix of thought and action, evidenced through everything from playing the violin to programming a computer. Following is a short synopsis from *Frames of Mind* of the proposed intelligences:

> *Spatial* - Most usually evidenced in visual thinkers, spatial intelligence is the "ability to perceive the visual world accurately . . . and to re-create aspects of one's visual experience" (173).
>
> *Kinesthetic* - As shown in disciplines from theatre to athletics to surgery, kinesthetic intelligence is the ability to master the motion of the body or manipulate objects with finesse (207).
>
> *Linguistic* - One of the two traditionally-prized intelligence(verbal section of the SAT), linguistic intelligence is sensitivity to the meaning, the order, and the sound of words (77).
>
> *Logical-Mathematical* - The other of the traditionally-prized intelligences (analytic section of the SAT), logical-mathematical intelligence is the "ability to handle skillfully

long chains of reasoning" as well as recognize patterns and order (139).

Musical - Sensitivity to pitch, rhythm, and other musical elements is the hallmark of musical intelligence (104)

Naturalist - The most newly "discovered" intelligence, the naturalist has a keen sensitivity to flora and fauna and their interrelations.

Interpersonal - Indispensable for group dynamics or counseling, the person with interpersonal intelligence has the "ability to notice and make distinctions among other individuals" (239).

Intrapersonal - Through meditation, religion, or philosophy, the person with intrapersonal intelligence can "access one's own feeling life" (239).

Gardner's theory is powerful for several reasons. One, it validates ways of thinking that are not traditionally prized in schools, treating those ways of thinking as "intelligences," not "skills" or "talents."[1] Second, Gardner's theory acknowledges the significant influence of "culture" upon the mind's development. According to his theory, intelligence is not something located only in brain physiology but something that also holds a deeply cultural resonance. Third, Gardner emphasizes the malleability of intelligence. Intelligence is not static upon birth. We can develop our minds, thus suggesting that the majority of knowledge is self-constructed as well as culturally constructed.

Many students already understand the concept of learning styles or have read of Gardner's work, so they readily accept that the brain has multiple avenues for knowing. What is difficult is getting students to become metacognitive about learning. To help guide the process, I review Gardner's theory and then ask students to do some brainstorming about thinking and learning. First I ask them Learning Questions:

1. Consider your interests. What interests you? What are you good at? Why? Do you have any special skills? What kind of intelligence might be involved in completing that skill?

2. How did you come to learn your interest? If you had to teach your special skill to someone, what would you want that person to learn? How would you teach your skill to someone else?

3. Consider what you're thinking about majoring in? Why does that major interest you? What intelligences are used in that discipline? What makes you think so? [2]

4. If you've taken classes in your major, what techniques or theories do you remember? Could you teach those techniques or theories to someone else?

After a class discussion about students' interests, we then talk about writing. By this point in their careers students have been writing for more than 12 years. It's important for them to consider the knowledge they possess about writing. Often students have never thought about writing on an abstract level, so I ask them the following Writing Questions:

1. Thinking about the way that you write, make a list of all the ways you begin to invent ideas when writing a paper. Do you think about those ideas in pictures? Music? Formulas? Movements? Do you have specific sources of inspiration or ways that you come up with ideas for papers? Do you talk to your friends or work alone?

2. When you first begin to put words on the page, what do you think about?

3. How do you envision the structure of your papers? Does that thinking process come in sections or strings or music?

4. If you get stuck when writing, what do you do?

5. What are your writing idiosyncrasies? Are you noted for a particular writing style?

6. When you think about the following terms, what do you think about? (Choose 2) flow, feel, strategy, voice, tone, rhythm, audience, composing, feedback, revising. What other terms have you heard used to describe writing? Are any of these similar to terms you've heard in other classes?

Diving In

At this point, I ask students to think about possible connections between the Thinking Questions and the Writing Questions. What I hope in their brainstorming is that they start weaving connections between ways of knowing so that the void between writing and music, for example, begins to disappear, and they can begin to see how the knowledge they're learning in music can be translated into what they're learning in the writing classroom. John, for example, wrote the following insights:

> My art helps me in my writing because it helps breaks things down, especially visually. I can break complex objects down to simple shapes in my head automatically without even realizing it. If I have a lot of things running through my head all at once, I can use this technique to break them down, and filter out the unimportant or irrelevant thoughts. I believe this is the reason why I can write a paper with out random sentences to jog my brain first. I can just pick out what I want, formulate a sentence with that, and then elaborate on whatever subject it may be.
>
> My interest in music helps me in a different way; it helps me with the fluidity of my writing. I think of each sentence as

> a jigsaw puzzle, and you need to together the words in such a way that it firms a mental image, or picture. It needs to fit together in order to be appealing to the ear. The same is true with a paper; it needs to flow so that it makes the paper easier to read. So I try to make my sentences have a kind of rhythm, and although they may not always have a certain rhythm, the exercise still helps me to make the paper easier to read.

For John, the connection between writing and art and writing and music was immediate and concrete. For other students, the connections between writing and thinking take on a more abstract sense. For example, Neal wrote, "The reason I feel I am a kinesthetic writer is the fact that when I am taking part in physical activities, my mind is more open for ideas. I think the higher my heart-rate, the more apt I am to ideas."

At this point, we discuss how to put together a presentation based on our brainstorming. I give students examples of presentations from previous semesters, but I leave the content and format of their presentations to them. My only requirements are as follows: 1. A clear explication or demonstration of the connection they want to make between writing and their thinking process. This must include a handout or a visual 2. A writing exercise based on the connection they see between the two processes. Since I'm not the expert in chemical engineering or juggling or salsa dancing, I leave the parameters of the class exercise up to individuals. From this point in the semester, every week we have a presentation at the beginning of class. For the first twenty minutes of class students present their ideas and have us complete a writing/thinking exercise based on their presentation. We have a short discussion about the presentation and each student writes a short reflective response letter to the presenter. In following class sessions I return to students' techniques to show students the value of their teaching tools.

After working with this technique for several semesters, I've found that students' presentations fall into two broad categories:

Alternative Composing — new composing or responding techniques based on models from other disciplines. Such exercises add to our repertoire of process writing techniques, such as mapping and freewriting.

Translating Using Metaphors — exercises that make a metaphorical link between writing and disciplinary epistemology. These presentations translate ways of thinking about writing into similar concepts used in other disciplines and expand our vocabulary for talking about writing.

Alternative Composing

In the following alternative composing exercises, students took composing, revising, or responding techniques they had learned outside our classroom and applied them to the writing process. This reflective think-

ing process re-enforces to students the idea that knowledge is not created in a vacuum and that every hobby, discipline, and profession has a method for making knowledge. Those ways of making knowledge need not be limited to curricular boundaries. Instead, techniques like sketching and focusing the body can be applied across the curriculum, and in particular, to writing.

Drew, an architecture major, used visualization as an invention strategy for his rough drafts. By turning writing prompts into a series of visual images rather than strings of words, Drew explained that he could begin to think of ideas more readily, via pictures, for his essays. He explained that if he tried to compose his initial drafts in words, he would "skip" ideas and couldn't keep in focus everything he wanted to say. By sketching a series of "scenes" of his first draft, however he could keep all the ideas in his mind together through a visual "movie" of his essay. He also explained that the visual relationship of the elements in his sketches helped him think of transitions between his ideas. For his presentation, he gave us a writing prompt ("What's on your mind?") and had us sketch the images we conjured while thinking about his prompt. The relationship and size of the images on the page suggested possible ways we might organize our papers or foreground certain ideas over others. Then, we began to add words to our sketches, using key words to focus on certain details in our sketches. Next, we began writing sentences. In slowly detailing in words what we had so quickly sketched minutes before, the written story of the sketch emerged in rich metaphorical language. If we forgot what we wanted to say, Drew suggested that we return to the drawing to remember ideas that might have gotten lost in the translation from images to words.

For highly visual-thinking students like Drew, inspiration is literally drawn through their visual renderings. For such students, words are often the accompaniment to their images, not their primary way of making knowledge. (As English teacher we usually think of pictures being the accompaniment to words.) The Creative Director of Turbine, Inc., a Microsoft Studio, explained the relationship between words and images for a designer as follows, "As designers, we think of images first. The block comes when you put the wrong foot first. When you try to get the image from the word, it won't work. You *have* to have the image first and then add the words. Visuals always come first" (Gaud interview). Donald Schon in *The Reflective Practitioner* found a similar relationship between words and images for architects. Schon writes that in the language of architectural design, a "spatial action language," words in-and-of themselves are "obscure" without their visual references (95). For students like Drew with powerful visual-spatial intelligence, the key to successfully teaching writing is not about helping them find ideas for writing, but helping them find the link between their visual ideas and words on the page. By beginning with

images, such students get a tangible beginning to the writing process before becoming overwhelmed by words. Nick summarized the value of Andrew's presentation for those students who struggle with words but find visualizing easy, "[Through drawing] I got to express myself without much trouble, and something significantly tangible was produced because of it".

For Andrew, the problem with words was also not solved by using traditional process writing methods. Andrew, a member of the Junior National Cycling Team, needed to focus his body for writing. He explained, "It's difficult for me to get things down on paper." He continued by explaining that part of that difficulty resulted when his mind became too active and disrupted the sense of "flow" he needed for writing. For students like Andrew who live their lives primarily through their bodies, an overactive mind while writing is a disruptive force that leads to frustration and resistance. His technique for overcoming this disruption was called "getting outside yourself," in which you "remove" yourself from the writing process. He called this process "self cleansing," explaining that you do whatever it takes so that you no longer "feel" attached to the writing. He asked us to try his method when we experienced writer's block. Andrew explained that "self-cleansing" had to be more than passive avoidance of writing; it was about investing your energy in an activity entirely unrelated to writing. Only when you were so absorbed in that other activity so that you no longer "emotionally attached" to writing, could you return to writing.

In *The Inner Game of Tennis* W. Timothy Gallwey describes the "effortless effort" that athletes perfect, so that the mind is quiet while the body performs: "only when the mind is still is one's peak performance reached" (Gallwey 21). Andrew's "self-cleansing" technique was about getting at this sense of a quiet mind. He achieved this sense mainly through cycling. When his mind was quiet, he could concentrate "without *trying* to concentrate" (Gallwey 22). Often athletes describe this sense as being "in the groove" or "in the zone." Being "in the groove" is about effortless effort, doing without telling yourself to do. From years of cycling, Andrew had learned this finely-tuned thinking process. He said "Only when I'm exhausted, I write." Andrew explained that when he was exhausted, the mental over-processing about writing goes away. He no longer needed to tell himself how to write; he could simply write. It's not surprising that those who reported the most success with Andrew's technique were other kinesthetic thinkers – a swimmer, a dancer, and a rower.

Kristy, a nursing major and self-described "psychologist," drew on her interpersonal intelligence to bring us strategies for peer response. She described her "Interaction With People" activity as a technique for successfully "communicating with others outside our familiar friendships and

associations." Indeed, the writing workshop is often about responding to people who are outside our familiar friendships. As teachers we can equip students with peer response techniques for responding to other's *writing*, but we also must equip students with techniques for responding to the *writers* whose work they are critiquing. As such, responders not only need to be good editors but good allies to individuals they may not know very well. Peter Elbow underscores the importance of being such supportive readers, "for improving your writing you need at least some readers to be allies, persons who wholly cooperate in the communicative transaction" (24).

To help our class rebuild a sense of community and open communication boundaries, Kristy had us do several ice-breaking activities. First, she gave us a series of question and response strategies for making conversation with a "stranger," thus showing us "how simple it is to become familiar with each other, have fun, and be comfortable all at the same time." In another exercise, she had us play a game that showed us the importance of remembering individual's names and details, thus underscoring the importance of thinking of each writer as an individual. As a writing teacher, I am always struck how successful response is really about finding the right words for the individual writer. In counseling terminology, such success depends on seeing the "patient" as "a series of one who must be understood in terms of the unique experiences of his life" (Schon 117). Kristy's exercise taught students the importance of considering each writer as a distinct "series of one."

Translating Using Metaphors

Metaphor is one of the most powerful tools we have for translating ideas from way of knowing to another. In fact, Lakoff and Johnson claim that by "experiencing one kind of thing or experience in terms of another" human thought processes are mainly metaphorical (6). Across disciplines and professions, within academia and outside of academia, we use metaphors to understand new ideas. Donald Schon, for instance, provides real world examples of how scientific researchers use metaphorical thinking to solve research dilemmas. In my writing class, students used metaphorical thinking to link everything from writing vocabulary and steps in writing an essay to music and pottery making.

A great example of the power of metaphorical thinking was the musical presentation by Chris and Paul. Chris and Paul, both musicians, were interested in explaining how terms like "phrases" and "form" were similar in writing and music. Chris explained his way of thinking about the project as follows:

> I broke down both topics MUSIC and WRITING and thought of them growing downwards like roots off a tree... In

> music there are so many different kinds of songs. Standards, free form, long, short, loud, soft.... and all by different musicians with different styles all trying to convey different perspectives using the same medium. With writing, I found it to be almost completely identical. Just different mediums. So you see, it was easy to find similarities; it was like comparing two different languages . . .

In their presentation Chris and Paul demonstrated how we could conceptualize those terms in the musical sense to give us new insight into the ways we use those terms when talking about writing. They taught us to count rhythm and read notes, reminding us "just like reading words requires learning a language, reading music also requires a language to learn." After teaching us to read music phrases, they then showed us that, as in writing, you put together groups of phrases in standard forms to make up a genre. They then performed a basic blues song as an example of a standard musical genre. As a final step, we broke down a standard academic essay to show the similarity between a musical form and a written one. That final step was a dynamic way to illustrate to students that "A good piece of writing not only has a rhythm (a musical quality), it moves with a larger rhythm of its parts" (Grow).

Devi, a business major and potter, used the power of metaphor to lead us through a demonstration of process by having us "compose" pottery. Her presentation metaphorically showed us the importance of process in the creation process and how each step in the writing process is akin to that done in pottery making. At the beginning she warned us: "If you miss any steps it will blow up in the kiln." First, we had to think of a purpose for our process — what were we going to create? Then we began wedging — pushing and pulling the clay to get the air-bubbles out and make the clay pliable. Devi likened this to brainstorming in which you "throw ideas around." Next, she likened the process of cutting out shapes in the clay to organizing a draft. Next, scoring and slipping the pieces of clay together, she likened that process to adding transitions to an essay. Finally, ready for the kiln, we made last minute adjustments to our clay vessels, making sure that those cosmetic flaws, like grammatical errors, didn't mar the final product. In the end, Devi's kinesthetic, hands-on approach to process was compelling, especially for students who often resisted the multiple draft process. Devi's kinesthetic teaching technique reminded me of those used by Linda Hecker and Karen Klein. Using kinesthetic exercises so that students "learn-by-doing," Hecker and Klein's kinesthetic activities teach students that essays can be "shaped, moved, rearranged, and moved again" (89). On another level, I thought Devi's kinesthetic metaphor for process would be especially compelling in a com-

puter-assisted writing classroom where the writing process often "flattens-out" when students compose entirely on-line.

In another presentation, Justin and Chris, two chess playing business majors, explained the concept of strategy, planning, and focus through the metaphor of making moves in a chess game. They explained that in chess as persuasive writing, you have to use spatial as well as logical-mathematical intelligences to "play the game in your head," anticipating the possible moves your "opponent" will make and your possible rebuttals to that move. Even with opening moves in a chess game, you have to think ahead. With each move, the possibilities for rebuttal change. Additionally, they explained that the objective of the chess player is not only thinking of the numerous possible moves of each piece, but also holding in view the final objective of the game.[3] Justin and Chris went on to explain that sometimes you have to sacrifice chess pieces in order to accomplish your larger goal. They likened that idea to sacrificing good ideas that are tangential to the main point of a paper. Their metaphor for sacrificing tangential ideas was powerful. As Gerald Grow reminds us, "One of the chief tasks of any writer is to find a way to focus the subject, to condense it around a central theme, approach, or organizing metaphor" (on-line). As a first year writing teacher, I think teaching focus is one of the toughest challenges in teaching writing, and I've used Justin and Chris's metaphor repeatedly to explain why we relinquish certain ideas for overall coherence.

Finally, when Shimauli and Riju, both avid badminton players and computer science majors, presented their connection between badminton and writing, they had an unexpected reaction from the audience. Their presentation used a logical-mathematical approach, diagramming the purpose of each player on the court as a step in their writing process. Pointing to the referee on the side of the court, they explained that the referee was like a writing teacher. Several students immediately disagreed with this analogy, arguing that the coach was the teacher NOT the referee. Students repeatedly returned to that image in our interactions, using it as a code for the way that they wanted me to respond to their writing: "OK now act like a coach. Don't tell me if it's a foul. Show me how to fix it"

Implications

By making links between writing and disciplinary ways of thinking (as well as ways of knowing that traditionally don't make it into academic classrooms but into dance halls, playing fields, concert halls, theatres, and performance art spaces), we ask students to expand their ideas about the boundaries of thinking, learning, and writing. When students become metacognitive about the thinking they engage in throughout their lives, they become owners of that knowledge. Moreover, by inviting students

into a discussion about disciplinary ways of knowing we open numerous opportunities for students to see disciplinary knowledge as malleable. We have to look no further than Talia for evidence. Talia wrote:

This type of thinking can definitely be brought into other areas of learning. Math and science both stress the importance of steps and a process. Economics, like journal writing, requires exploratory thought to reach possible conclusions about changes in the economy.

For students who consider themselves "bad writers," translating the writing composing process into other mediums can enrich their understanding of words. To conceptualize what I'm thinking, simply reverse the following quote from Connolly and Vilardi: "Writing must become the instrument for translating the seemingly foreign and unrelated but indispensable worlds of science and mathematics into comprehensible and relevant matters" (xv). The sentence for some students makes more sense read as follows, "[Science and mathematics] must become the instrument for translating the seemingly foreign [world of writing] into comprehensible and relevant matters" (Connolly and Vilardi xv). By deconstructing old ways of thinking about writing as purely a linguistic process, we can open the possibilities of literacy to more students and open our classroom to exciting new composing techniques

Critics may ask if using Multiple Intelligence theory really produces better writers or simply makes students feel better. I've found that asking students to become metacognitive about ways of knowing and how we can translate one form of knowledge into another asks students to become more engaged in their own learning. They become experts on their writing process and that makes them better thinkers about writing, which in turn makes them better problem solvers about writing dilemmas. In the semesters since I've started asking students to do MI presentations, I've found that students' process notes have improved dramatically, becoming more self-reflective and expansive. Moreover, students seem to find words more easily when they see the ways words connect to other parts of their lives.[4] Adam explained it this way:

> [The MI Projects] helped to show how writing is just like things we do everyday. It made the writing process not look so foreign at times. Being able to look at writing like playing a video game, taking a picture, listening/writing music, or even like mixing a drink, makes the whole thing look easier.

Conclusion

The modern WAC movement was founded on the belief that "writing is a complex process integrally related to thinking" (Russell 7). Yes, writing is a complex process integrally related to thinking, but so are other ways of experiencing the world, and we miss a real opportunity when we

overlook the importance of other ways of knowing in the learning process. Alternative methods of composing offer writing teachers a wealth of teaching tools for students who don't think of themselves as good writers or who "hate" writing because they find words foreign and difficult. In *Presence of Mind*, editors Alice Glarden Brand and Richard Graves write:

> The greatest need for growth in composition studies lies now in the ways we create meaning beyond what is currently considered acceptable knowledge. A comprehensible view of composing conceptually and practically must include these other ways of knowing — call them unconscious, automatic, ineffable, inexplicable. . . People are hungry for transformation (5).

The people most hungry for transformation are students. Students are hungry to make sense of the matrix of knowledge they are expected to negotiate between disciplines, professions, athletics, hobbies, interests, and the world. By offering students an avenue to make connections between multiple ways of knowing in the writing classroom, we help students acquire a personal ownership of writing.

In his 1997 article "Writing to Learn to Do: WAC, WAW, WAW — Wow!" David Russell outlines some of the larger goals of the WAC movement. He includes the following: active learning across the curriculum, scholarly exchange among faculty, helping faculty make connections with students and each other, and curriculum reform (Russell 7). I believe inviting a larger vision of composing and the making of knowledge can hold-true to these goals and take us to exciting new territory in the next century.

Works Cited

Armstrong, Thomas. *Multiple Intelligences in the Classroom*. Alexandria, VA: ASCD, 1994.

Brand, Alice Glarden and Richard Graves. Introduction. ***Presence of Mind: Writing and the Domain Beyond the Cognitive.*** Portsmouth, NH: Boynton/Cook, 1994.

Chiseri-Strater, Elizabeth. *Academic Literacies: The Public and Private Discourse of University Students*. Portsmouth, NH: Boynton./Cook, 1991.

Connolly, Paul and Teresa Vilardi. Foreward. *Writing to Learn Mathematics and Science*. New York: Teachers College Press, 1989.

Elbow, Peter. *Writing With Power: Techniques for Mastering the Writing Process*. New York: Oxford UP, 1981.

Emig, Janet. "Writing as a Mode of Learning." In *Landmark Essays on Writing Across the Curriculum*. Ed. Charles Bazerman and David R. Russell. Davis, CA: Hermagoras Press, 1994.

Gallwey, W. Timothy. *The Inner Game of Tennis*. New York: Bantam Books,

1974.
Gardner, Howard. *Frames of Mind: The Theory of Multiple Intelligences*. New York: Basic Books 1983.
Gaud, Anthony, Creative Director, Turbine, Inc. Personal Interview. 30 September 1999.
Grow, Gerald. "Writing and Multiple Intelligences," A Working Paper. http://168.223.2.3/sjmga/ggrow/7In/7IntelIndex.html. 1997
Hecker, Linda and Karen Klein. "The Write Moves: Cultivating Kinesthetic and Spatial Intelligences in the Writing Process. *Presence of Mind: Writing and the Domain Beyond the Cognitive*. Portsmouth, NH: Boynton/Cook, 1994.
Hoerr, Thomas R. "Introducing the Theory if Multiple Intelligences." *Bulletin*. The National Association of Secondary Schools Principals. 80.583 (1996): 8-10.
Lakoff, George and Mark Johnson. *Metaphors We Live By***.** Chicago: University of Chicago UP, 1980.
Langer, Judith A. "Speaking of Knowing: Conceptions of Understanding in Academic Disciplines." In *Writing, Teaching, and Learning in the Disciplines*. Ed. Anne Herrington and Charles Moran. New York: MLA 1992.
Russell, David R. "Writing to Learn to Do: WAC, WAW, WAW — Wow!." *Language and Learning Across the Disciplines.* 2.2 (1997): 5-8.
Schon, Donald. *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books, 1983.
Smagorinsky, Peter. "Multiple Intelligences in the English Class: An Overview." *English Journal*. 1995.19-26.

Notes

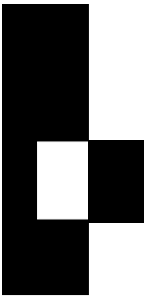
[1] First year writing is a critical place to begin undermining those long-held beliefs about intelligence (especially when the first year attrition rates for some groups soars to 50% or more).

[2] This question can lead to a small mini-research project for students.

[3] As Justin and Chris talked, I thought of Donald Schon's interview with a product manager at a large American firm who explained "Product development is a game you can win, so long as you keep it open — so long as you remember you can redefine your target" (Schon 251). For these two business majors, the strategy needed in chess should be a good metaphor for the type of thinking they'll do in Management classes.

[4] The other unexpected result of using the Multiple Intelligence framework is that it invites students to envision "diversity" in new ways.

I'd like to thank Elizabeth MacDuffie and Kim Marcello for their insights in writing this paper.



Learning the Language of Mathematics

Robert E. Jamison
Clemson University

> Just as everybody must strive to learn language and writing before he can use them freely for expression of his thoughts, here too there is only one way to escape the weight of formulas. It is to acquire such power over the tool that, unhampered by formal technique, one can turn to the true problems.
>
> — Hermann Weyl [4]

This paper is about the use of language as a tool for teaching mathematical concepts. In it, I want to show how making the syntactical and rhetorical structure of mathematical language clear and explicit to students can increase their understanding of fundamental mathematical concepts. I confess that my original motivation was partly self-defense: I wanted to reduce the number of vague, indefinite explanations on homework and tests, thereby making them easier to grade. But I have since found that language can be a major pedagogical tool. Once students understand HOW things are said, they can better understand WHAT is being said, and only then do they have a chance to know WHY it is said. Regrettably, many people see mathematics only as a collection of arcane rules for manipulating bizarre symbols — something far removed from speech and writing. Probably this results from the fact that most elementary mathematics courses — arithmetic in elementary school, algebra and trigonometry in high school, and calculus in college — are procedural courses focusing on techniques for working with numbers, symbols, and equations. Although this formal technique is important, formulae are not ends in themselves but derive their real importance only as vehicles for expression of deeper mathematical thoughts. More advanced courses — such as geometry, discrete mathematics, and abstract algebra — are concerned not just with manipulating symbols and solving equations but with understanding the interrelationships among a whole host of sophisticated concepts. The patterns and relationships among these concepts

constitute the "true problems" of mathematics. Just as procedural mathematics courses tend to focus on "plug and chug" with an emphasis on symbolic manipulation, so conceptual mathematics courses focus on proof and argument with an emphasis on correct, clear, and concise expression of ideas. This is a difficult but crucial leap for students to make in transitioning from rudimentary to advanced mathematical thinking. At this stage, the classical trivium of grammar, logic, and rhetoric becomes an essential ally.

There is, in fact, a nearly universally accepted logical and rhetorical structure to mathematical exposition. For over two millennia serious mathematics has been presented following a format of definition-theorem-proof. Euclid's *Elements* from circa 300 BC codified this mode of presentation which, with minor variations in style, is still used today in journal articles and advanced texts. There is a definite rhetorical structure to each of these three main elements: definitions, theorems, and proofs. For the most part, this structure can be traced back to the Greeks, who in their writing explicitly described these structures. Unfortunately, this structure is often taught today by a kind of osmosis. Fragmented examples are presented in lectures and elementary texts. Over a number of years, talented students may finally unconsciously piece it all together and go on to graduate school. But the majority of students give up in despair and conclude that mathematics is just mystical gibberish

With the initial support of a grant from Clemson's Pearce Center for Technical Communication and the long-term moral support of the Communication Across the Curriculum program, I have been working for several years now on developing teaching strategies and developing teaching materials for making the syntactical and logical structure of mathematical writing clear and explicit to students new to advanced mathematics. The results have been gratifying: if the rules of the game are made explicit, students can and will learn them and use them as tools to understand abstract mathematical concepts. Several years ago, I had the opportunity of sharing these ideas with the Occasional Seminar on Mathematics Education at Cornell, and now through this paper, I hope to share them with a wider audience.

> *One should NOT aim at being possible to understand, but at being IMPOSSIBLE to misunderstand.*
>
> — Quintilian, circa 100 AD

The use of language in mathematics differs from the language of ordinary speech in three important ways. First it is nontemporal — there is no past, present, or future in mathematics. Everything just "is". This presents difficulties in forming convincing examples of, say, logical prin-

ciples using ordinary subjects, but it is not a major difficulty for the student. Also, mathematical language is devoid of emotional content, although informally mathematicians tend to enliven their speech with phrases like "Look at the subspace killed by this operator" or "We want to increase the number of good edges in the coloring." Again, the absence of emotion from formal mathematical discourse or its introduction in informal discourse presents no difficulty for students.

The third feature that distinguishes mathematical from ordinary language, one which causes enormous difficulties for students, is its precision. Ordinary speech is full of ambiguities, innuendoes, hidden agendas, and unspoken cultural assumptions. Paradoxically, the very clarity and lack of ambiguity in mathematics is actually a stumbling block for the neophyte. Being conditioned to resolving ambiguities in ordinary speech, many students are constantly searching for the hidden assumptions in mathematical assertions. But there are none, so inevitably they end up *changing* the stated meaning — and creating a misunderstanding. Conversely, since ordinary speech tolerates so much ambiguity, most students have little practice in forming clear, precise sentences and often lack the patience to do so. Like Benjamin Franklin they seem to feel that mathematicians spend too much time "distinguishing upon trifles to the disruption of all true conversation."

But this is the price that must be paid to enter a new discourse community. Ambiguities can be tolerated only when there is a shared base of experiences and assumptions. There are two options: to leave the students in the dark, or to tell them the rules of the game. The latter involves providing the experiences and explaining the assumptions upon which the mathematical community bases its discourse. It requires painstaking study of details that, once grasped, pass naturally into the routine, just as a foreign language student must give meticulous attention to declensions and conjugations so that he can use them later without consciously thinking of them. The learning tools are the same as those in a language class: writing, speaking, listening, memorizing models, and learning the history and culture. Just as one cannot read literature without understanding the language, similarly in mathematics (where "translation" is not possible) this exacting preparation is needed before one can turn to the true problems. Thus it has become an important part of all my introductory courses, both at the undergraduate and graduate level.

This paper is a report on my efforts to make the rhetorical and syntactical structure of mathematical discourse explicit and apparent to the ordinary student. For concreteness sake, it is based on examples from a College Geometry course for juniors majoring in Secondary Mathematics Education. The same principles and goals apply, however, from freshman discrete mathematics for computer science majors to the linear algebra

course for beginning math graduate students. As such it is about teaching and learning the tool of language in mathematics and not about grappling with the deeper problems such as the discovery of new mathematics or the heuristic exposition of complex mathematical ideas or the emotional experience of doing mathematics. As important as these deeper problems are, they cannot be approached without first having power over the tool of language. Mastering the trivium is necessary before the quadrivium can be approached.

> *Mathematics cannot be learned without being understood — it is not a matter of formulae being committed to memory but of acquiring a capacity for systematic thought.*
> — Peter Hilton [3]

Systematic thought does not mean reducing everything to symbols and equations — even when that is possible. Systematic thought also requires precise verbal expression. Since serious mathematics is usually communicated in the definition-theorem-proof format, the first step in learning the formal communication of mathematics is in learning definitions. For this reason, and because it requires the least technical sophistication, I will illustrate my general methodology with definitions. Although the examples below are kept elementary for the sake of the general reader, the principles they illustrate become even more critical the more advanced the material. This is sometimes a difficult point for students, who may not understand the need for meticulous precision with elementary concepts. But to have the technique needed to deal with complicated definitions, say the definitions of equivalence relations or of continuity, it is necessary to first practice with simple examples like the definition of a square.

Let us begin with a definition of definitions and some examples of good and bad definitions. A definition is a *concise* statement of the *basic* properties of an object or concept which *unambiguously identify* that object or concept. The italicized words give the essential characteristics of a good definition. It should be *concise* and not ramble on with extraneous or unnecessary information. It should involve *basic* properties, ideally those that are simply stated and have immediate intuitive appeal. It should not involve properties that require extensive derivation or are hard to work with. In order to be *complete*, a definition must describe exactly the thing being defined — nothing more, and nothing less.

> GOOD DEFINITION: A rectangle is a *quadrilateral* all four of whose angles are right angles.

POOR DEFINITION: A rectangle is a *parallelogram* in which the diagonals have the same length and all the angles are right angles. It can be inscribed in a circle and its area is given by the product of two adjacent sides.

This is not CONCISE. It contains too much information, all of which is correct but most of which is unnecessary.

POOR DEFINITION: A rectangle is a *parallelogram* whose diagonals have equal lengths.

This statement is true and concise, but the defining property is not BASIC. This would work better as a theorem to be proved than as a definition. In mathematics, assertions of this kind are regarded as *characterizations* rather than as definitions.

BAD DEFINITION: A rectangle is a *quadrilateral* with right angles.

This is AMBIGUOUS. With some right angles? With all right angles? There are lots of quadrilaterals that have some right angles but are not rectangles.

UNACCEPTABLE DEFINITION:
rectangle: has right angles

This is unacceptable because mathematics is written as English is written — in complete, grammatical sentences. Such abbreviations frequently hide major misunderstandings as will be pointed out below.

In Aristotle's theory of definition, every "concept is defined as a subclass of a more general concept. This general concept is called the *genus proximum*. Each special subclass of the *genus proximum* is characterized by special features called the *differentiae specificae*." [1, p. 135] We will refer to these simply as the *genus* and *species*. In each example above, the italicized word is the *genus*. In the case of rectangle, the genus is the class of quadrilaterals and the species is the requirement that all angles be right angles. One of the greatest difficulties students experience with new concepts is that they fail to understand exactly what the genus is to which the concept applies. The unacceptable definition above skirts this issue by avoiding the genus altogether. To illustrate the importance of genus, note that we cannot say:

These two points are parallel.
This triangle is parallel.
The function $f(x) = 3x + 1$ is parallel.
35 is a parallel number.

The term "parallel" has as its genus the class of pairs of lines (or more generally, pairs of curves). Any attempt to apply the word "parallel" to other kinds of objects, like pairs of points, triangles, functions, or numbers, results not in a "wrong" statement but in nonsense. Note that the nonsense is not grammatical, but rhetorical. The four statements above are all perfectly grammatical English sentences, but none of them makes sense because of the inappropriate genus. Students only rarely make nonsensical statements like the four above because the genus is on a sufficiently concrete level that confusion is unlikely. However, when several layers of abstraction are superimposed, as is common in modern mathematics, nonsense statements become more common. Let us look at a specific abstract example.

In geometry parallelism, congruence, and similarity are all examples of the general notion of an equivalence relation. Equivalence relations abstract the basic properties of "sameness" or equality — for example, similar triangles have the same shape and parallel lines have equal slopes. Euclid includes one such property of equivalence relations as the first of his common notions: "Things which are equal to the same thing are also equal to one other." [3] In modern terms, this property is called "transitivity" and is enunciated formally as follows:

> A relation R on a set X is transitive if and only if for all choices of three elements a, b, and c from X, **if** a is related to b and b is related to c, **then** a must also be related to c.

Let us look at this definition from the standpoints of rhetoric, grammar, and logic. Rhetorically, there are three layers of abstraction in this definition: first, the objects or elements (which are abstract rather than definite), then the set X of such objects, and finally the relation R on this set. Students struggling with these layers of abstraction tend to get them confused and may say:

"a, b, and c are not transitive but e, f, and g are."
"The set X is transitive."

Such statements do not make sense because they attempt to apply the term "transitive" at a lower layer of abstraction than its genus requires. Although it may be possible to guess what the student has in mind, it is

important to stress that this is not enough, as the Quintilian quote emphasizes.

The definition of transitivity also illustrates the absence of ambiguity. There is no hidden assumption that a is related to b. There is no hidden assumption that a and c must be different. These assumptions are not left up to the discretion of the student or the whim of the professor. They are simply not there. Yet these assumptions are often tacitly made by students trying to understand transitivity.

Grammatically, students have a tendency to use the active voice "a relates to b" rather than the passive "a is related to b", which is standard mathematical usage. Attention to this single, simple linguistic detail seems to heighten the focus on listening for proper usage and as a consequence proper understanding. Students who are attentive and disciplined enough to pick up this minor detail, which incidentally I repeatedly stress, generally are more secure with the concepts and more likely to apply them correctly. Shallow listening leads to shallow understanding. Here the difference is not a significant one conceptually, but it is a difference which is universal in the culture of mathematical discourse and thus is a shibboleth for distinguishing a "native speaker" from an outsider.

Of course, understanding the definition of transitivity also requires understanding the logical structure of the species. In this case, the species involves two logical connectives: AND (logical conjunction) and IF ... THEN (implication) preceded by a universal quantifier FOR ALL. All of these present major difficulties for many students due to the comparative sloppiness of ordinary speech. For example, "any" is an ambiguous word since it can be used in both the universal and existential senses:

Can anyone work this problem?	(existential quantifier)
Anyone can do it!	(universal quantifier)

For this reason I urge students to avoid the use of "any' when trying to learn the use of quantifiers. Although much more could be said on these issues, for brevity let me turn immediately to the one which is by far most important and most difficult: implication.

Implications are the backbone of mathematical structure. Many definitions (like transitivity) involve implications and almost all theorems are implications with a hypothesis and a conclusion. Like the Eskimo "snow," the phenomenon is so pervasive in mathematical culture that we have evolved many different ways of expressing it. Here are eight different but equivalent ways of stating that squares are rectangles, with names for some of the variations given on the side:

1) If a figure is a square, then it is a rectangle.	Hypothetical
2) A figure is a square only if it is a rectangle.	
3) A figure is a rectangle whenever it is a square.	
4) All squares are rectangles.	Categorical
5) For a figure to be a square, it must necessarily be a rectangle.	Necessity
6) A sufficient condition for a figure to be a rectangle is that it be a square.	Sufficiency
7) A figure cannot be a square and fail to be a rectangle.	Conjunctive
8) A figure is either a rectangle or it is not a square.	Disjunctive

There are three major issues involved in understanding implications. Two of these are purely logical:

1) realizing that an implication is not the same as a conjunction:

"If quadrilateral ABCD is a square, then it is a rectangle."
is not the same as
"Quadrilateral ABCD is a square and a rectangle."

2) realizing that an implication is not the same as its converse:

"If quadrilateral ABCD is a square, then it is a rectangle."
is not the same as
"If quadrilateral ABCD is a rectangle, then it is a square."

The third issue is a more subtle rhetorical issue involving a grasp of the relationship between premise and conclusion. The relationship is not one of causality, and the premise and conclusion can be implicit in a turn of phrase that is not an explicit if-then statement. An excellent exercise is to give students a dozen or so implications, expressed in different ways, and ask them to find the premise and conclusion in each. Then ask them to reformulate each implication in several different ways, just as I did above for "Squares are rectangles." It is not necessary, and in fact in some ways undesirable, for the students to understand the meaning of the statements. The point here is that these are syntactical exercises, and it is enough to have a feel for the language and an understanding of syntax to be successful. It does not depend on the actual meaning. At this point as

in the learning of definitions, I stress that the results must read and sound like good English sentences.

How is all of this implemented in the classroom? As I said above, I proceed similarly to teaching a foreign language. Early in the semester, I present the students with a list of roughly twenty common geometrical terms, such as, circle, square, trapezoid and midpoint, and for homework ask them to write out definitions. I provide them with the following "Guidelines for Definitions in Good Form":

1. A definition MUST be written as a complete, grammatically correct English sentence.
2. A definition MUST be an "if and only if" statement.
3. A definition MUST have a clearly stated ***genus*** and a clearly stated ***species***.
4. The quantifiers in a good definition MUST be explicitly and clearly stated.
5. The term being defined MUST be underlined.

The next few class periods are spent with students putting their definitions on the board. The class and I critique them according to the principles outlined above. This invariably brings to the fore many issues, ranging from a reluctance to write in complete sentences and a decided preference for symbols over words to the syntactical issues described above. Many misconceptions can be brought to light and usually corrected. I also call on students to state definitions verbally. By engaging both speaking and writing, I hope to more deeply and actively penetrate the students' thinking.

We also explore the meaning of the definitions, the range of choices available, and some of the history involved. For example, Aristotle (384 - 322 BC) insisted that the subclasses (species) of each genus be disjoint: they could not overlap and one subclass could not include another. Thus for Aristotle, a square was NOT a rectangle. [1, p. 136] From the modern point of view this is inconvenient. Virtually everything one wants to prove about non-square rectangles also holds for squares, so it is a nuisance to have to state and prove two separate theorems. The modern standard is that squares are special cases of rectangles, so theorems about rectangles also apply to squares.

Finally, students are assigned to groups, first to provide feedback on the members' definitions and later to compile as a group a list of "standard" definitions in good form for all the given terms.

I do not require students to memorize common geometric definitions, but when we reach the abstraction of transitivity and equivalence relations, I provide models which must be memorized. There are two main

reasons for this. First, it is not possible to have a good class discussion involving these concepts if students must constantly flip through their notes to look up the definitions. Second, the definitions I provide are models of good mathematical expression, something which is often lacking in elementary texts. Students can use these models to help build their own definitions (and later, theorems and proofs), but most importantly, repeating them out loud and memorizing them helps develop an ear for how correct mathematical discourse should sound.

ΑΓΕΩΜΕΤΡΗΤΟΣ ΜΗ ΕΙΣΙΤΩ

"Let no one ignorant of geometry enter here"
— Plato, now the Motto of the American Mathematical Society

In conclusion, I want to confess what my real goals are in teaching this material. In a society in which information is passed in 60 second sound bites and reasoning limited to monosyllabic simple sentences, careful, analytic thinking is in danger of extinction. And this is a grave danger in a democratic society beset by a host of very complex moral and social problems. When geometry passed from the pragmatic, monarchical Egyptian surveyors to the democratic Greek philosophers nearly three millennia ago, its purpose changed. True, geometry (and more generally mathematics) has been many practical applications. But that is not why geometry has retained a universal place in the curriculum. It has been taught to teach reasoning and intellectual discipline. This why Plato placed his famous motto over the academy door. That is why Abraham Lincoln studied Euclid. And that remains my main goal in teaching.

Notes

1. Lucas Bunt, P. S. Jones, and J. D. Bedient, *The Historical Roots of Elementary Mathematics*, Dover, New York, 1988.

2. Euclid, *The Thirteen Books of The Elements* (Sir Thomas L. Heath, trans.), Volume I, Dover, New York, 1956, p. 222..

3. Peter Hilton, "A Job on Our Hands" in *FOCUS*, Newsletter of the MAA, March, 1986.

4. Herman Weyl, *Space-Time-Matter*, New York, Dover, 1922.

Using a 'Conference Model' to Teach Communication Skills in a Communication Across the Curriculum Program

Joanna Tapper and Paul Gruba
University of Melbourne, Australia

Introduction

In Australian universities it is unusual to find obligatory writing courses. Elective courses in academic or technical writing are also unusual. Writing problems, of course, do exist, but students having difficulties with academic writing requirements are referred to learning skills units for one-on-one tutorials. Second language speakers of English are accommodated in these units, or in a separate ESL support unit.

Generally, the focus in Australia on communication skills is broader than that in North American universities. Courses in both spoken and written communication skills development share a crowded syllabus with enhancing electronic, small group, leadership and related skills. For the Australian academic then, there are two broad concerns about students' communication skills: one is the communication skills which they need to succeed as students; and the other is the skills they will need as graduates in the workplace. However, Baldauf (1996) has noted that despite these concerns, no Australian university has yet established a comprehensive institution-wide policy covering language, literacy and communication skills.

Put into perspective, the lack of institutional approaches to writing or communication skills development in Australian universities is not surprising, given the fact that there are few general education programs. Most students begin their specialized studies at first year, entering directly into faculties such as engineering, architecture, agriculture, and medicine, as well as into the generalist faculties of arts and science. Any requirements for writing or communication skills are faculty matters, and there is often great diversity in the requirements. In some faculties communication skills courses are obligatory, while in others the courses are electives, or not offered at all.

Whether or not stand-alone communication or writing skills courses are offered, individual academics can address these skills in their content

courses. However, WAC and WI designations for particular courses are not practiced in Australia. Indeed, most university staff development programs take a fairly generic approach to teaching and learning topics. WAC programs are all but unknown, and staff development in teaching writing or communication skills within the disciplines is rare.

Against this background, our small Communication Across the Curriculum Project (the CAC Project) at a large Australian research university faces a number of challenges. In our drive to foster communication skills across the curriculum, we have found that a major course project which involves students in the organization and execution of a public conference is an effective way to achieve the Project's aims. In this paper we give both theoretical and practical explanations for why we have developed this 'Conference Model'. We then present the Model's main features, and describe two major applications. The paper concludes with a brief evaluation of the Model's application so far, which may be useful to other practitioners who are working in the area of language and learning across the disciplines.

Theoretical Support for the Model

With some adaptations, WAC theory and pedagogical approaches have provided a sound basis for our CAC Project at the University of Melbourne. Clearly, WAC's cross-curricular approach to the development of students' communication skills accords with our beliefs that communication skills are best taught within the disciplines. WAC practice has informed our faculty staff development seminars, which promote the integration of communication skills into content courses.

However, staff development has been a slow process. Apart from the difficulties in starting the new cross-curricular venture, there are other forces which make it difficult for the CAC Project to attract widespread support. These include the lack of a University language, literacy and communication skills policy; a strong push by the central administration for academics to increase their use of information technology and multimedia in their classroom teaching (which distracts the attention of those who might otherwise be interested in helping students with their communication skills) ; and a strong tendency for academics to refer students to learning support units rather than addressing students' academic learning skills themselves.

For us, entry into the disciplines has come through acting as team teachers on content-specific courses. One of the first challenges that we face when working with colleagues is to set out our own beliefs about effective communication. At times, it is difficult to explain that modern theories of communication supercede the widely-regarded transmission models of communication, and that to us the social aspects of situated

and project-based learning are vital. We often have recourse to Driscoll's (1994) clear articulation of five key principles of social constructivism to help explain our reasons for thinking that student conferences work well in enhancing communication skills development.

In the following paragraphs, key features of the Conference Model, and our experiences in using the Model are presented to show how Driscoll's five principles guide our practice.

1. Integrate authentic activity within a complex learning environment

Although some academics have argued with us that "a student conference isn't really authentic", we counter with the argument that authenticity occurs whenever there is a situation in which the price of failure is high and has widespread implications. Seen this way, organizing a public conference at a major urban university is clearly real. The students certainly see such a project as 'real' as they struggle with the complexity of the task set before them. As the conference nears fruition, they come to feel a sense of ownership and accomplishment that often goes beyond what they have experienced in other academic pursuits.

2. Emphasize social negotiation as integral to learning

Placing the group project at the core of the class focuses student attention on group dynamics and interpersonal communication. Students quickly realize that the conference project is too large for only a few students to organize and come to understand that they must work collaboratively towards the goal. Because of inherent conflicts in coming to terms with what a conference is, social negotiation in and out of class takes place. Our role as instructors is then increasingly one of facilitating informed reflections on social and organizational processes that are taking place within the larger context.

3. Juxtapose instructional content and include multiple modes of representation

Students studying a content subject which also contains a communication stream inevitably are confronted by a juxtaposition of ideas in their classes, and in the sources from which they gather materials. The nature of the conference project ensures that they work with multiple modes of representation (spoken, written, individual, group, graphic and electronic).

4. Keep instruction relevant to student needs

Throughout the organization of such an event, a number of contingencies arise. For the smaller crises, we respond to students with individual or group email messages. The larger problems force us as a whole class to resolve an issue at hand, or to address a topic that is necessary if we are to be able to go forward. With experience, teachers are able to predict when students will be likely to require a lecture. In this way, we

give a lecture or demonstration (for example, on 'how to give an effective oral presentation') at the time when students also see the need.

5. Reflect on practice

When we first used a conference in our classes, we made the mistake of giving students all the time we could. Because of that, students would hold their conferences on the last day of the semester. That way of thinking led to a hollow victory, as we often had no way of finding out who had learned what. When we revisited our theoretical foundations, we saw that we had not allowed sufficient time for us, or the students to think about what had gone wrong, what had gone right, and how we could improve the way we communicated. That is, we did not reflect on the communication practices that had influenced the successes or failures of the conference. We now advise that a class should hold the conference no later than week ten of our twelve-week semester. During the last two weeks, we debrief students with a series of self and peer assessment activities.

The Practical Rationale for the Conference Model

There is also a very practical reason why the Conference Model has been so successful for the implementation of the CAC Project. Quite simply, conferences attract the attention of our fellow academics. In addition, they can readily see that the activity challenges the students to improve their communication skills. As previously explained, the University has no communication skills policy or general education requirements, and so there is no pressing reason why fellow academics should integrate the teaching of communication skills into their content teaching. We have to attract 'clients' and find out what communication needs they identify among their students. Oral communication is a high priority; followed by small group, collaborative work; and the alliance of critical thinking with academic writing. The Conference Model addresses these needs.

Essential Elements of the Model

No matter whether students are going to run a conference in a content course or in a stand-alone communication skills course, the instructor needs to work out the relationship between the course objectives, mode of delivery, and order of topics very carefully. A course based on the Conference Model is complicated for students and teachers to grasp. Above all, assessment tasks in their various modes (written, oral, small group work and so on), and the sub-tasks and stages need to be worked out well in advance of teaching the course. Appendix A shows the assignments which were required in a Communication Skills course taught to third year Computer Science students.

Some of the key elements of a Conference Model course are listed below:

A Fast Start

Explain the Conference concept and how it will be achieved in the first week of class, to allow students time to grasp the implications. Here is an account of how students received the news in a Computer Science class:

In the first ten minutes of our communication skills subject, we announced to students that they were to hold a public conference eleven weeks later, and that they had to organise the event themselves. Our role, we told them, was to help facilitate their efforts.

The first reaction from the students was silence, and then the questions began. Who was to fund the conference? How could we fit 65 student papers into one day? What *was* a conference (Gruba & Sondergaard, 1998).

The Organizing Committees

When a full Conference Model is implemented, each student joins one of the Organizing Committees. Students can be randomly assigned, or join a committee in whose activities they are particularly interested. One way to form the Steering Committee is for each of the other committees to second one member to the Steering Committee. Joining a committee can be linked with specific communication tasks, like writing an application letter and forwarding a CV to support the application. An expansion of this task is to post the CVs of committee members on the Committees' Webpages.

The names and duties of the organizing committees can be varied, but we have found that the seven-committee structure we have devised (see Appendix B) covers the major tasks. With smaller classes, we have had as few as four committees. Larger classes have needed an IT Committee to help with Web publishing.

The Committees hold their first meetings in week one of the semester, and for the remainder of the semester they need to meet regularly, both in and out of class time. Committee meetings are at first tentative and hesitant as students feel their way with each other and with their teachers. Students can organize meetings as they wish, although teachers may want to suggest that they appoint a chair, at least on a rotating basis, if not a permanent officer, and a minute-keeper. Committees are required to post the minutes on the Website, or keep them in hard-copy folders, which the teacher examines at times.

Some Committees go beyond their briefs, while others keep to it narrowly, but over time, students come to realize that they have ownership of the conference and their tasks. Some responsible students do much more work than they should because of poor delegation skills. Tension builds up between intrinsically-motivated students who may become ob-

sessive about the project, and instrumentally-motivated students who do the minimum of work. There are widely disparate views (associated with individual time management skills) on what constitutes a reasonable workload.

Timely instruction and readings on small group and leadership processes are important if students are to reflect productively on their collaborative processes. Chapters on communicating in groups, and on group development can be found in most communication skills textbooks (for example, Johnson & Johnson, 1997; and Mohan, McGregor, Saunders & Archee, 1997).

A Process Approach

The committee, oral, written work and electronic assignments involve cumulative tasks which must be carried out according to agreed time-lines in order for the project to be achieved.

Peer work

Students give feedback to each other on proposals for papers, on oral presentations and on written papers, either face-to-face, or by assessment sheets, email and Web conferencing. In spite of the stresses of small group collaboration, an important outcome of a Conference project is that peers come to be valued as resources, not only as critics or competitors.

Wider Community Involvement

Students learn a great deal about communication and about course content from the contacts they make with the wider community outside their field of studies. In order to stage the conference, they interact with invited speakers from outside the university context, sponsors, academics from other fields, and non-university members of the conference audience.

Reflection

As recommended by Driscoll (1994), periodic reflection is an important part of any learning process, and communication skills teaching frequently involves reiterative reflection on both processes and products. Various reflection tasks can be carried out by individuals and groups. Students can be asked to keep reflective logs, debriefing sessions are held after the conference, and a final reflective essay is often part of the assessment for the course.

The Role of the Teacher

It can be difficult for both teacher and students to become accustomed to the role of the teacher when a Conference Model is being applied. When students are working in committee, the teacher may not be physically present, but even during class time, the teacher is no longer the holder of all knowledge, with answers to all problems. Students have to deal with their conference and interpersonal interactions themselves.

Sometimes the teacher is operating in a fairly traditional way in lectures during the course, but switching to the facilitator role as far as the conference project is concerned. The teacher can help students by giving input and advice on some aspects of conference organization, and on small group processes, conflict resolution and so on. At the same time, teachers need to hold back, and allow students to get frustrated. Deciding when intervention is needed can be difficult. In addition, teachers may have to face a heavy load of detail and management of a Conference Model course.

The Social Aspects

Social aspects of running a conference should be recognized and integrated into the course, not dismissed or ignored. A social event, such as a lunch-time barbecue, part way through the semester, can help students from different committees to appreciate each other.

Variations in Applying the Conference Model

A basic issue is whether to apply a full-scale Conference Model, or a scaled-down model. During our work on the CAC Project we have worked as members of teaching teams on several courses which applied both full- and scaled-down models. We have also watched colleagues who applied full-scale models as sole instructors on their courses.

An example of a course using a full-scale Conference Model is *Science and Communication,* which is an obligatory first year course for students in the Institute of Land and Food Resources. There are usually 65 – 80 students, and the course is team-taught. Lectures and tutorials cover issues in the history and philosophy of science, communication skills, academic study skills, and several professional skills such as marketing and leadership. There is a heavy emphasis on electronic skills in the course, and most of the course management is done through the Web (see *Science and Communication*, 1999).

Some much smaller classes using a full Model, and taught by only a single teacher, have been offered by the Faculty of Arts in elective communication skills courses, available for students from all faculties across the disciplines.

As an example of a scaled-down application of the Model, there is the course on *Professional Issues in Computing* (1999) offered by the School of Electrical Engineering & Computer Science. About 150 students took this course, of whom most were in third year computer science, with others from a range of disciplines. The content on computing issues was presented by expert guest lecturers, and the communication skills module was presented by the two CAC Project lecturers. Since many of the students had not written argumentative essays during their degree program, the course co-ordinator was very keen to stress critical argumentation in

humanities-type essays. Another requirement was that students should learn and use LaTeX – a software particularly useful for collaborative writing. It was decided that the class was too large for individual oral presentations at the conference, and also that there would not be time for full committee work, given the other course requirements. Therefore, a scaled-down Model was adopted, with a single volunteer committee of about 16 students organizing the entire conference (with assistance from one of the communication lecturers). The conference oral and written papers were prepared and presented by pairs of students.

In deciding how to apply the Conference Model, several considerations need to be borne in mind. Firstly, it can be adapted easily to different disciplines, and differing balances of communication skills can be accommodated. For example, lecturers and students in some courses may want more or less focus on oral work, or on research writing, or on collaborative work, or on the resources of the Internet and the World Wide Web.

Secondly, the Model can be adopted at differing year levels. When used in a first year course, it is a powerful way of helping students to transfer from high school to university. This is particularly relevant in Australia, where the upper grades of high schooling can be strongly teacher-focussed, with limitations on collaborative or independent student learning, associated with the need to gain good grades in internal and external competitive assignments and exams. A Conference Model taught in a first year subject also builds a sense of collegiality and community, which help students to settle into the anonymity of tertiary education. In contrast, if taught at a senior level, a Conference Model can be associated with a professional practice course, and stress workplace communication skills.

As we have seen with the computer science course, the amount of time which students can be expected to give to conference organization, in conjunction with the nature of the course content and other requirements can determine whether to apply a full-scale model or not.

Evaluation of the Conference Model

Observations by both content and communication skills instructors, student comments on course evaluation sheets, and reflections in logs, essays and committee reports reveal a number of benefits which students derive from participating in a conference. These include:

- A sense of camaraderie and group identity, which reduces the sense of alienation which first year and international students, in particular, may suffer from in a large, impersonal research university.
- A sense of achievement both as individuals and members of small and large groups.

- The development of new skills and resulting material for students' CVs. This is extremely useful for students who are applying for positions which require proof of good communication skills.
- Peer recognition of each other's talents.
- The acquisition of useful knowledge of how things work in the university itself, and in the wider community.
- An appreciation of this kind of learning.

The following two excerpts from students' emails illustrate some typical reactions to their experiences.

> First year student
>
> When I first heard that we had to put on a conference and that we had to come to uni on a Saturday to attend the conference I thought that it was a stupid idea and a waste of time. I also didn't like the idea of the committees and having to go to meetings each week for them. But now that it is all over, I look back on it and would say that it has been the most enjoyable uni activity (although the pub crawls and Booze Cruize come close), for the whole year. The conference was interesting and it gave me a good experience in presentations. I liked listening to all the other talks and found most of them to be very informative. Looking back on the committee work, it gave me a good chance to organise a major event and it gave me the opportunity to get to know a number of other students in the course who I had never talked to before.
>
> Third year student
>
> After ensuring the sponsors were happy and content and that I had done appropriate introductions, I ensured I knew how to use the technology in the Latham Theatre and organised the bustling students trying to load their presentations onto the computer.
>
> I compared the rest of the day in the Latham Theatre, which I found to be an interesting experience with such a small audience. After listening to presentation after presentation on cryptography, I became so bored in the afternoon sessions that I completed a report for every single presentation held in the afternoon session. I thought this may help out Joanna and she seemed to appreciate it.

Although we have heard anecdotal accounts of student conferences being incorporated into content courses in Australia and the USA,

there does not seem to be much literature on this topic. Borstler and Johansson (1998) report on a one-semester course with a final public conference, but with a much smaller class, less student involvement in the organization, and without the reflective assessment components. Papers written by academics at our own institution include Gruba and Lynch (1997), Gruba and Sondergaard, 1998, and Rimmington, Lynch and Gruba (1997), all of which discuss the Conference Model in terms of constructivist pedagogy.

So far we have not been able to carry out qualitative or quantitative research projects to evaluate the application of the Model. In particular, we are eager to investigate the nature of student interactions in their collaborative group work.

A further refinement during this third year of using the Model is to pay more attention to the quality of student writing (especially in terms of critical thinking, argumentation and writing style), which until now has been somewhat neglected. As noted earlier in this paper, using a Conference Model is very complex, and our earlier efforts focused on developing students' oral presentation skills, their group work, and peer review. Now we are ready to pay more attention to other aspects of written language and the interplay of writing and learning content.

Works Cited

Baldauf, R.B. (1997). Tertiary language, literacy and communication policies: Needs and practice. In Z. Golebiowski (Ed) Policy and practice of tertiary literacy. Selected proceedings of the First National Conference on Tertiary Literacy: Research and practice. Volume 1 (pp. 1 – 19). Melbourne: Victoria University of Technology.

Borstler, J. & Johansson, O. (1998). The student conference – a tool for the teching of research, writing, and presentation skills. *SIGCSE Bulletin,* 30 (3): 28 – 31.

Driscoll, M.P. (1994). *Psychology of learning for instruction.* Boston: Allyn and Bacon.

Gruba, P. & Lynch, B. (1997). Constructivist approaches to communication skills instruction. In R. Kevill, R. Oliver & R. Phillips (Eds). *What works and why.* Proceedings of the 14th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education (pp. 245 – 249). Perth, WA: Curtin University of Technology.

Gruba, P. & Sondergaard, H. (1998). Transforming communication skills instruction: The conference approach. Unpublished manuscript.

Johnson, D.W. & Johnson, F.P. (1997). *Joining together: Group theory and group skills.* Boston: Allyn & Bacon.

Mohan, T., McGregor, H., Saunders, S. & Archee, R. (1997, 4th ed). *Com-*

municating! Theory and practice. Sydney: Harcourt Brace.
Professional Issues in Computing (1999). Online: http://www.unimelb.edu.au/HB/subjects/433-3343.html. Online: http://www.cs.mu.oz.au/343/
Rimmington, G., Lynch, B. & Gruba, P. (1997). Constructivist approaches to communication skills instruction in a technology-rich environment. In J. Mason, M. Nott, J. Fung, G. Hart & P. McTigue (Eds). *Doing IT at Melbourne!* Melbourne: University of Melbourne.
Science and Communication (1999). Online: http://webraft.its.unimelb.edu.au/212105/pub/

Appendix A
Assessment Tasks and Activities for a Computer Science Communication Skills Course

Committee statement (15%): group-produced document of each committee's mission statement, individual member profiles and responsibilities, work-plan setting out project milestones. Assessed for completeness, evidence of group coherence (consistent tone of member profiles, etc), structure, style, grammar.

Conference written paper (40%): individual or collaborative (up to 3 authors per paper). Word limit 2000— 3000 words. Recognition of audience awareness is important (reader in the field or outside, or a mixed readership). Topic chosen by student from a list of possible topics offered by lecturer. Must be on a non-trivial issue, relevant to subject content and theme of the conference.

Conference oral presentation (15%): all students present individually. Team of academics as evaluators, using guidelines and an assessment sheet. Two major categories are content and delivery. Students all had copies of assessment sheet before making presentations, and were encouraged to submit sheets on each others' presentations to evaluators.

Self-evaluation (20%): a formal one or two-page latter addressed to the Head of the Department. Describes the student's individual contribution to the class project.

In-class essay (10%): an in-class reflective essay on the role of communication skills in practice. Students write an essay chosen from 3 or 4 possible topics.

Two popular topics are:

- This subject used a "conference approach" as a way to teach communication skills. Choose one aspect of the conference project (organizing, publicity, theory, etc.), assess that aspect critically and suggest ways to improve the conference approach.
- To give a truly effective oral presentation, would it be better to deeply know your subject matter or deeply know your audience?

Faculty Collaboration on Writing-Across-the-Curriculum Assignments: Linking Teaching and Scholarship

Washburn University WAC Discussion Group
Contributors: Margaret E. Stewart, Pat Mower, Diane McMillen, Mary McCoy, Patti McCormick, Pam MacDonald, Donna LaLonde, Sarah Cook, and Gary Baker
Washburn University

Anne Herrington argues that writing-across-the-curriculum(WAC) programs should be guided by the model of "faculty coming together to discuss teaching practices, reflectively and generously..." (89). In addition, Toby Fulwiler cites "mutually beneficial publication projects" as one of the possible outcomes of WAC faculty workshops (185). In our WAC discussion group at Washburn University, we do meet regularly to talk about teaching, as Herrington recommends, and we do collaborate on conference presentations and publications, as Fulwiler describes. In the process, we have discovered the importance of a third activity, one that connects the other two. In our experience, collaborating on experimental assignments can be an important link between teacherly reflection and scholarly publication.

Washburn University is a municipally owned, open-admissions university in Topeka, Kansas. It has schools of law, business, nursing, and applied studies, as well as a college of arts and sciences. Historically, the "WAC program" has been nothing more than one member of the English Department who was available to talk with faculty from other departments about writing in their classes. Such consultation was initially an overload, but in1995, the administration increased its support for WAC by giving the WAC consultant a half-course of released time. In 1994, our WAC consultant organized a discussion group that met several times a semester and that drew faculty from eleven departments in Arts and Sciences and from business, applied studies, and law. The first year of our meetings we simply compared notes about writing in our classes. But the second year we moved from talking together to working together. We began to experiment with collaborative assignments.

Our first experiment was a writing-exchange assignment, inspired by Art Young's "The Wonder of Writing Across the Curriculum." In that article, Young describes a student writing exchange that had worked well in his literature class. Our group decided to try such an exchange across disciplines, with math and physical education students writing to each other, ESL and education students exchanging essays, and so on. A typical cross-class assignment was that used in an exchange between classes in exercise physiology and personal finance: "Write an essay in which you (1) explain one thing you have learned in this class, (2) tell why it was important to have learned it, and (3)explain why someone outside your class should know it." Students exchanged these essays and replied to them, and then the original writers had an opportunity to clarify further (Konzem & Baker). In addition to these inter-class exchanges, several members of our group arranged for student exchanges within individual classes, as Young had done. One such assignment asked students in a Viet Nam War in Literature and Film class to "describe any aspect of our subject that perplexes or puzzles you. Place this description in the context of the literature and film we have seen so far and the topics we have touched on in class discussion." The students were then to reply to each other's queries, placing their responses likewise within the context of class materials (Stewart, "Student"). Finally, we surveyed our students as to their perceptions of the value of the writing-exchanges.

Our second collaborative assignment was a creative writing assignment, asking students to "use creative writing to show your understanding of _____." Each member of our group filled in the blank in a course-appropriate way. Our students responded to the assignment by composing dramatic monologues, free verse, sonnets, limericks, plays, fiction, video-mysteries, satires, new words to Poe's "The Raven," and new lyrics to "Danny Boy." We were so impressed with our students' creativity that we organized a campus-wide coffee house reading where all the students who participated in this WAC assignment could share their work with the whole community. We have now institutionalized this coffee-house reading as an annual event, a place where students can, as one writers' group puts it, "write out loud" (Seattle). As with the writing-exchange assignment, we surveyed our students extensively about their responses to the creative-writing assignment, and our students' reactions inspired us to reflect back on our teaching.

Indeed, we found that every aspect of our collaboration on these two assignments deepened the discussions of our teaching. Our shared experience permitted us to formulate our speculations in concrete terms. Why, for example, did students seem to write better for each other in an ungraded context than they did for us in a graded one? Why did students both appreciate the freedom of the creative writing assignment and ask for

more guidelines? Why did both assignments work better in some contexts than in others? What could account for the enthusiasm of students' reactions? And what were we to make of the few student dissenters?

As we pondered these questions, we began to come up with ideas we wanted to share. We started to collaborate on articles and conference presentations (Konzem and Baker; Kent, Stewart, and Baker; Stewart, LaLonde, and Baker; Washburn University Writing-Across-the-Curriculum Discussion Group, "Creative," "Learning," "Revitalizing") and to offer workshops of our own (Washburn University Writing-Across-the-Curriculum Discussion Group, In-service, Faculty). We jumped into the growing "scholarship of teaching" at different venues around the country, and as we did so, we brought new ideas back to our classrooms. Then we were eager to see each other at our next WAC discussion meeting, to talk about those classrooms once again.

Thus, our collaborative experimental assignments helped us link teaching and scholarship in a way that connected the energy from the one with the energy from the other. Those elements form a circle that mirrors our faculty WAC group, sitting around a meeting room on a Friday afternoon, talking about teaching.

Works Cited

Fulwiler, Toby. "The Quiet and Insistent Revolution: Writing Across the Curriculum." *The Politics of Writing Instruction: Postsecondary*. Ed. Richard Bullock and John Trimbur. Portsmouth, NH: Boynton/Cook, 1991. 179-187.

Herrington, Anne J. "Back to the Future: Instructional Practices and Discourse Values." *Language and Learning Across the Disciplines*. 2 (September 1997): 88-96.

Kent, Marilyn, Margaret E. Stewart, and Gary Baker. "Writing Across the Curriculum: A Trilogy." *Business and Economics for the Twenty-first Century*. Vol. 1. Athens: Business and Economics Society International, 1997.

Konzem, Patti and Gary Baker. "Essay Exchanges to Improve Student Writing." *Kansas English* 81 (Spring 1996): 64-69.

Seattle Writers' Community. http://www.seattle.sidewalk.com (July 1999).

Stewart, Margaret E., Donna LaLonde, and Gary Baker. "Innovative Teaching Practices and Intellectual Community at an Urban Commuter University." Rocky Mountain Modern Language Association. Denver. October 1997.

Stewart, Margaret E. "Student Writing Exchanges: Social Energy and Individual Learning." *Teaching Professor* 11 (October1997): 6.

Washburn University Writing Across the Curriculum Discussion Group. "Creative Writing, Learning in the Disciplines, and Campus Community." Rocky Mountain Modern Language Association. Salt Lake City. 1998.

. Faculty Development Workshop. Washburn University. Topeka, Kansas. 5 March 1999.

. In-service Workshop. Hayden High School. Topeka, Kansas. 22 August 1996.

. "Learning Together: Innovative Teaching Practices, WAC, and the Growth of Intellectual Community." Learning Communities Conference, University of South Florida. Tampa. March 1999.

. "Revitalizing WAC: Innovative Teaching Practices, Collaborative Assignments, and the Growth of a WAC Program." Writing Across the Curriculum Fourth National Conference. Cornell University. Ithaca, New York. June 1999.

Young, Art. "The Wonder of Writing Across the Curriculum." *Language and Learning Across the Disciplines*. 1 (January1994): 58-71.

Anchoring WAC by Focusing on Rhetorical Analysis in First-Year Composition

Yvonne Merrill
University of Arizona

At the University of Arizona, we are orienting undergraduate writing toward academic inquiry and the social construction of knowledge through the written conversations among researchers and scholars. To provide coherence in the sequence of undergraduate writing experiences, we are revising four structural components: 1) a first-semester composition course that focuses on teaching rhetorical analysis using an anthology of readings by our faculty across the disciplines, 2) an increased writing component in each general education course, showcased in a student academic conference from across the first tier curriculum, 3) a mid-career writing assessment that requires students to demonstrate interdisciplinary thinking skills on the content and theoretical principles taught in the general education core curriculum, and 4) a revision of writing emphasis courses in the majors, focusing on discourse analysis of writing in disciplines building on students' first-year experience in rhetorical analysis. Through these structures, writing across the curriculum becomes firmly situated in both the first-year composition course and the disciplinary curriculum.

In the revised first-year composition course, we teach rhetorical analysis as the "portable" skill students can take with them from their composition course into their other writing situations at the university. This approach has two advantages: it provides students with 1) a theoretical approach to performing the diverse writing tasks they will encounter at the university and 2) experience in performing thinking skills highly valued by faculty across the curriculum: analysis, interpretation, synthesis, application, and invention, which we teach overtly in our revised course. The first caveat in promoting this focus to both writing and disciplinary faculty is to emphasize that writing is demonstrated *thinking*, thinking in progress made visible and subject to feedback and revision, as opposed to demonstrated linguistic knowledge and skills applied to thinking already accomplished. We thus promote writing to think and learn as the WAC focus in the lower division and composition as the theoretical site where students learn how to do it.

The University Composition Board has run a series of short and long-term faculty development workshops to articulate the thinking that faculty want their students to do and writing tasks that elicit and demonstrate it. What they originally believed was thinking peculiar to their separate fields, they came to see as *common* thinking that was demonstrated in conventional discipline-specific ways. They also discovered they had usually failed to specify, in clearly worded assignments for their students, either the particular thinking demanded by the task or the disciplinary rhetorical conventions for the text they expected. In the first-year composition course, therefore, we teach the terminology for the thinking skills and raise students' awareness to them for texts they will write for disciplinary faculty, using models of faculty writing.

As we work with the general education faculty, we help them with the terminology of rhetorical analysis so that they can talk to their students about writing assignments in ways that reinforce what students are learning in composition. We show them how to frame their assignments rhetorically by specifying the thinking they want to see demonstrated; why this kind of thinking is valued in their assignment, course and discipline; and what the expectations of the readers may or may not be in terms of the assignment's purpose, situation, and stance.

Analysis thus becomes the fundamental thinking skill taught in the composition curriculum. But it also encompasses all the critical and creative thinking skills valued by the students' other academic contexts. In composition, we frame thinking in writing as the way scholars conduct inquiry and construct new knowledge in their fields. We then supply students with the categories for the analysis of texts and contexts in order to help them see how scholars and researchers report and refine their problem solving process through conversations with audiences they expect to respond.

Composition students pursue a research question in the disciplinary area of their interest; engage the articles from their anthology written by faculty in this area; converse with the authors themselves if possible about their thinking, writing processes and strategies; and write their own position papers presenting their conclusions about the issue or intellectual problem they have researched. We encourage students to attend to disciplinary textual conventions by examining their faculty models for such things as typical research problems, methodology, unwritten assumptions, and textual formats, tone, style, and language.

The student conference at the end of the first year introduces students to the role of writing in all academic inquiry via an authentic context that emulates the way scholars construct disciplinary knowledge. Individual student presentations or panels of related presentations from across the Tier One general education curriculum occur throughout an entire day

of concurrent sessions. All Tier One faculty and students are invited to participate and attend the conference, which is co-sponsored by the Office of Undergraduate Education and the English Department.

We are refocusing our mid-career writing assessment on the thinking and concepts of the core curriculum with the help of Ed White, who has been hired as a consultant for the new instrument. Ed chairs a committee representing the principal stakeholders in writing from across the campus – the Office of Undergraduate Education, faculty from the general education curriculum, members of the University Composition Board, college deans, and members of the Intercollegiate Writing Committee. We are considering not only a timed writing exam, but an exit portfolio from the general education curriculum.

Originally, this assessment's purpose was to evaluate students' readiness to perform written work in the upper division. But students have avoided taking it until too late to serve this function, so the committee is debating ways to make it a requirement for student progress beyond Tier One and an instrument for assessing the effectiveness of the Tier One writing component.

This new exam will have a decided impact on the nature of the writing emphasis courses in the majors, which have no longer been able to rely on the test to indicate the curricular and writing readiness of the students enrolling in these courses. The Intercollegiate Writing Committee is thus articulating more specific criteria for student outcomes and writing pedagogy for these upper division writing courses and implementing ways to approve and monitor them. The University Composition Board will undertake the faculty development workshops for the disciplinary faculty who teach them. The thrust of these faculty workshops will be, again, introducing faculty to the terminology and rationale for rhetorical analyses and providing heuristics to help faculty overtly teach disciplinary textual conventions. Students will be able to apply what they learned in first-year composition to more in-depth analyses of discourse communities as the contexts and typical audiences for academic writing in their own fields.