Continuous Faculty Development

A Compendium of the Gateway Workshop

As educators, we value learning and recognize, as Socrates said, that a good teacher is also a good student. Challenged by the needs of a changing student population, many of us have joined in a learning community to find ways to enhance student learning and improve our own teaching.

The Gateway Coalition, is committed to exploring effective ways to bring new methods into engineering teaching, in particular, and to support faculty who experiment with pedagogy. During the summer of 1995, Gateway sponsored fifty professors from eight colleges and universities to gather at Drexel University in Philadelphia for three days. Discussions ranged from how we teach and how to implement collaborative learning strategies to how faculty can get credit for such activities.

This CD-ROM is a collection of materials and ideas that were generated during that conference. We hope you will find this material useful and thought-provoking. We will continue to examine our progress as teachers and welcome your comments about what you find effective.

Valarie Meliotes Arms
&
Jane Fraser

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GATEWAY COALITION

GATEWAY ENGINEERING EDUCATION COALITION

WWW Address: http://www-gateway.vpr.drexel.edu

The “Gateway” Engineering Education Coalition is a collaborative program of 10 institutions, supported by the Engineering Directorate of the National Science Foundation. Headquartered at Drexel University and representing a diversity of institutional cultures imbedded in regions of significantly underrepresented minority populations, the Coalition expects to open new “gateways” for learning by altering engineering education from a focus on course content to a focus on the development of human resources and the broader experience in which individual curriculum parts are connected and integrated.

To learn more about the Gateway Engineering Education Coalition, press anywhere on this letter, explore the table of contents of this CD-ROM and see our home page located at the WWW address listed above.

The Gateway Coalition is supported, in part, by the Education and Centers Division of the Engineering Directorate of the National Science Foundation (Award EEC-9109853).

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Eli Fromm

Gateway Project Director

GATEWAY PARTNER INSTITUTIONS

CASE WESTERN RESERVE UNIVERSITY

THE UNIVERSITY OF PENNSYLVANIA

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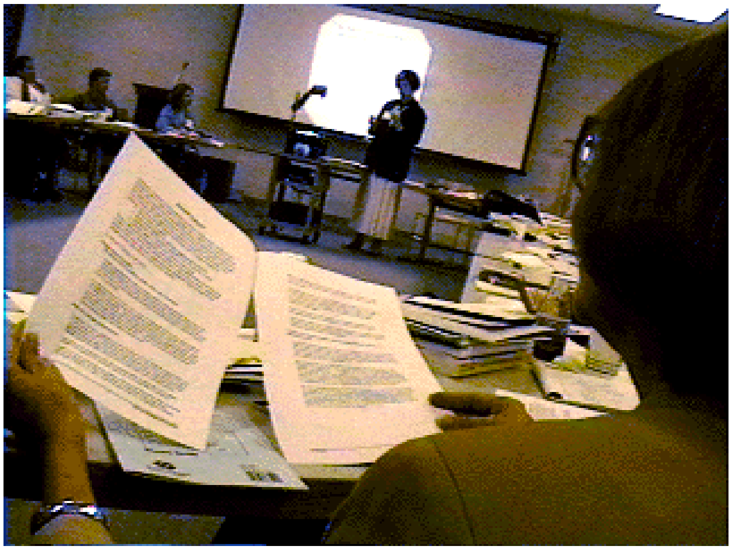
Continuous Faculty Development in the Gateway Coalition

Valerie Meliotes Arms, Ph.D.
Jane Fraser, Ph.D.

We believe that a key step necessary for faculty development and for improved learning is the creation of community. In focusing of outcomes for students, faculty can transcend disciplinary boundaries to form a new community as an interdisciplinary team. Students can develop a sense of community as a result of team projects and study groups which include classroom presentations.



Together, the faculty and the students are a community of learners all engaged in a common pursuit, the development of a professional engineer. And within the framework of the Gateway Coalition, we have an opportunity to develop a larger learning community. The Coalition provides a critical mass that could effect cultural change in academe with support for the innovators not yet readily available. Such changes offer a way to build a new paradigm - cooperation rather than competition.

As a first step, the Continuous Faculty Development workshop aims to foster the development of learning communities at each campus and between campuses of the Gateway institutions. We hope participants in this workshop will learn new methodologies and strategies to implement them hat they can share the knowledge with others on their own campus and elsewhere.

The second step will be the development of proposals responsive to the concerns of coalition community as they evolve during the workshop. Proposals for year 4 activities should be submitted by August 21, 1995 and will be reviewed by the PALS and their committee by August 30, 1995. All proposers will be notified of the disposition of the proposals by September 7. Please see the enclosed proposal guidelines for further information.

Valarie Meliotes Arms, Ph.D., Department of Humanities and Communications Drexel University, PAL for Faculty Development

Jane Fraser, Ph.D., Dept. of Industrial, Welding and Systems Engineering Ohio State University, PAL for Continuous Quality Improvement

Consensus on Drexel's E^4 Program

Dr. Valarie Arms, Hum.-Comm. Dept.
Dr. Ken Bingham, Hum.-Comm. Dept.
Dr. Robin Carr, M.C.S. Dept.
Dr. Leonard Cohen, Phys. & Atmos. Sci. Dept.
Dr. F. Elaine Delancey, Hum.-Comm. Dept.
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Dr. T.S. Venkataraman, Phys. & Atmos. Sci. Dept.
Dr. J. Richard Weggel, Civ. & Arch. Eng'g Dept.
Dr. Charles Weinberger, Chem. Eng'g Dept.
Dr. Richard Woodring, Civ. & Arch. Eng'g Dept.

The interdisciplinary program at Drexel, "Enhanced Educational Experience for Engineers" (E^4), a five year project funded by the National Science Foundation (NSF) in 1988, represents a unique example of a learning community. Humanities, Science, Mathematics and Engineering faculty have jointly explored a variety of educational topics: integrated and interdisciplinary courses, faculty development, student learning styles, writing in science and engineering, the fundamentals of the discipline up-front and establishing the groundwork for professionalism. In this program, freshmen and sophomore engineering students experience an innovative curriculum that stresses concepts and their connections rather than following traditional disciplines. Faculty and students use interactive and collaborative learning methods to investigate and promote creative problem solving skills.

The program has succeeded in establishing "community" in a variety of ways. In focusing on outcomes for students, faculty have transcended disciplinary boundaries to form a new community as an interdisciplinary team. Students have developed a sense of community as a result of team projects and study groups which include classroom presentations. Together, the faculty and the students are a community of learners all engaged in a common pursuit, the development of a professional engineer.

The basic curriculum provides a broad base for engineering in the first two years with specialized courses in the upper division.

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The fundamentals of engineering are presented "up-front" and integrated with science, humanities and mathematics; when higher level sciences and mathematics are presented later, they are tied to professional engineering interests. Design techniques are incorporated throughout the entire curriculum to emphasize that engineering is the intellectual centerpiece of the Drexel E^4 Program. The founding principles respond directly to the recommendations made in A National Action Agenda for Engineering Education (American Society for Engineering Education, 1987). From its inception, the program has had the following emphases which are stated in the original NSF proposal.

Program Emphases

• Emphasis on the central body of knowledge, experience, methods, and attitudes which form the fabric of the engineering profession and will also be valid and important in the future

• Emphasis on the unifying and interdisciplinary aspects of engineering rather than parochial interests of individual disciplines

• Emphasis on experimental methods in engineering; their use in analysis, design, development, and manufacturing; and the interpretation and effective presentation of experimental results in written and oral forms

• Emphasis on the computer as: an aid to study; an object of study; a professional tool; an intellectual tool; an instrument for social change; and most important its revolutionizing impact on the very nature and practice of the engineering profession in all disciplines

• Emphasis on the use of a wide variety of educational methodologies and techniques to improve efficiency and effectiveness. A special emphasis on self-paced and directed study to develop skills and attitudes essential for continued professional development after graduation

• Emphasis on the imperative of continuous and vigorous life-long learning for professional achievement and personal enrichment

• Emphasis on the development of excellent written and oral communications skills as prerequisites of professional success

• Emphasis on the ever increasing importance of social awareness and responsibility of the engineer and his/her profession.

All of the Humanities, Science, Mathematics and Engineering faculty involved in teaching in E^4 further agree on some fundamental principles based on their experience with actually implementing the program. Although faculty differ on some issues, such as the appropriate sequence of topics in a course, our consensus on what is essential to the success of an innovative program may be instructive in deliberations by curriculum committees and administrators. It is the openness and willingness of current participants to explore new territory that have made the E^4 project stimulating. It is our hope that administrators, faculty and students will join a continuing discussion about the educational goals for students with equal good will. Our comments are divided into

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Methodology and **Content** and are followed by our **Recommendations**.

A. Methodology:

1. Our first responsibility is to the students. The program is student-centered with an emphasis on interactive learning.

2. Creativity is enhanced by encouraging independent thinking and risk taking - for both students and faculty. Open-ended inquiry is encouraged.

3. Team teaching is an important aspect of the interdisciplinary curriculum. Weekly meetings are essential for faculty teams to coordinate efforts within components and within the program.

4. The view of the engineer as a professional, living and working in a social context, is clearly articulated. Faculty participation with students in co-curricular activities such as attending plays or touring a power plant is important.

5. Formative and summative assessment is conducted continuously through faculty, student and external evaluations.

6. Students are empowered by giving them responsibility for their education. This includes a) having students as active participants in the weekly staff meetings, b) encouraging weaker students to attend special make-up sessions after finals and then to re-take the finals, c) routinely offering review sessions, d) having students peer review their writing, and e) encouraging study groups.

7. To build community, students are divided into groups of approximately 100 and have a dedicated team of faculty. These groups include honors students who may participate in special programs in addition to the regular curriculum. The students remain in the same group throughout the freshman and sophomore years.

8. The majority of teachers are full time faculty who share equally in the commitment to the students and to shaping the curriculum. As much as possible, faculty teach and teaching assistants work in the lab and grade assignments.

9. Teaching assistants are trained to handle interdisciplinary labs.

10. A coordinated calendar lists assignments, quizzes, and midterms for all components.

11. Each team of 100 has a central office with secretarial support and with adequate equipment support for its faculty and students.

B. Content:

1. All components use an interdisciplinary approach. In one of the least obvious examples, the Humanities component has combined assignments with Sciences and Engineering so that over 50% of the Humanities syllabus is integrated with other components.

2. Engineering design is emphasized.

3. Lab work with engineering applications is integrated with each of the components from the first day.

4. Group projects are vital and are used to synthesize the E^4 experience.

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5. Strong oral and written communication skills are required across the curriculum with active support from all the faculty.

6. The computer is used as an empowering tool.

7. Assignments are authentic tasks that introduce students to the professional community. This includes technical writing and Fundamentals of Engineering.

8. Whatever the content, the curriculum is dynamic to reflect immediate responses to assessment.

9. "Introduction to University Life" is an essential part of the curriculum which involves all of the faculty in orienting the students to the college and urban experience.

10. Students are required to keep journals as tools for reflection, for charting individual growth, as well as for assessment of the program.

Our Recommendations

Our Recommendations go beyond curricular reform to suggest that faculty development is essential in revitalizing engineering education. What is vital is not more engineering courses, but rather concerned faculty who appreciate the role of engineers responsive to the unique contributions made by the "two cultures," Sciences and Humanities. The E^4 faculty themselves model the ideal of the life-long learner by team teaching, thereby revealing themselves as experts in some fields but students still as they admittedly learn from their colleagues. As their journals reveal, students are sensitive to the models faculty present and recognize the program is "an experience" not just a collection of courses. They learn from what we do as we admit mistakes, clarify goals, negotiate solutions and respond to one another with respect despite intellectual disagreements. These are valuable lessons not offered in a course syllabus, but they have become the hallmark of the E^4 community. As others consider interdisciplinary programs, we recommend the following.

1. Any new engineering program should reflect the principles described under **Methodology** and **Content**. A program in a different discipline might benefit from our experience by considering these points in its own context.

2. Teachers should be **full-time faculty** committed to this endeavor, since extensive meeting and planning time is essential to the program. Adjunct faculty are not reimbursed for such activities, nor can they provide the continuity necessary to develop further interdisciplinary activities with faculty in other settings. For continuity of instruction and maintenance of interdisciplinary focus, those adjuncts who do teach in the E^4 model must be given annual contracts.

3. The University must support all necessary professional activities, in addition to those of E^4, through time allocation and other means, wherever appropriate. These activities include publications and research necessary to produce them, editorial and refereeing activities, travel for collegial interaction, and the active

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participation in national and international societies.

4. The reward system for tenure and promotion must recognize the scholarly activity involved in creating teams of faculty and a new curriculum. Appropriate assessment of faculty could include some of the creative ideas emerging from the American Association for Higher Education (AAHE) Initiative on Faculty Roles and Rewards such as teaching portfolios and peer assessment.

5. Summer training and compensation is essential for faculty who join the program.

6. Summer compensation is essential for experienced faculty to assess and revise offerings and to train new faculty.

7. Academic support offices (such as Admissions, O.S.I.R., Co-op, Residential Living) should be involved in planning for expansion to ensure that the entire university community focuses on the student as our first consideration.

8. Students with less adequate preparation should be identified and offered courses designed to prepare them for the challenges of college.

9, Administrators and faculty should foster an environment which assures that the **dynamic** nature of the program be maintained. To retain its vitality the program must be continuously responsive to changing needs.

Technologists of Pleasure
Drexel University's Engineering Students Write Poetry

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Abstract

An important element of integrating disciplines and enhancing creativity in Drexel University's engineering curriculum is an assignment which combines poetry and engineering. For this assignment, students choose an artifact, researched it, created a one-page annotated visual explaining how it works, and then wrote an original poem about it. Although the poetry instruction, based on a transactional model, takes place in the Humanities classroom, student poems become a component of a concurrent engineering assignment and are read aloud in an engineering lecture, attended by humanities faculty, designated as the "Poetry Reading." Short in length and having a distinct design on the page, poetry is a particularly suitable literary medium for engineering students to explore. Students relinquish stereotypes about engineers when they see their engineering professor endorse poetry. They also begin to broaden their professional and educational goals.

I. Introduction

In the Fall of 1994, the freshman class of Drexel University's Engineering Curriculum, (formerly "Enhanced Educational Experience for Engineers" or E^4), an integrative program in engineering with communications playing a vital role(1), wrote original poems to fulfill a joint Engineering and Humanities Project. In the Fall semester of their freshman year, students take "Fundamentals of Engineering: An Introduction to the Art of Engineering,(2)" which has as its culminating project an assignment entitled "How It Works." For this assignment, students choose an artifact, research it, and on one page using pictures and words analyze its parts. A few examples of artifacts chosen were: a CD Rom, a laser printer, radar, a suspension bridge, and a hand held calculator. To fully achieve integration of course material across the disciplines we created a coinciding Humanities unit called "How A Poem Works," with emphasis on the process of creation. Through instruction in the reading and writing of poems, students were required to write an original poem about their "How It Works" artifact. Although the poetry instruction took place in the Humanities classroom, the poems became a component of the "How It Works" assignment and were read aloud in an Engineering class, attended by Humanities professors, designated as the "Poetry Reading." In the past, Drexel's Engineering Curriculum has established integration of Engineering and Humanities courses through its Freshman Design Projects. The writing assignments for these projects—an abstract, a design proposal, and a final report-were technical. This new program emphasizes and provides an opportunity to further explore creative thinking and develop methods to reinforce creativity. Furthermore, in being made to realize that their engineering course involves poetry, students gain the perspective of seeing their engineering professor as someone who respects poetry, defying the stereotypical assumption that engineers are not interested in writing.(3) In "Drexel's E^4 Program: A Different Professional Experience for Engineering Students and Faculty," Robert Quinn recounts

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that when students in Drexel's traditional engineering curriculum were asked how they would define an engineer or engineering, they answered: "Engineering is rigorous"; "Engineering is the application of math and science in different fields"; Engineering is the science of playing with electronics." Yet when students in E^4,participants in a program where engineering faculty promote connections between disciplines, were asked this question, "every E^4 student defined an engineer or engineering as problem solving," thus identifying creative thinking in their definition of what it means to be an engineer.(4)

II. Methodology

In order to make the study of poetry relevant to engineering students and their needs, the poetry unit draws on two important engineering skills: 1) the ability to understand how things work; and 2) creativity. Students write original poems describing how something works using the same artifact they have selected to study for their engineering project. The process of poetry is emphasized: students read published poems, compose their own poems, participate in a poetry workshop, and then, based on peer comments, revise their work. With reference to the work of Kenneth Koch, a pioneer of the Poets in the Schools Program where reading poetry and writing poetry is taught as one subject, our students studied selected poems as models of a particular technical innovation.(5) Doing so, helped broaden students' perceptions of poetry. Often we would read and discuss a poem in class and then set aside class time for the students to begin composing their own poems. Our responses to student writing was as non-judgmental as a brainstorming session, where all ideas are accepted. The one rule which we upheld from Koch is that students need not use rhyme: "Rhyme is wonderful but (students) generally aren't able to use it skillfully enough to make good poetry. It gets in their way. The effort of finding rhymes stops the free flow of their feelings and associations, and poetry gives way to sing-song."(6)

The following formal devices we suggested are easier to use than rhyme and were new to our students, thus expanding students' notions of poetry:

1) Odes: poems in praise of someone or something.

2) Epistles: poems addressed to someone or something.

3) Image or Shape Poems: poems written in the actual shape of the artifact being described.

4) Metaphors: poems introducing a new comparison or metaphor for the artifact in as many lines as possible.

5) Persona Poems: poems in which the writer imagines himself as the artifact.

We also encouraged students to use as many technical and scientific words as they could in their poems. This knowledge can make the poems engineering majors write seriously different from the poems of literature majors with a more limited scientific vocabulary. We told the students we wanted to see how their special knowledge infused language with energy and power. Language is by definition an organic response to an environment. If we write poems that do not contain words that describe our technological age, our writing cannot be authentic. Certainly, many practicing poets would be envious of an Engineering student's technical range: "We are almost all of us delighted if we can squeeze into a poem some

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new physical detail, something no one ever put in a poem before—not only for its symbolical sense, either, but for its literal value as a *thing*." (7)

III. Results

We found that in a ten-week term students could learn to write remarkable poems, samples of which are given in the concluding section. Indeed, the wrongfulness of stereotyping engineering students as not interested in writing poetry asserted itself as we took possession of the folder which contained the 500 original poems our freshman students had written. From the first poem to the very last, there was in each of them a voice converging science and language to express some new way of regarding the world. Usually students do not relate the skills they acquire in engineering to the skills necessary for the writing of poems.

Yet just as the rigidity of classifications leads to the rigidity in the way things are looked at(8), skills engendered in one academic discipline do not preclude their use in others. Why must Steinmetz be one of the rare examples of an engineer in the nineteenth century who writes poetry?(9) Engineering students' knowledge of the physical world, their extensive technological and scientific vocabulary, their visual orientation, their ability to work with symbols, and their role as problem solvers more than adequately prepare them for the trial and error process of writing poems. Some students were writing their first and, given the tendency of practitioners to stay within the defined parameters of their field, their only poem. These are the poems that will become the associative link to poetry in the mind of their writer, that link magnified to include the poems of their classmates, discussed in a workshop setting and read aloud. Other students, it came out (at first furtively with sidelong glances and the enthusiastically as more and more students raised their hands or nodded their heads) had written poems on their own and were relieved to discover that choosing to study engineering does not constitute a preemptive strike against the writing of poems or any other non-technical pursuit. "Specialization, although a necessary feature of our civilization, needs to be supplemented by integration of thinking across the disciplines," writes Murray Gell-Mann in <u>The Quark and the Jaguar</u>, a book that widely draws on this Nobel-winning physicist's knowledge of humanities and the arts to bridge the gap between nature and human culture.(10) The failure to do so is reflected in our labeling of engineering students as "logic-bound" "non-readers" "poor writers,"—labels that only serve to reinforce stereotypes. Along with labeling engineers, we are accustomed to rewarding students with good grades when they find the "right" answer. If a student is accustomed to being rewarded only when his thinking produces the right answer then he will not have the courage to seek out riskful ideas. In <u>The Experimental Psychology of Original Thinking</u>, Wilbert Ray writes that "thinking is a process, an activity, and it can be increased in amount, and perhaps in quality, by practice."(11) Even more interesting, Ray, Rigano, Mednick, and Gordon all demonstrate that it is the amateur and not the expert who is often most likely to come into a field and see it anew: "The greater the number of instances in which an individual has solved problems with given materials in a certain manner, the less is the likelihood of his attaining a creative solution using these materials. Thus, if a newcomer to the field has the requisite information, he is more likely to achieve a

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creative solution than a long-time worker in the field."(12) We saw this theory come into effect when Nathan, a student in the program, wrote a poem that seemed to be imitative of the style of Marianne Moore, a modern American poet noted for her surprising use of scientific terminology and for her interest in esoteric words. Nathan had not studied Moore's poetry. He had, however, liked our suggestion of using scientific terms in his poem. As a consequence, the tone and style of many of the lines of his poem are delightfully reminiscent of Moore's technique:

Jet Engine
by Nathan
A volcanic duet;
a quartet
sparrow sings informatively
unheard beneath the deafening roar
Soaring; powering over
the oceans
where
the simple octopi propel
by a sophisticated but
parallel manner
significantly more efficient
Nature again overpowers!
Craving unfounded epiphanies
Already existent in the natural world
We trudge through
scads of specifics of backward principles
aimlessly swimming in an ever darkening sea.

Despite its myth of inaccessibility, we found that poetry is a particularly suitable literary medium for engineering students to explore. Poems are meant to be read in one sitting. They can be written, revised, and discussed in a single class period Furthermore, each poem has a distinct design on the page. Poems are objects to be looked at as well as listened to. Poet C.K. Williams explains: "Novels differ from the more formal kinds of literature in that the movement of their language, however deft and dense, is driven to the utmost degree by the force of their subject matter, and only very rarely can a novel bring us to the condition in which we experience the radiance accessible to us in the presence of beauty as we feel it in...poems."(13)

Although many students were intrigued by the idea of this assignment, others could not understand how poetry could begin to be of relevance to engineering, their chosen course of study. Students are not accustomed to making connections between ideas shared by different disciplines and even more acutely, within a given discipline. Many students form an artificial separation of subject matter and ideas. Infusing a literary subject such as poetry into the engineering curriculum prods students to synthesize and integrate ideas with the goal of having them realize that poetry is also in the engineering classroom, but it is not defined as poetry. When a class was asked why should engineering students study Shakespeare, upon being assigned to read and see a local performance of The Taming of the Shrew the following semester, a student answered that Shakespeare took many of his ideas for his plays from existing literature to help give form to his ideas and that, likewise, engineers often draw on previous innovations to design structures. To be able to see that both a poet and an engineer engage in the same activity shows a broadened sense of the world.

IV. Problems

As an interdisciplinary reform, the joint poetry and engineering assignment was an infusive force in combining two ostensibly divergent

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subjects. An entire freshman class of engineering students faced the task of being required to write an original poem. Because our goal was to create a positive, non-judgmental environment for writing poems, we did not grade the poems. Indeed, many creative writing instructors grade on a pass/fail basis. This is not to say, however, that creative writing classes lack standards; in fact, they are usually rather high. In contrast, approximately half of the poems produced by our freshman class unskillfully used rhyming endwords as their system of organization. Although we had encouraged students not to use rhyme, introducing them to published poems written in free verse, we were fighting against their bastion of belief that poems rhyme.

Whenever we had come out against rhyme in class discussion and lecture, many students challenged this notion, based on faith and not on experience as we were offering them. The lack of originality in a poem using the unskilled, sing-song manner of rhyme these poems exhibit compared to their free-verse counterparts are obvious in the following samples of a rhymed and then an unrhymed first stanza:

A Record Player's Show
by Christine

A record spinning round and round
for some reason out comes sound

Where it comes from I shall tell
so pay attention and listen well...

The CD Player
by Megan

The music captures the atmosphere—
the light sweat from dancing so long
that collected on your brow,
the vibration of the bass that echoes
in your stomach, your chest, your throat...

This stanza from Megan's poem approaches beauty. Its descriptions are based on observation. The *o* sound that appears at the end of each line, whether intended or accidental (and I suspect the latter) is a much more original and interesting use of sound than Christine's campfire oration.

Very few students tried to write narrative poems. Although the assignment stated that they should try to link past experience to their object, very few students delved into their memories. Again, this may have occurred because just as students do not think of non-rhyming poems as poetry, they are unfamiliar with the narrative mode, having studied mostly lyrical poetry in school. Both of these problems define, once again, stereotypes that oppose original thinking; i.e., the bias toward rhyme and lyrical verse. "To be confronted, shocked, to understand that a poem might mean a revision of one's notion not only of the poem one is reading, but of poetry itself, becomes an elemental pleasure."(14) In order for students to fully participate in the pleasure of poetry they must begin to peel away their assumptions. A vital discovery the project in poetry writing has brought about is that subverting accustomed patterns of thought is a far more difficult process than we had accounted for, one that requires much reinforcement over time.

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V. Conclusions and Recommendations

On the premise that students retain the most information from their classes when their level of involvement is active, we are planning to continue the joint poetry and engineering project as a part of our curriculum. We believe that teaching poetry so that students may become more familiar with the craft for the purpose of creating their own poems transforms their distant respect of poetry into ownership. They are proud of their poems and they want to write more. On the day of the poetry reading, class attendance was among the highest of the semester. Their attention was rapt. Very few students came without a poem to read. When the engineering professor read a poem, the notion that engineers have no interest in participating as members of a creative writing community was at once dissolved.

Giving students an ungraded mode of discourse in which creative self-expression is maximized is one of the primary goals of the assignment. This is certainly a reversal of the usual university format where student works are read "not to inform and entertain, but to assess how well students can perform..." (15) Some student poems did employ craft learned from the model poems or class discussion. Other student poems seemed to be informed only by the preconception that a poem rhyme. Rather than trying to subvert this notion, which we discovered led to greater resistance, we recommend the inclusion of model poems and poetic forms written in the modern idiom which successfully employ rhyme and rhythm.

One effective way of doing this while still offering our students the possibility of transforming their assumptions about poetry is to introduce students to non-English and exotic prosody such as Pantouns, Acrostics, Villanelles, and Sestinas, forms which contemporary poets practice. In a Sestina, for example, the "six end words are picked up and reused in a particular order, as end-words in the remaining stanzas. In the envoy, which ends the poem, the six end-words are also picked up: one end-word is buried in each line and one end-word finishes each line." (16) Lewis Turco's widely studied Book of Forms references over 175 verse forms that employ rhyme and repetition in strictly adhered to patterns, much like the configuration of a Rubik's Cube. Such constructions may particularly please engineering students. In so doing, the tools presented match student needs and at the same time help them to step out into another realm.

Sample poems

Persona: *Videophone Poem*
by David

do you really need this newfangled thing-a-ma-jig
I mean, really, I'll hop on a horse you can pay me

you damn engineers already put those nice horsemen out
no "thank-you" just what took you...

all I want to do is tell you what happened to me this week
honestly I could care less to see your face right about now

I hope you guys did a better job with this than that VCR thing
it's going out the window

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your great grandchildren are too lazy for your own good
get off your behind and walk instead of calling me on that screen

maybe this will end all those calls from people
I guess that Jaque Strapp won't call me anymore
don't know

isn't this great
you kids have another excuse not to come see me

Persona: *The Virtual Experience*
by Sonia

Through the mirror that shields our vision you see,
what your mind's eye creates.
Secluded on the other side of a diver's goggles you plunge

into the deep recesses of this drunken state
where uncertain movements are controlled
only theoretically by your thinking.
My sensors inhale your touch
and formulate the flirtatious links
of pics and frames.

Beneath a secure metal shed
microchips greet neurons.
The screen
like the visor of a motorcycle helmet
reveals a distorted image of reality
while preparing its rider
for the challenge that awaits.
In this computer generated world
the desires of the heart are only limited
by the memories of the hard drive
and the capability of the software.

Epistle: *"a poem which is merely about the generic microprocessor in american computers both business and home"*
by Todd

I see you now, microprocessor
demon of speed, clad in silicon
3.3 million transistors
how hold you so?
Easily processing lines of code
in a fleeting instance
intel, motorola, and spark
all vying for the title
king of MHz.
You run UNIX and DOS
XENIX and SYSTEM 7.5
flawlessly...except of course for win-DOZE
capped with a heat sink and a fan
running as hot as to melt butter
seated in your harness
your pins as legs
running endlessly...

Metaphor: *Projection*
by Charles

Like two magnets drawing us to the future
the refracted light lets us gaze into a new world.
As the light passes through the aperture
the mirror reflects it.
You let us see
the transparency magnified on the screen.
The oscillation of the fan
cools you from the emitting rays.
The light refracts off a two-sided image
from what is unclear to what is clear.
The magnification lens receive the beam
projecting it to a screen and allows it to visualize the world
now gone that was so small
is now projected to something that can be viewed by

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all.
The ambiguous is now clear and a new future has arisen.

The Empire State Building
by John

without being on a plane or on any drugs
the highest i ve ever been
was when i was on the empire state building
102 floors and more than 1000 feet to the bottom
i looked out the window; boy what a gorgeous view

after looking down at the crowded new york streets for awhile
i was on my way
to where? i don t know?
maybe i ll go to the village
just to chill and relax
tan under the warm sun
or catch a show in the park
get drunk off tequila and rum
and go home when it gets dark.

Image: *Laser Printer Poem*
by Oleg

The image! Where's that mindless image?
Come on you lazy laser beams, transfer the image!
Then there'll be a squeaky drum with positive and negative
electric charges.

The bits of black-plastic toner and the light.
Once more the image, then the paper.

The toner from the noisy drum and fiery, fusing rollers.
Rollers, rollers and again the rollers until it'll lay upon my back.

Ode: *Graphing Calculator*
by Juana

O, graphing calculator,
Please don't allow your batteries to die
For I have my Monday quizzes to take
And without you I cannot pass.
I truly value your convenience
All I have to do is push some keys
and I store my formulas
I don't even have to worry about such a trivial thing like
what 4/2 is.

Yes, I cherish having you
You made me have to think less
And for that I am grateful
I can worry about other things
Like writing a poem
I beg of you
Please don't die on me now
I promise I will buy you new batteries
After my Monday morning quizzes.

Ode: *Ode to Radar*
by Stephen

Radar, or as your name implies
Radio Detection and Ranging
Your questioning pulses are transmitted
Across great lengths, at light's speed
With determined wavelength and frequency
While our receiver waits
For the echoing return
A signal is required and a range is calculated
As a blip materializes on the screen

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Radar, your use is so common
A necessity to air traffic controllers
And also pilots, sailors, and soldiers
Many ship and plane you've plotted but you aren't
limited to earth bound applications
To the lunar surface you've guided men
And mapped the moons of Jupiter
And the mountains of Venus
O, Radar, such a useful friend

HARRIET LEVIN MILLAN

Harriet Levin Millan was a member of the Iowa Writer's Workshop at The University of Iowa from where she holds a master of fine arts degree in creative writing. She is an visiting assistant professor in the Department of Humanities and Communications, Drexel University, Philadelphia, Pennsylvania. Her poetry manuscript, The Christmas Show, has received many prizes including the Alice Fay di Castagnola Award from the Poetry Society of America, the Grolier Poetry Prize and Nimrod's Pablo Neruda Award and was a 1994 finalist for the Walt Whitman Award for first book publication sponsored by the Academy of American Poets. Her poems have been published in The Partisan Review, The Iowa Review, New Letters, Nimrod, and West Branch. She has been a fellow at Yaddo and at the Virginia Center for the Creative Arts. As a poetry consultant for the Poets in the Schools Program in New York City and most recently in Philadelphia for the Head Start Program, she has led poetry workshops in numerous schools and institutions, reaching thousands of students and opening their facility for self-expression. Currently, she is team teaching in the Humanities component of Drexel University's Engineering Curriculum, an outgrowth of "An Enhanced Educational Experience for Engineers" (E^4), creating and teaching an integrated curriculum.

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An Introduction to the Classroom Assessment Project Cycle

by Thomas A. Angelo and K. Patricia Cross

When Classroom Assessment is fully integrated into a course, ongoing assessment becomes part of the faculty member's overall plan for instruction. In such courses, Classroom Assessment is an important element of the syllabus, along with classwork, homework assignments, and tests. We (the authors) refer to the carefully planned use of a Classroom Assessment Technique that is well integrated into the course syllabus as a Classroom Assessment Project. Classroom Assessment Projects differ from simple Classroom Assessments in much the same way that a carefully planned, scheduled examination differs from a spur-of-the-moment, unannounced "pop quiz." While "pop quizzes" may serve a useful function, they cannot take the place of well-constructed exams. Similarly, simple, spur-of-the-moment Classroom assessments are often helpful and informative, but they cannot substitute for carefully planned Classroom Assessment Projects.

The assessment map on the next page presents a process for successfully planning and carrying out Classroom Assessment Projects, as well as for responding to the feedback these assessments generate.

This step-by-step process, called the Classroom Asessment Project Cycle (or, simply, the Project Cycle), was developed and refined through field testing at several colleges over a three-year period. Many faculty have found it to be a useful framework, one that helped them structure and organize their Classroom Assessment Projects more effectively.

This introduction to the Classroom assessment Project Cycles is adapted from the book "Classroom Assessment Techniques - A Handbook for College Teachers" by Thomas A. Angelo and K. Patricia Cross, second edition, Jossey-Bass Publishers, 1993 pages 33 -59.

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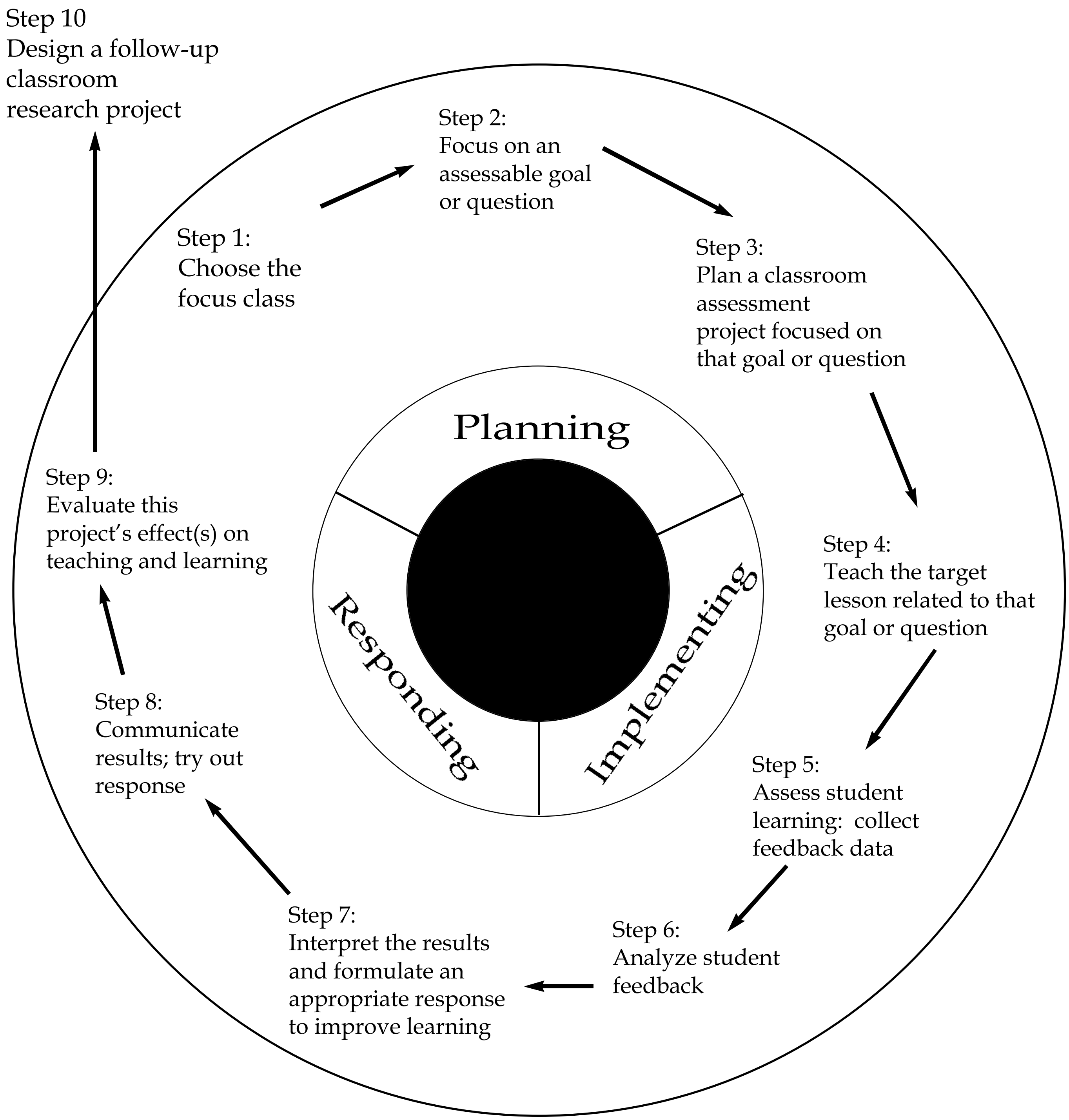
Figure 4.1 Map of a Classroom Assessment Project Cycle.



Angelo, T.A., & Cross, K.P. (1993). Classroom assessment techniques. A handbook for college teachers. San Francisco. Jossey-Bass. pp 35.

Knowing whether students actually meet the objectives we set for a class is often hard; such was the case for William C. Rando. He hoped that students in his adult education course would come away with their own well-thought-out philosophy of education. To get at this level of information, he asked his students to write him a personal letter.

The Case of the Learning Letter

William C. Rando

Last fall, I taught a course titled Problems in the Education of Adults. I taught a group of eight adult evening students, most of whom were seeking a bachelor's degree. We met for two and a half hours every Thursday night in a comfortable seminar room.

The course format was very interactive. For half of every evening, we discussed the issues embedded in the reading from the week before. I felt that my students and I developed rapport. Discussion was lively and often courageous: students were not afraid to express themselves even when that meant disagreeing with me or other students. In addition, we laughed and kidded each other quite a bit. Because the course was on adult education and we were all adults, there was a natural tendency for us to become self-reflective and ask ourselves, "What kind of adult education are we involved in right now?"

Planning

Throughout the semester, I got a lot of feedback from my students, but at mid-semester, I realized that one big question remained unanswered, "How are students' overall perceptions of adult education changing?" This, after all, is what the course was all about.

Like many social science instructors, I designed my course around the premise that students have preconceived notions that bias their understandings of the social world. My course objective was to help students develop a more intelligent orientation toward adult education. I could hear student consider other ideas in class discussion, but I still didn't know how their fundamental perceptions were evolving or if they we re changing at all.

Collecting

To determine how my students' perceptions of adult education were changing, at midterm, I asked my students to compose a letter to me. I allowed them to write the letter outside of class, which saved class time but also gave them time to produce a more thoughtful response. I chose a letter format because of the introspection and natural language that a letter encourages. I didn't want a lot of jargon in their responses; I wanted to know how they were changing. I provided the first two words, "Dear Bill," and a list of questions to answer (see the resource section of this chapter).

Processing

From their letters, I learned that students were, in fact, changing. My students described the personal meanings that they attached to the ideas in the class. As expected, most described movement toward a broader definition of adult education. They also mentioned that this movement was unanticipated and that they had originally expected something more concrete,

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like a list of recipes for motivating adults. I felt certain that my objective was being realized.

In response to the last question, many students commented that the broadening of perspective came with an increased sense of anxiety about how little they really knew or how few answers there really were. Students tacitly hoped that I would "tie things up" toward the end of the course. The letters provided a gateway into a level of student information that discussions cannot readily tap.

Responding

In a letter I wrote back to them, I tried to summarize the comments of the class and simultaneously address one main point of each individual student without violating anyone's anonymity. I wrote, "Many of you had expectations that this class would focus on a collection of theories and prepackaged notions about how to teach adults. To your surprise, the material is much more personal, much more conceptual, and, at times, much more ambiguous." I also devoted a bit of the next class to describing how the class, as a whole, seemed to be moving, as well as how I planned to address their concerns.

In the remaining weeks, I put many of their suggestions and requests into action. For instance, I designed and discussed material that put what we had been doing all semester into a larger context. I think I did this without oversimplifying the field. As I had anticipated, some of my students were caught in a quagmire between their old understandings and their new discoveries. For them, I assigned special readings that suggested answers to their questions (and more questions to their answers...so it goes). Essentially, the feedback in the letters allowed me to promote the primary learning objective of my course, to help them develop a new personal philosophy of adult education.

At the end of the process, I felt more confident that the course would actually accomplish for my students what I wanted it to accomplish. I had good evidence in support of my belief that when students engage material that is conceptually challenging but ultimately more satisfying than their current thinking, they do evolve.

Editors' Notes

The distinguishing characteristics of the feedback method in this vignette include an open-ended structure for maximum student response, genuine questions to encourage thoughtful student answers, and a metaphor of correspondence to encourage communication between students and the teacher. If you seek a maximum amount of honest communication from your students, consider strategies that encompass the characteristics inherent in the "Letter to Bill."

Because Rando employed a feedback method specifically designed and tailored for his students, he gained a great deal of useful information about course objectives. Although the questions he asks students to answer in the letter pertain to his course directly, five minutes of thought about alternate questions will yield a ready-to-go feedback strategy for any course.

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A Letter to Bill

Please reflect on the learning you have done so far in this class and, using the format of a "Letter to Bill," ask and answer the following questions:

1. How has my understanding of adult education changed as a result of this class? Have I gained any new perspectives or insights? Have I learned any important facts?
2. What have I learned about myself as a learner? How do I view myself in relation to other learners in the class or to all other learners?
3. What questions remain and how can Bill and this class help me go about answering them? What new questions has this class raised?

I have chosen the personal letter format to encourage you to use your own voice in this assignment; I hope you learn a lot in completing it. I will provide you with a "Letter to the Class" after I have read and reflected upon your letters.

This letter may be as long as you like. The assignment will be graded on completion alone. In reading this letter, I will get a sense of your ability to reflect on your own learning as evidenced by the way you articulate your learning needs as well as your learning accomplishments. In addition, I will use your comments to address your concerns in the remaining week of the class. To get you started, I have provided you with your first line:

"Dear Bill,"

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Why Journal Writing?

Elizabeth L. Haslam, Ph.D.

Thought and language work together

We use symbolic tools (one is language) to perceive and understand our world and make meaning out of it. Each of us perceives, builds concepts, and constructs meaning in individual ways. The central idea of this recent rhetorical perspective is epistemic: we make meaning through our symbolic, innate powers of language and imagination. We form our precepts and concepts simultaneously; "forming is a way of knowing." (Berthoff, 1984, p. 103, my italics).

Journal writing is useful in facilitating the depth of processing new information because we slow down the processing process when we write. Writing research demonstrates that we connect the "hand, eye, brain" in one movement (Emig, 1984). And the use of journal writing makes possible the construction of meaning, investigation and enlarging of reality -- feats that are difficult to achieve without writing (Yinger and Clark, 1981).

Journal writing is not academic writing; it is not often clear, organized, assertive and objective. Instead, journal writing is personal, expressive, and informal. It is closest to our processes of perception (Berthoff, 1978; Britton, 1975).

Journal writing:

- personalizes the learning process;
- deepens the learning process (elaboration, association, connections);
- forces us to make understanding concrete;
- gives us a record of our progress;
- grounds us in time and space; and
- develops higher order thinking and creativity.

Reflecting on the journal entries:

- reveals how we learn and think (styles);
- helps us discover what we think about, how we think and why we know something; and
- helps us assess our learning and thinking

Journal Thought Processes

Observations

Observing something of interest, looking closely, looking again. Scientists use observations as part of the inquiry method.

Questions

Writers use journals to formulate and record questions: personal doubts, academic queries, questions of fact and theory. It is more important here that there be more questions than answers.

Speculation

Learners wonder aloud -- on paper, about the meaning of events, issues, facts, readings, patterns, interpretations, problems and solutions.

Self-awareness

Learners become conscious of who they are, what they stand for, how and why they differ from others through reflection.

Digression

Learners departing as they write from what they intend to say, sometimes to think of personal matters and sometimes to connect apparently disparate pieces of thought.

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Synthesis

Learners putting together ideas, finding relationships, connecting one course or topic with another, building concepts

Revision

Learners looking back at prior entries, seeing where they have changed their minds and viewing the topology of thought.

Information

Evidence of reading done, course material processed, facts and theories understood and related to what is known.

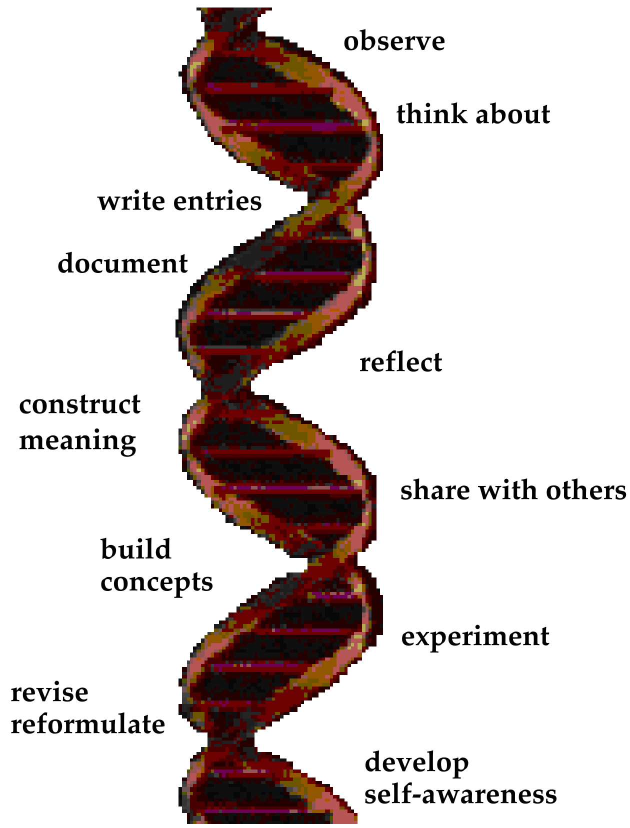
Methodology

Respond to journal entries periodically to generate faculty/student dialogue, invite students to share entries with the class, and recognize interesting questions and entries as a departure for class discussion and investigation. Remember, journal writing will not work unless you respond to it and validate the process.

General Cues

• What have you learned? What questions do you have? What needs further clarification or review? How will you apply what you have learned?

• What were the steps you took to work through today's homework problems? Where did you have difficulties or questions? Did you make any discoveries?



Writing and Reflecting in Journals

• If you could take one photograph of today's learning, what would it be? (This might be an idea, a product, a concept, principle, procedure, or process.) Draw a picture of the photograph.

• Draw a concept map of how the course concepts/principles are related.

• What connections are you making of your learning in this course to other areas of study and learning?

• How would you teach this concept (idea, principle, process, procedure)? How would you design this lesson for a software application?

• What would you like to investigate further and why?

• What issues are emerging from this course you were not aware of before?

Hands-on Experience Cues

• If you could make a video of today's experience, what close-ups would you like to see, what parts would you spend the most time shooting, and what would you edit out?

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• What experiences have you had before that reminded you of what you did today and why did you make those connections?

• What sensations were you aware of (sounds, color, texture, materials, etc.) What were you reminded of?
Group Work

• What role did you play in your group/team project today? What would you like to change? What did you observe about the group dynamics?

Research Examples

University students in one engineering section of Structural Analysis and Design at MIT in 1986 wrote in a journal once a week, while another section did not (Selfe and Arbabi, 1986). The journals were collected three times a quarter and responded to by the instructor. Although the purpose behind requiring the journal was to get more writing into the engineering classroom, it soon became evident that keeping a journal provided much more than that. It helped students:

• clarify their thoughts;
• work out strategies for solving engineering problems;
• understand the important aspects of the structures course;
• identify areas in which they needed more help.

Finally, the journal assignment also improved the performance on the final written project, because the section that had written the journals submitted projects with more coherent, organized and complete explanations of the design process than those of the control section.

2. Journal Writing in E^4 (Haslam, 1993)

Group work in practice
The realities include deadlines, grades, delays, and frustrations.

Today I experienced the stress of doing a project at the last minute. Today I had a lab due in Engineering Lab. Last night, my lab partner and I worked from 7:00 to 1:30 am trying to get it done. We ended up with something that looked like a book! To top it off, we had to go to Korman Center this morning to print everything out. It just feels good to have it completed.

If everyone would just do their work instead of talking about it so much, more would be accomplished. I have found several problems with working in a group. There seems to be almost no compatibility. I have always found that the rest of the group never wants to work when I do. On the other hand, they seem to know my schedule perfectly and are always able to pick a time when I am most busy. And the best ideas I can come up with are viewed as lousy by the rest of the group. . . . I hope I can choose my future groups, because being assigned one certainly doesn't work.

After the design presentation. . .

Coolness!!! We just completed our oral presentation of our Freshman design project. All in all it went very well. I just heard that we are one of the prime candidates to repeat our presentation this coming Monday for the multiple deans of engineering from other big schools and the NSF. Cool beaners. I think that we can do mega-super job. I'll bet that the people from NSF will just pull out their check books and start writing.

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I was pleasantly surprised in my own speaking ability. It seems like once I entered college, I have gained the courage to speak my mind, especially in recitations.

Today our lecture intertwined the subjects of Science and Philosophy. While discussing order of magnitudes we tried to define space. It would seem to be a very simple definition, whereas it is really a loaded question. Space is something that contains matter, is cold, dark and infinitely divisible. Those parts of the definition I can agree with. But I have a difficult time understanding how space can be infinite in time and infinite in itself.

In Engineering Lab today, we worked with optic sources and detectors. A light was activated, and we used different instruments to measure the voltage of each light. This is a two-week lab that we will finish next week. In Chemistry lecture, we are continuing to study light and wavelengths. I can see that the Engineering lab and Chemistry are tied together.

I have chosen a topic in which there is minimal information and I don't completely understand the topic, but I guess that's what will make it a worthwhile choice for I will learn a great deal about it in the meantime.

In English 101, students were asked to write about their readings in relation to their engineering learning.

I really liked the analogy that Dr. Primo Levi makes about ignorance in The Periodic Table. He said in the gold chapter, "When you are in the mountains and your rope is frayed and about to break, and you don't know it, yet feel safe." Dr. Primo Levi makes many analogies in this book, some deep, some nothing to do with the subject, and others really memorable. This one is memorable to me.

My reactions to the novel The Control of Nature hasn't been very positive. After listening to the English lecture my curiosity was peaked; I thought that the novel would be quite interesting. . . . . I finished Control of Nature, and it got a little better towards the end. I think it was because I stopped trying to think about the designing aspects and spent time on what he was talking about in terms of his trip down the river. I'm going to compare it to The Gods Must be Crazy. They both deal with the idea of men tampering with the control of nature and the consequences of those actions.

The Control of Nature raised two points that I thought were interesting. First was the idea of man's role in controlling things that perhaps he wasn't meant to. Redirecting a river does raise some ethical questions. Was man overstepping his boundaries? Was man trying to play God? Who decides what's right to control and what isn't?

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Press HERE to see the whole page.

Now
Press HERE to go back to the opening page.

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Forms and Guides

Design Report Peer Review

This form should help guide and focus your work on your final report. Read another student's paper thoroughly, at least once, and write comments on this form under the appropriate headings. You may use notebook paper to supplement your comments. Where comments refer to a specific sentence in the paper, place a number in the margin of the draft, and mark your comment with the same number.

After you and your partner have finished writing the evaluations, explain all of your comments.

PEER REVIEW COMMENTS:

List Authors' Names:

Reviewer's Name:

Comments on Individual Sections:

Title Page: Does the title briefly and adequately state the subject? Are the names of all team members listed? Are the date and other specific identifying information included?

Abstract: Does the abstract tell the reader the problem, methodology, results, conclusions, and recommendations that appear in the report? If the abstract stood alone, would the reader still know basically what the report is all about? Does it do all of this in 200-250 words?

Table of Contents: Does the table of contents clearly and accurately identify the organization of the paper by reproducing the headings and subheadings, figures, tables, and appendixes? Does it include the correct page numbers?

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Executive Summary: Does this section give the background of the report, including the problem statement? Does it adequately summarize the major sections of the report, including the advantages of the work? Is it written in a style appropriate for a management-level readership that does not necessarily share the specific technical knowledge and expertise of the authors?

Methodology: Do the authors describe in sufficient detail how they did their work? Does the level of writing reflect the shared technical knowledge of the authors and their counterparts who read the report? Does the section include descriptions and visual aids, when appropriate, of the equipment and materials used? Does the methodology section reflect in a logical and coherent way how the authors actually proceeded?

Results: Assess the presentation of the results for clarity and brevity. Are the results presented objectively, without interpretation or claims?

Research: What evidence is there of convincing research? How is it integrated into the report

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Graphics: Are the graphics prepared and placed appropriately. Comment on the correlation between text and illustrations.

Conclusions: Do the conclusions flow logically from the results? Have the authors written their conclusions clearly, in language accessible for management people as well as engineers?

Recommendations: Are the recommendations made clearly and directly? Do they flow logically from the conclusions that you have just read?

Word Usage: Throughout the report, assess the vocabulary. Does the diction in each section match the anticipated comprehension level of the readers (managers, engineers)?

Overall Assessment of the Quality of Writing: Does the report hold your interest? What problems have you identified in the organization of the material, sentence structure, consistency of style, or mechanical problems (e.g., spelling, grammar, punctuation)?

Additional Comments:

Graphics Peer Review

This form is designed to guide and focus your peer review of a graphic that another student has prepared for a specific text, such as the design project proposal, a technical paper, or an interim or final technical report. A graphic, or visual, may be a table, diagram, chart, graph, photograph, or map.

After you and your partner have completed your comments, explain your evaluations in detail.

PEER REVIEW COMMENTS:

List Authors' Names:

Reviewer's Name:

Evaluate the clarity and usefulness of the graphics overall.

Is the title informative? Applicable?

Does the title stand out visually, so that it is distinct from other information in the table?

Do you see information in the table that needs, but does not have, any explanation in one or more footnotes? Tell your partner specifically what elements in the table need further explanation. Suggest appropriate footnotes.

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Is the origin of the data in the table attributed, if necessary? If the table comes from the writer's own data it does not need a reference, but if the information in it comes from an outside source, the source must be stated.

If there is a table, is the format of the graphic consistent and appropriate? (Numbers, for instance, should be right justified, dollar amounts should line up at the decimal point, etc. . . .)

Evaluate overall the usefulness, comprehensibility, and appropriateness of the graphic, considering the audience.

Does the caption correctly identify the graphic? If not, suggest how your partner should change it.

If the graphic uses cross-hatching, shading, and other identifiers, has the author provided a legend?

Does the text explain the graphic? (Don't assume the graphic "speaks for itself"!) Examine the relationship of text and illustration carefully to decide whether the text repeats information in the graphic, explains it, or adds information (all of these should happen). Comment on the graphic-text relationship and decide how appropriate and useful it is.

Elements of a Charter

Version 1.1

This format was intended for use by teams (e.g. PATs) but can easily be modified for assignments given to individuals or functions.

Item	Example or explanation
1. Tactical Objective: Strategic Objective this tactical objective supports.	expand the definition of the tactical objective so a reader not present today can understand the desired end.
2. Purpose/Mission (What is this assignment?)	• To implement _______ tactical objective. • To study the problem(s) associated with ___ tactical objective. • To increase the use of ___ across the organization. • To streamline & improve the ____ process. • To resolve differences between ____ and _____.
3. How to proceed and assign: a. is this an ongoing activity? b. should this be tabled? c. how should the objective be assigned?	a. if so, incorporate into the implementation plan. b. table the objective until appropriate to revive. c. individual job, function, or team? If a team, identify SO Owner, PAT leader, facilitator (if applicable), and members.
4. Assumptions and available data (why are we creating this team?)	• The ____________ process appears to require too many resources and still receives lots of complaints. • Our customers have asked us to improve this. • The majority of our resources (e.g. 60%) are devoted to this process (cost driver). • We have outgrown our current facilities. • The process is broken. • Funding for this function is being cut X%. • The team will not address ____________.
5. Team Goals (anticipated result of the team)	A1. To have documented __________ process; A2. To make a presentation of recommendations for streamlining to the QMB. A3. To implement (w/o approval) any recommendations within their individual authority. B1. To identify the root cause of ________ problem. C1. To draft _____ document and distribute once approved. D1. To draft a plan for increasing the use of _________. D2. Upon approval, execute the steps of the plan.
6. Time Frame (to accomplish the goals)	• Report in 3 months; disband in 6 months upon presentation of status. • We expect this team would be finished (goals accomplished) within 8 months.

Team Assessment Form Directions

In completing the following Team Assessment Forms, keep in mind that they are a part of the your Humanities class participation grade for a number of reasons, such as:

1. The forms should help you and your group establish healthy attitudes toward your Design Project and your roles in completing the work on time;

2. They will enable you to pinpoint problems areas and correct them before they snowball;

3. They will show which team members and which behaviors are helpful to the development of engineering principles and team efforts as well as those that negatively effect the group;

4. They will act as a continual reminder of what the group is striving for-- to have each member equally contributing and participating in a way that is satisfying to the group as a whole and to individual group members; and

5. They will encourage each member to be responsible and productive since the Humanities Instructors will be made aware of which team members aren't approaching the work in a professional manner.

To receive full credit for the Team Assessment Forms, keep in mind the following:

1. A copy should be submitted to the appropriate Humanities Instructor from each group member in the section (for example, if two team members share one instructor, the instructor should get a separate and individually completed form from both students; if each team member has a different instructor, each instructor should receive a separate and individually completed form from her/his own student);

2. You must submit your completed form at the beginning of recitation on the appropriate weeks (Winter, weeks 6 and 9; Spring, weeks 6 and 8);

3. The Humanities Instructor should see that you approached the forms in a professional and constructive way. Attendance, tasks completed, and so on, should be noted if group members are not taking the necessary responsibility while approaching the design project.

A Note of Interest: The Team Assessment Forms may be the only way that you feel comfortable in documenting a team member's approach to the project. If needed, use this tool before a negative situation gets out of hand. Professionalism means approaching difficult areas as well as those that are more easily handled.

Team Assessment Form, Week 6 of Spring Term

I am a member of Team ______________________________
(Name of your project)

The members of my team are:

(Name)	Sec. #

Please rate the following statements:

Personal Interaction

1. My team members work well together.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

2. Team members are helpful towards each other.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

3. Team members are getting along well with each other, without hostility or aggressiveness.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

4. Conflicts among team members are resolved effectively and constructively.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

5. Team members are enthusiastic and willing to work.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

6. Team members want to succeed.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

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Communication

7. There is open communication of ideas and thoughts among team members.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

8. Team members are willing to listen to and respect each other's ideas and input.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

9. The team employs constructive criticism when discussing ideas and individual work.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

10. There is a dominant member in your group that exerts control over all other members.

1	2
Yes	No

11. There exists a team consensus when team decisions are made.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

Performance

12. Members attend meetings regularly to assess the progress on the project.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

13. Evaluations are done periodically to assess team performance.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

14. There is equal participation and contribution of each team member in team meetings and/or planned activities.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

15. Each team member completes her/his assigned task in a timely fashion.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

16. How would you rate the quality of your teammate's work?

1	2	3	4	5
Poor				Outstanding

Continued on next page...

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17. Rate the overall performance of your team members.

1	2	3	4	5
Poor				Outstanding

18. While preparing for the oral presentation, the following contributions from my teammates proved to be helpful:

19. While preparing for the oral presentation, the lack of the following elements from my teammates proved to be hindrances:

20. Throughout the tense times of working together, the following elements strengthened my teammates' enthusiasm and ability to work effectively:

21. Throughout the tense times of working together, the following elements weakened my teammates' enthusiasm and ability to work effectively:

22. Additional comments:

Possible Portfolio Items

Appropriate for...	Improvement	Personnel	Me
Material from Oneself			
Description of teaching responsibilities (including advising and other work)	_____	_____	_____
Statement of teaching philosophy and goals	_____	_____	_____
Representative course syllabi	_____	_____	_____
Samples of course handouts and tests	_____	_____	_____
Self-evaluation statement	_____	_____	_____
Description of course development or teaching improvement efforts	_____	_____	_____
Copies of papers or presentations on teaching topics	_____	_____	_____
Videotape of a sample of classroom teaching	_____	_____	_____
Records of teaching awards and honors	_____	_____	_____
Material from Others			
Summaries of student evaluations of teaching	_____	_____	_____
Reports of others who have observed class	_____	_____	_____
Comments of others who have reviewed course materials	_____	_____	_____
Samples of student work (preferably graded)	_____	_____	_____
Student performance data for courses	_____	_____	_____
Records of student/alumni accomplishments progress after the course	_____	_____	_____

Faculty and TA Development, The Ohio State University, 1995

Use this as a guide to

Why Journal Writing

Taken from the article "Why Journal Writing" by Elizabeth L. Haslam, Ph.D.

Methodology

• Respond to journal entries periodically to generate faculty/student dialogue, invite students to share entries with the class, and recognize interesting questions and entries as a departure for class discussion and investigation. Remember, journal writing will not work unless you respond to it and validate the process.

General Cues

- What have you learned? What questions do you have? What needs further clarification or review? How will you apply what you have learned?
- What were the steps you took to work through today's homework problems? Where did you have difficulties or questions? Did you make any discoveries?
- If you could take one photograph of today's learning, what would it be? (This might be an idea, a product, a concept, principle, procedure, or process.) Draw a picture of the photograph.
- Draw a concept map of how the course concepts/principles are related.
- What connections are you making of your learning in this course to other areas of study and learning?
- How would you teach this concept (idea, principle, process, procedure)? How would you design this lesson for a software application?
- What would you like to investigate further and why?
- What issues are emerging from this course you were not aware of before?

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"Why Journal Writing" continued...

Hands-on Experience Cues

- If you could make a video of today's experience, what close-ups would you like to see, what parts would you spend the most time shooting, and what would you edit out?
- What experiences have you had before that reminded you of what you did today and why did you make those connections?
- What sensations were you aware of (sounds, color, texture, materials, etc.) What were you reminded of?

Group Work

- What role did you play in your group/team project today? What would you like to change? What did you observe about the group dynamics?

Use this as a guide to

Journal Thought Processes

Taken from the article "Why Journal Writing" by Elizabeth L. Haslam, Ph.D.

- Observations
  Observing something of interest, looking closely, looking again.
  Scientists use observations as part of the inquiry method.

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  Writers use journals to formulate and record questions: personal doubts, academic queries, questions of fact and theory. It is more important here that there be more questions than answers.

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  Learners wonder aloud -- on paper, about the meaning of events, issues, facts, readings, patterns, interpretations, problems and solutions.

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  Learners become conscious of who they are, what they stand for, how and why they differ from others through reflection.

- Digression
  Learners departing as they write from what they intend to say, sometimes to think of personal matters and sometimes to connect apparently disparate pieces of thought.

- Synthesis
  Learners putting together ideas, finding relationships, connecting one course or topic with another, building concepts

- Revision
  Learners looking back at prior entries, seeing where they have changed their minds and viewing the topology of thought.

- Information
  Evidence of reading done, course material processed, facts and theories understood and related to what is known.

Resources on the Teaching Portfolio

Anderson, Erin, ed. (1993). Campus Use of the Teaching Portfolio: 25 Profiles.
Washington, DC: American Association for Higher Education.
(Order from AAHE, One Dupont Circle, Suite 360, Washington, DC 20036;
members: $13.00, non-members: $15.00)

Bird, Tom. (1989). "The Schoolteacher's Portfolio: An Essay on Possibilities."
In Handbook of Teacher Evaluation: Elementary and Secondary Personnel.
2nd ed. Edited by J. Millman and L. Darling-Hammond.
Newbury Park, CA: Sage, pp. 241-255.

Cerbin, William. (1992). "How to Improve Teaching with Learning-Centered Evaluation."
The National Teaching and Learning Forum, Volume 1, number 6, pp. 6-8.

Cerbin, W. (1992). "A Learning-Centered Course Portfolio for Educational Psychology."
Unpublished teaching portfolio. (Available at no cost from William Cerbin,
Department of Psychology, University of Wisconsin-LaCrosse, LaCrosse, WI 54601.)

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Why Groups Fail: Student Answers

Volume 5, Number 9 **The Teaching Professor** November, 1991

Why Groups Fail: Student Answers

Professors assign group work to help students learn. It gives students the chance to learn how to work cooperatively with their peers. The recent trend in business and other fields is to make decisions within groups rather than as individuals. Hence, group learning introduces students to experiences they're likely to encounter in the world of work.

But students have been known to complain about group work -- in fact, to object to it quite strongly. Susan Brown Feichtner and Elaine Actis Davis decided to see if they could discover why.

They asked 215 students about their most and least positive group learning experiences. Based on 155 responses, the authors identify objectionable dimensions of group work and outline measures professors can take to make these experiences more positive -- at least from the student perspective.

Structure plays an important role in the success or failure of a group. By a ratio of nearly 2 to 1, students claimed their worst experiences came from working in groups they themselves formed. The best experiences were when professors assigned students to groups.

The best group experiences also occurred in small cohesive groups. Four- to seven-member groups do very well, while smaller groups often lack resources and larger groups have difficulty working together.

Once the groups are formed, the type and amount of tasks they must complete can create problems. Feichtner and Davis found that students were much more likely to report a positive group experience from classes in which no class presentations or papers were required or in which only one of either was required. That's not a mandate to do away with presentations and reports, but it does pinpoint them as potential problem points where additional instructor involvement might be helpful.

Paradoxically, when students in groups took some form of group exam, they reported positive experiences. The authors think this may happen because group exams ensure that the success of the group does not rest on only the work of a few diligent members but on the efforts of everyone.

The peer evaluation also had unclear value. Some students claimed that peer evaluations worked well to pressure fellow students to cooperate and to prevent peers from getting "a free ride." However, peer reviews can also cause some real problems by destroying peer trust. One student noted, "I really got burned on the evaluations at the end of the term, and I did the same amount of work as anybody." (p. 81)

There are several strategies professors can adopt to make group work more beneficial and pleasurable form the student point of view. They can make at least some class time available for group meetings and include a substantial group performance component in the grading system. When group work accounted for more than 20% of the course grade, the majority of students reported having a positive experience.

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Other ways professors can enhance group work, based on student experiences reported in this survey include:

- Explain why group work is relevant to them: 72 students claimed that this is probably the most crucial element in the success of a group. Show that group work is not simply busy work.
- Help them set realistic expectations.
- Create diverse groups.
- Give multiple opportunities to make decisions.
- Listen in on group discussions and offer advice.
- Provide immediate feedback.
- Let them sit in their groups during regular class time.

Student experiences, both positive and negative, don't necessarily prescribe sound group dynamics procedures. However, we can learn from student experiences and may make group work better by incorporating aspects of the positive experiences they describe.

Reference: Susan Brown Feichtner and Elaine Actis Davis, "Why Some Groups Fail: A Survey of Students' Experiences with Learning Groups." ***The Organizational Behavior Teaching Review, Vol. 9, No. 4. pp. 75-88.***

DREXEL UNIVERSITY

Drexel University Engineering student poetry samples:

Jet Engine

A Record Player's Show

The CD Player

Videophone Poem

The Virtual Experience

The generic microprocessor

Projection

The Empire State Building

Laser Printer Poem

Graphing Calculator

Ode to Radar

DREXEL UNIVERSITY

ROBERT QUINN
Robert Quinn
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Robert Quinn challenges tradition by defining engineering as a fine art.

Drexel University

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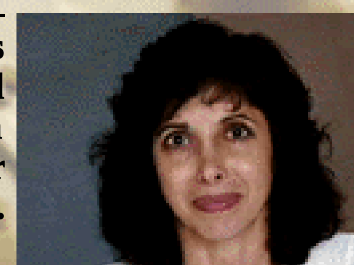

Valarie Meliotes Arms discusses the need to reward innovative professors in today's world of higher education.

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Participants develop methods for a collaborative approach to curriculum design and evaluation.

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Florida International University

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Office phone: 305-348-3907

William Rando provides engineering professors with a first step to interactive lecturing.

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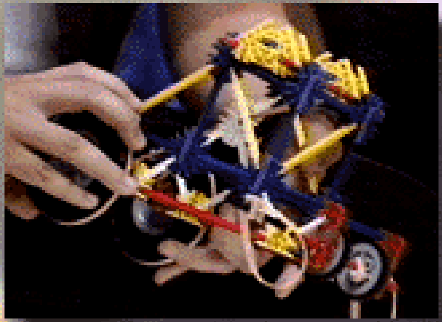
The Language of Engineering



Freshman engineering students at Drexel University talk about team work and the "language" of Engineering.

Freshman Design Projects

Listed below are a few of the designs projects produced by Freshman Engineering students at Drexel University.

ERGONOMIC DATA ENTRY DEVICE
Brian Trapp, Michael West,
Andrew Clemenko and Niles Johnson

CYBERSPACE CHAIR
Donna Soriano and Halimah Roundtree

THE REDESIGN OF THE OVERHEAD PROJECTOR
James Barbato, Dan Hua, Joshua Hughes,
Walter Luizaga and Elias Tsepouridis

LANDSAILOR REDESIGN TO INCREASE SAFETY
Kevin Hofmann and Jeffrey Markowitz

LICENSE PAYABLE PARKING METERS
Mahdieu Tarawaly, Dale Delauney,
Terrell Simpson and Alain Noel

DIVERSE TERRAIN ADAPTING ROCK CLIMBING SHOES
Christopher Noraka, Anthony Pellegrino,
Jeffrey Rieks and Joseph Piazza

AUTOMATIC SHUT-OFF SWITCH FOR AN OVEN AND STOVETOP OVEN
Alicia Koller, Greg Abrams, Bibin Daniel
and John Hersker

THE MULTI-SENSORY ALARM CLOCK
Jordan Fox, Sean Christopher, Jude Fanning,
Daryl Sherwood and Robert Leach

DEVELOPMENT OF AN IMPROVED AUTO INDUCTION SYSTEM
Jay Cavalcanto, Shawn Stad and Anthony Turchi

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Setting goals is key in Engineering curricula.

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The Cooper Union

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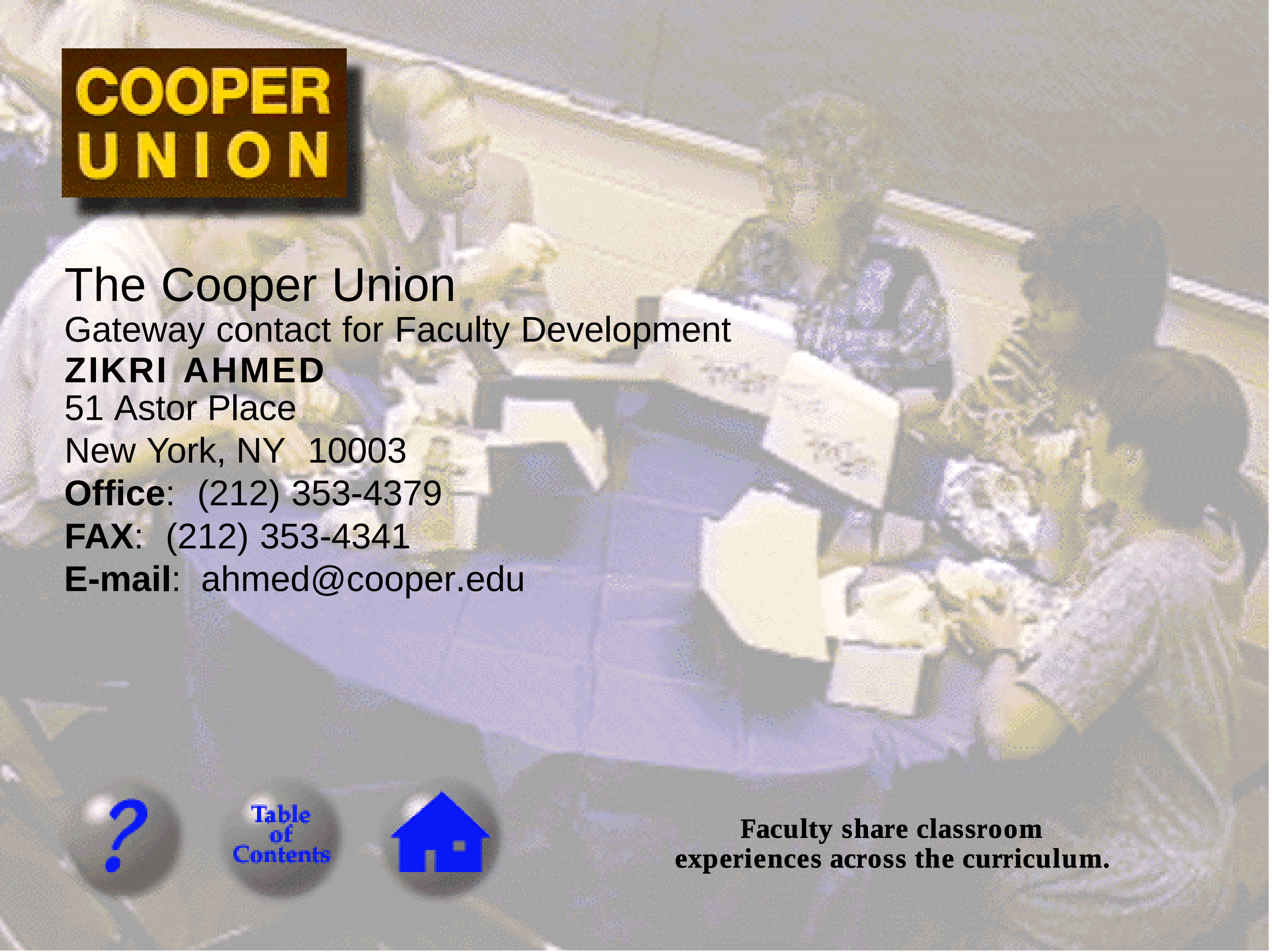

Faculty share classroom experiences across the curriculum.

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A question to ponder:

"What should I do with engineering freshman who tell me they are bored with engineering?"

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Journal writing is a key element in helping students assimilate what they experience in the classroom

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The Fundamentals of Engineering: The Art of Engineering

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ABSTRACT

This sequence of courses is a major component of Drexel's E^4 experimental program which spans the freshman and sophomore years. It is based on the premise that there exists a central body of knowledge, methods and attitudes which constitute the "Art" of Engineering. Further, exposing students to this art at the very beginning of their education is an excellent way to introduce them to the profession. The subject matter emphasizes design as the critical professional essence, interdisciplinary, and common fundamentals, the pivotal roles of the computer and experimentation, and the imperative for superior communications skills. The methodology is experiential, consisting of several practicums, experiments, and projects. The achievement and growth of participating students has been impressive. Evaluations indicate that the program also generates considerable interest and enthusiasm among the students and a sense of pride in their accomplishments. It appears that most students begin to understand what it means to be an engineer and may begin to enjoy the practice of the profession.

I. Introduction

At the end of World War II, the emphasis in engineering education shifted rather abruptly from the fundamentals of engineering to the fundamentals of science and mathematics. The basic science and mathematics component of the lower division curriculum grew rapidly through the fifties and sixties displacing the engineering component. The situation then stabilized for the last three decades. The study of basic science and mathematics has occupied the overwhelming majority, sometimes as high as 95%, of the freshman engineering student's time and effort. Rather remarkably, the content has also remained relatively constant, indeed frozen in time when compared to the almost cataclysmic changes in engineering and technology during this period. Science and mathematics are almost always presented in separate sequences of courses with minimum attention given to their interrelationships let alone their importance and applications in engineering. This approach is intimately tied to the attitude that engineering is essentially "applied science and mathematics" and the best way to learn engineering is to study science and mathematics first. This approach is also faculty centered and unfortunately makes little accommodation to the students' expressed interests and motivation which are well known to be dominant elements in the success or failure of the learning process. Given these attitudes

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and perspectives, the small amount of time and low priority allocated to relating science and math to engineering an/or actually studying engineering itself, it is little wonder that many students find the traditional curriculum difficult and/or boring. Sadly, on a national basis, well over half of them decide to "quit engineering" during their first year without recognizing that they never really "began engineering." This situation is clearly bad for the students, bad for the profession and if continued, potentially bad for the entire engineering enterprise in this country.

In 1988, Drexel University began a five year experimental project designated "E^4" to develop and implement new strategies to enhance its undergraduate engineering curriculum.[1] This program involves a comprehensive restructuring of the freshman and sophomore engineering curriculum in terms of objectives, subject matter, and instructional methodology.[2] Objectives focus on an early exposure to the engineering profession and the critical elements of its practice. The subject matter is organized into four sequences replacing and/or integrating material in thirty-seven existing courses in the university's traditional curriculum. The four sequences are The Fundamentals of Engineering, The Mathematical and Scientific Foundations of Engineering, The Engineering Laboratory,[3] and the Personal and Professional Enrichment Program. Several different instructional methodologies are used, all of which emphasize the development and use of computer and personal communications skills in a variety of environments. The theme of all activities is a central focus on the students as emerging professional engineers and the faculty as their mentors from the very beginning of their education.

The Fundamentals of Engineering sequence centers on two themes. The first is professional in nature and based on the premise that there exists a central body of knowledge, methods and attitudes which constitute what one might call the "Art" of Engineering. Further, this "Art" is dynamic and continuously evolves to form the fabric of the profession at any given time. The second theme is pedagogical in nature and based on the premise that weaving this fabric for the students from the very beginning of their education is an excellent way to introduce them to the profession. Thus the program consists of a three-credit course in each of the first five academic terms.

II. Objectives

The common general objective of all courses of this sequence is to help the student gain an understanding and appreciation of that which is defined as the "Art" of engineering by study and practice. Emphasis is placed on: design as the critical essence of the profession; the unifying and interdisciplinary fundamentals of general practice; the pivotal role of the computer as an active agent which will continuously alter the very nature of the profession; the central importance of experimentation; and the imperative for superior communication skills in professional practice.

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Within this context the specific objectives of the introductory courses
are to help the student to:

1) learn the history and character of the engineering profession;
2) understand fundamental engineering methods and develop skills in their use;
3) develop written and oral communication skills;
4) use the computer as a professional and intellectual tool;
5) plan, successfully execute and report the results of engineering projects;
6) learn to work effectively as a member of an engineering team.

III. Methodology

The methodology is experiential in nature, consisting of a series of laboratory practicums and related individual and/or team projects. The focus of initial projects is to provide students and "engineering" experience and introduce them to one or more software packages that they own and will use in future courses or practice. Students learn to use these packages as professional tools while completing an engineering project. There is a two-hour practicum session each week during which students are introduced to a software package in the Computer/Design Center. They practice using the software with supervision and coaching. Students then complete their projects using their own computers with faculty acting as consultants. The various projects are designed to have most, if not all, the following characteristics: use the computer and software package(s) owned by the student; require the use of laboratory facilities and multiple educational resources; require team effort, resourcefulness and creative thinking; and have definite written and/or oral deliverables, deadlines and elements of competition.

As the course evolves, activities increase in scope and complexity and begin to focus on providing practice in designing, managing, executing and reporting the results of engineering projects. Constant emphasis is placed on stating and solving problems creatively to develop analytical and critical thinking skills. Although the "problems" given to the student are of an engineering nature, the techniques for stating and displaying their solution demand communication skills. Thus, members of the Humanities faculty supervise the writing and speaking activities of students such as: keeping a personal journal and/or laboratory records; writing memos and proposals; participating in brainstorming sessions; and giving formal and informal oral presentations and reports. The practicum-project series is supplemented by a lecture series and a set of related exercises.

IV. Subject Matter

A. Practicum-Project Series

There is an almost endless variety of practicum-project combinations which can be developed by faculty. The following are

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illustrative examples of combinations which have been used during the first four years of the experimental program.

1) Product Specification Sheet and Quality Control: This combination is begun the first day of class and involves the use of four general purpose software packages (MacWrite, MacPaint, MacDraw, and Excel) to develop a "Customer Product Specification Sheet" and a suggested quality control process for various products. Students are given several samples of actual products and must work in teams, maintain logs, perform laboratory measurements and use analysis techniques learned in the first two Engineering Test, Design and Simulation Laboratory experiments to successfully complete the project.

2) Optimization of a Production Process: This combination introduces the students to TK Solver Plus which is a package they can use effectively in several other courses. The project, "Optimization of a Production Process," involves using 12 simultaneous equations which model the production of butadiene from butane. Students optimize the design and operating conditions of a reactor to achieve minimum production costs.

3) Data Acquisition and Analysis: Because of its overall versatility as an engineering tool and its central role in our Engineering Laboratory experiments, the software package, LabVIEW, is introduced in this and the following combination. During the practicum, digital signal processing routines are used to reinforce such measurement concepts as peak-to- peak and RMS values, average value, and standard deviation. Other concepts learned in earlier laboratory experiments are reviewed. Students then analyze data actually taken in two experiments. They then create virtual instruments in the software which simulate the real experimental configuration, generate data and compare results.

4) Detection of a Structural Flaw Using Ultrasonic Scanning: This combination involves digital signal processing using LabVIEW. In the practicum and the laboratory, students learn about the frequency content of a signal and the frequency responses of lowpass, highpass, and bandpass filters using both real and virtual components. They are given data from an actual ultrasonic scan of a stainless steel test sample which contains a flaw. They are given general information about ultrasonic scanning techniques and then required to implement a virtual instrument that will display the processed and unprocessed signals and the location of the flaw.

5) Graphical Representation of Objects: Students are introduced to descriptive geometry and the practices and principles of graphical representation of a variety of engineering artifacts using the software package Claris CAD.

6) Group Design Projects: The culmination of the first year activities consists of a major team project. Early in the second term, freshmen form teams to work on a professional project suggested by them and approved by the faculty. The time allotted is approximately thirteen weeks with the teams working on their own and faculty serving as consultants. The teams first develop a full scale proposal to conduct the

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project they have selected. This proposal contains an analysis of the current status including a review of the literature, the proposed plan of action, tradeoffs and justifications, division of team effort, a timetable for completion, and cost estimates. Next, the teams begin the project development, obtain access to needed facilities, supplies, etc. and write progress reports to their faculty sponsors. The project is completed and a final comprehensive written report is prepared. The experience concludes with the annual freshman design seminar held in the third term during which each team makes a formal oral presentation to students, faculty, and guests. In the sophomore year, students plan, execute and prepare a written report of a second major team project of fifteen weeks duration.

7) Individual Projects: Students also conduct a personal project which involves researching a topic of their choice and preparing a comprehensive written report. This experience spans fifteen weeks and concludes with an individual oral presentation at the annual sophomore symposium attended by students, faculty, and guests.

B) Lecture Series

The practicum-project series is supplemented by a lecture series and related exercises. While there is no specific textbook for this course, students are provided a collection of recommended readings to supplement the lecture notes.

Professional Perspectives and Settings: This series compares and contrasts the Scientific and Engineering World Views, Methods, and Enterprises. It discusses the important theories, concepts, processes, phenomena, and general dimensions of the physical environments in which engineers practice.

History of Great Engineering Achievements: This series sketches the history of the profession by tracing the evolution of technology in various areas such as energy generation and conversion, prime movers, manufacturing processes, electronics, computers, and communications.

Developing Professional Knowledge and Skills: This series involves highly interactive sessions with the entire class and two sets of special exercises to develop individual basic engineering knowledge and skills which I call 'engineering savvy.' The first set of exercises involves preparing a series of 'savvy' charts. These charts display values of a physical variable along a logarithmic (base 10) scale showing only the power of ten and "real world" objects, properties, events, etc., representing this variable placed at appropriate points along this line. For example, the variable might be mass in kilograms ranging from -30 to +30 (10^{-30} to 10^{+30}). The lower and upper entries might be the masses of an electron and the sun with intermediate entries such as a sodium atom, a penicillin molecule, a paper clip, or a diesel locomotive placed at appropriate points along the line. Charts are developed for length, mass, time, velocity, density, tensile strength, thermal and electrical conductivity, permittivity, permeability, specific heat, heat capacity, and boiling and melting points. Students are encouraged to prepare and study as large a

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collection of personal charts as possible. The preparation, study, and use of these charts helps students develop a "feel" for important characteristics of the engineering environment in which they must function. The second set of exercises involves preparing "savvy" papers. Students are required to describe an engineering artifact on a single sheet of paper using both graphics and text. The description must include at least the principles of operation, construction and uses of the artifact presented at a level understandable to a high school student. These exercises provide an effective way to sharpen students' visual and communications skills while expanding their understanding of technology.

Introduction to Problem Solving: This series includes a presentation of the basic elements of problem solving using both vertical and lateral thinking techniques. Students are encouraged to use these techniques in their projects and other courses.

Project Management: This series presents the basic elements of project management including: establishing goals and objectives; identifying important check points, activities, relationships, and time estimates; developing project schedules; and constructing and using pert charts. Students are given opportunities to apply the theory in the major team project conducted in the sophomore year.

V. Summary

Our experience over the last four years indicates that the practicum-project strategy coupled with our unified computing and laboratory environment provides a very effective and challenging educational experience. The growth and achievement of the students is impressive. They very quickly become proficient in the use of several software packages which they can use throughout their education. They also develop a sense of ease and facility with the computer. Given their level of knowledge and experience, they complete rather sophisticated and demanding projects on time and in a quality manner. Evaluation of their reports and presentations shows a marked increase in their graphical, written, and oral communication skills.

Evaluations conducted by an external evaluator in the form of interviews and reviews of personal logs indicate that the projects generate considerable enthusiasm among the students, a knowledge of group dynamics, and a sense of pride in their accomplishments.

In summary, evidence indicates that we have created an environment and experiences valuable for all our students. Those who decide to leave engineering do so with at least a rudimentary understanding of its nature and practice. Those who decide to continue to study engineering show every indication they are beginning to understand and enjoy its artistic dimensions.

This project is supported, in part, by Grant USE-8854555 from the Education and Human Resources Directorate of the National Science Foundation.

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(2) R. G. Quinn, "Drexel's E[4] Program: A Different Professional Experience for Engineering Students and Faculty," Journal of Engineering Education, Volume 82, No.4, October, 1993.

(3) R. G. Quinn, "The E[4] Introductory Engineering Test, Design and Simulation Laboratory," Journal of Engineering Education, Volume 82, No. 4, October, 1993.

Bob Quinn: "The Fundamentals of Engineering: The Art of Engineering"

The Active Learner

Elizabeth L. Haslam, Ph.D.

Mary Alice White has described the critical need for a new curriculum and approach to learning: "As the world of information changes quickly, deeply and widely . . . the changes are so significant for how we learn, remember, and form judgments that education needs to develop a curriculum designed to educate for these changes" (White, 1987, p. 41). For us, as university teachers, the convergence of technologies and more effective teaching methods are breaking the mold of the old transfer-of-content knowledge lecturing. To help students become more active in their learning, we need to use better teaching methods.

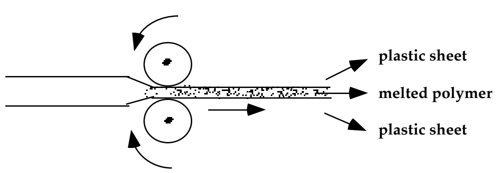
Learning Research Theories

1. We construct our knowledge, organizing information to create meanings.

> *Instructor: Help learners construct schemas using links to what students already know.*

2. Visual thinking facilitates learning: the mind scans the image and pulls things together. Our visual memory is stronger than verbal memory.

> *Instructor: Routinely ask students to provide a map or sketch of a procedure or idea.*



From a student's journal sketch in a Gateway course in Materials' Engineering .

3. Metacognition has to do with one's awareness of how he or she learns or knows. The more aware the learner is, the more efficient the learner can fill in the gap.

> *Instructor: Provide opportunities for learners to reflect on their learning.*

4. Learners perform better when they know the goal, see models, know the criteria for assessment and know how their performance compares to the standard.

> *Instructor: Use alternative assessments Give a range of examples Jointly set criteria for judging up front Include peer review*

5. Deep, long-term understanding requires active, prolonged engagement and construction of meaning. Brain research calls this "active processing."

> *Instructor:Provide opportunities for learners to synthesize information in ways that are both personally meaningful and conceptually coherent so that transfer of learning can occur.*

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Herman, J. et al (1992). *A Practical Guide to Alternative Assessment.* Alexandria, VI: ASCD.

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Teaching Practices

Establish learning communities.

Communicate high expectations.

Encourage active learning.

Encourage cooperative learning.

Ask students to think reflectively.

Respect diverse talents and ways of learning.

Use a repertoire of alternative assessments.

Gateway Engineering Education Coalition

by Eli Fromm
Gateway Project Director

WWW address:
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The “Gateway” Engineering Education Coalition is a collaborative program of 10 institutions, supported by the Engineering Directorate of the National Science Foundation. Headquartered at Drexel University and representing a diversity of institutional cultures imbedded in regions of significantly underrepresented minority populations, the Coalition expects to open new “gateways” for learning by altering engineering education from a focus on course content to a focus on the development of human resources and the broader experience in which individual curriculum parts are connected and integrated.

The intellectual threads weave together the introduction of engineering and its functional core “up-front”, unified and connected supportive knowledge “concurrently”, the integrative aspects of the engineering process, multidisciplinary emphasis, and instructional technologies. To the greatest extent possible these are achieved through cross-institutional programs which lead to lowering barriers among institutions as well as within institutions.

Delivering an educational experience that incorporates these objectives and tools requires a change in the pedagogical culture from a curriculum that is lecture driven and teacher centered to one that is process driven and student centered. Inherent in this educational process is to better understand how we learn as well as how we teach. In the longer term these collective efforts push the envelope of the institutional culture to alter and enhance the manner in which it initiates and embraces systematic institutional change.

The scope of the program includes four major foci:

- curriculum innovation and development
- human potential development
- educational technologies and methodologies
- quality assurance and evaluation measures

The issues, within the spheres which the Gateway Coalition addresses, extend beyond the student to include faculty and institutional culture broadly. The Coalition is attempting to alter institutional culture in many ways including:

- the curriculum;
- how we teach as well as what we teach;
- the context in which the educational process engages the student;
- the use of innovative technologies to help in this process; and
- the personal environment in which the students find themselves.

To meet this challenge, the Gateway Coalition has identified its human potential development efforts with four sub-focus areas:

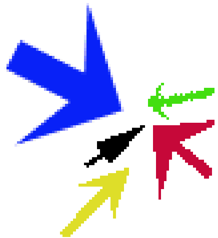
- Women in Engineering
- Minorities in Engineering
- Student Development
- Faculty Development

This CD-ROM is a result of one project undertaken by a combination of the areas of faculty development and Quality Assurance under the leadership of Dr. Valarie Arms and Dr. Jane Fraser, respectively.

The Gateway Coalition is supported, in part, by the Education and Centers Division of the Engineering Directorate of the National Science Foundation (Award EEC-9109853).

Click here for a listing of Gateway contacts.

Help Page

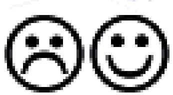


Getting around

How to use the “tool” bar above

Using the information on the left

Printing tips



Troubleshooting

TOC

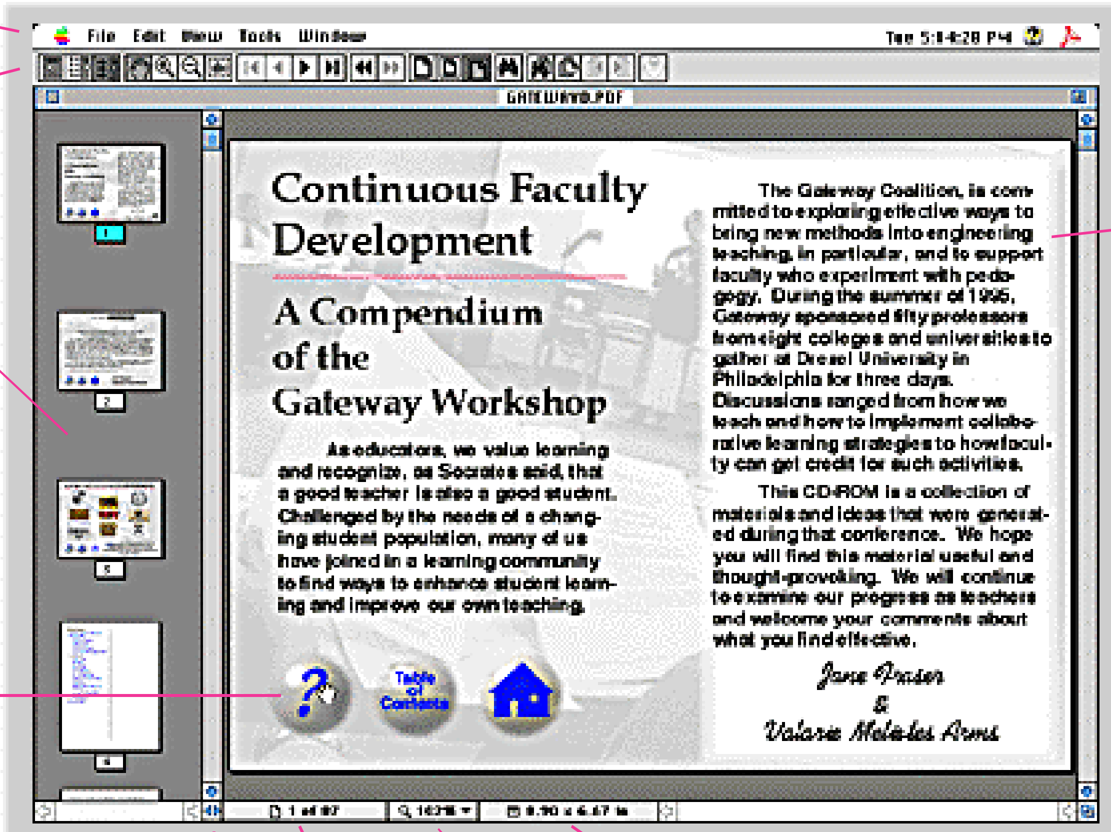
Help Page Screen layout

MENU BAR

TOOL BAR

OVERVIEW AREA SHOWING THUMBNAIL VERSIONS OF DOCUMENTS

ITEMS IN THE DOCUMENT AREA & SHOWN IN BLUE ARE LINKED TO OTHER MATERIALS.



DOCUMENT AREA

WINDOW SPLITTER

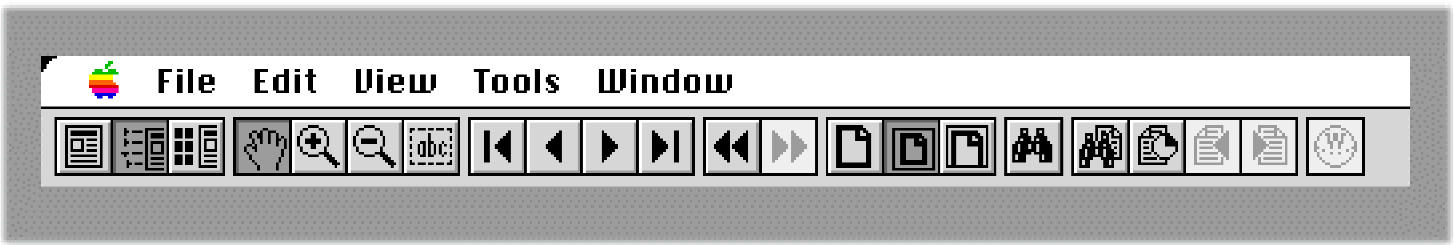
PAGE #

MAGNIFICATION BOX

DOCUMENT SIZE

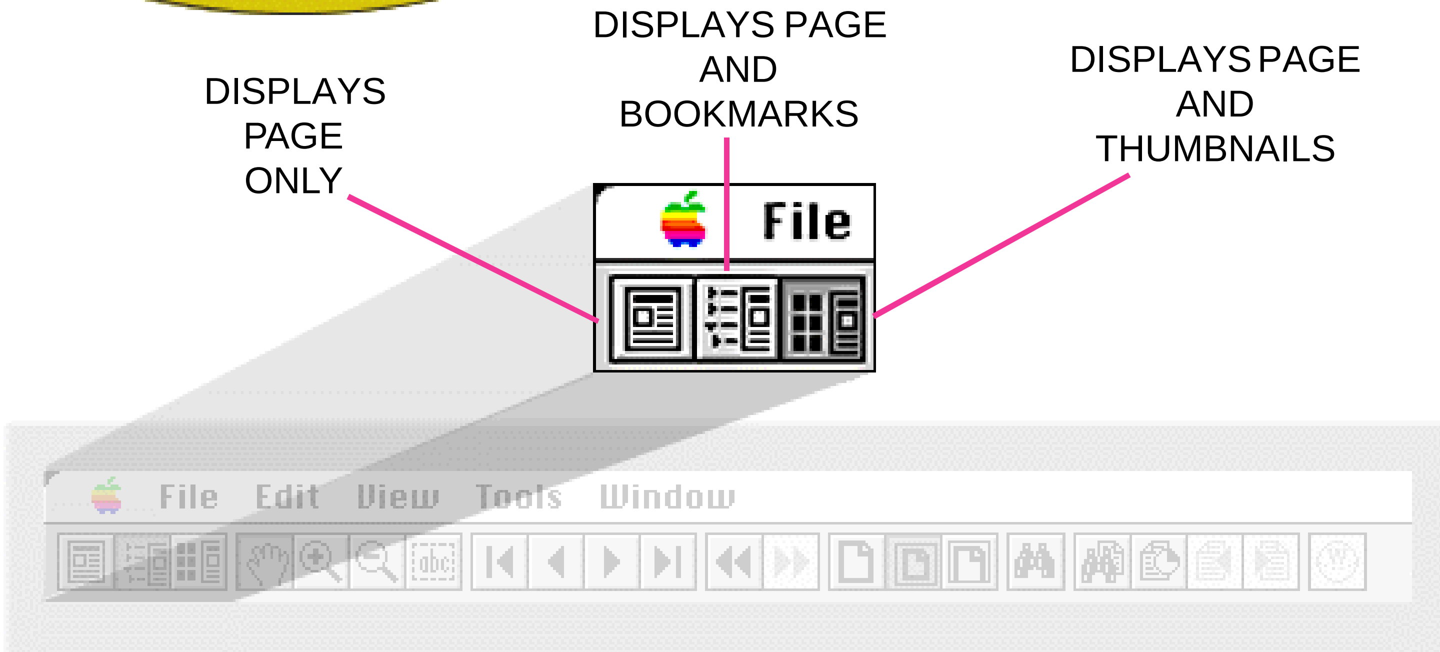
Tool bar

Click on one of the tool bar buttons below to learn more.



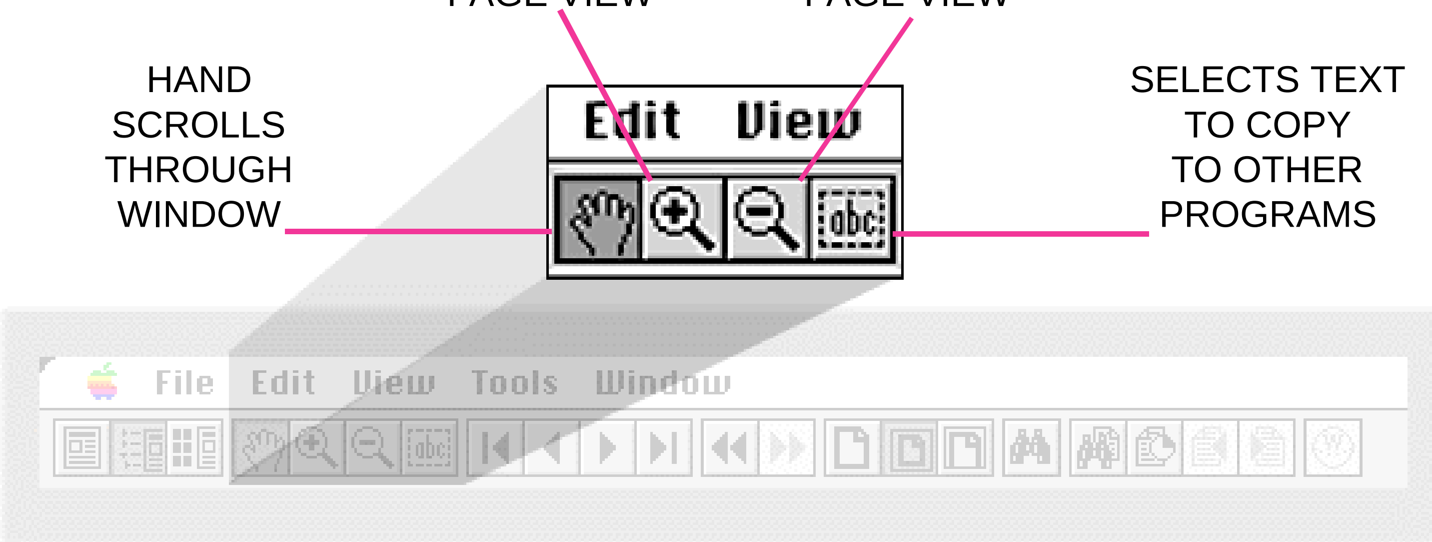
Help Page

Tool bar



Help Page

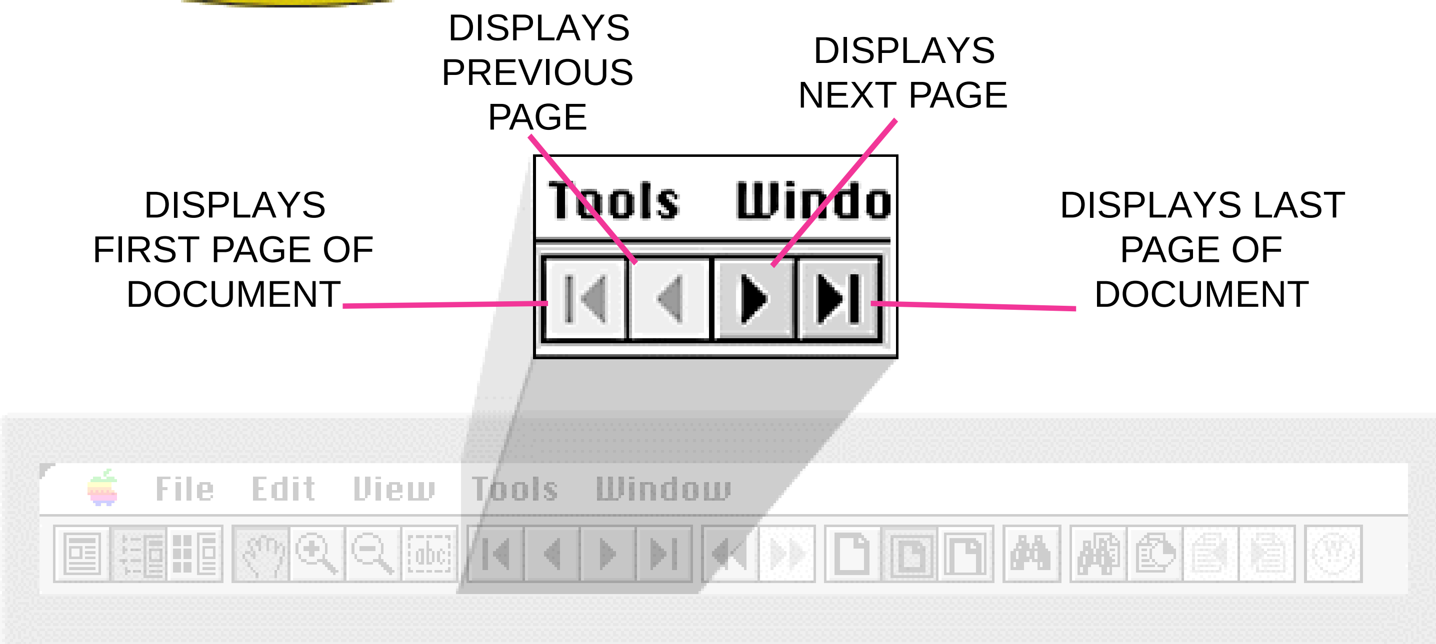
Tool bar



TOC

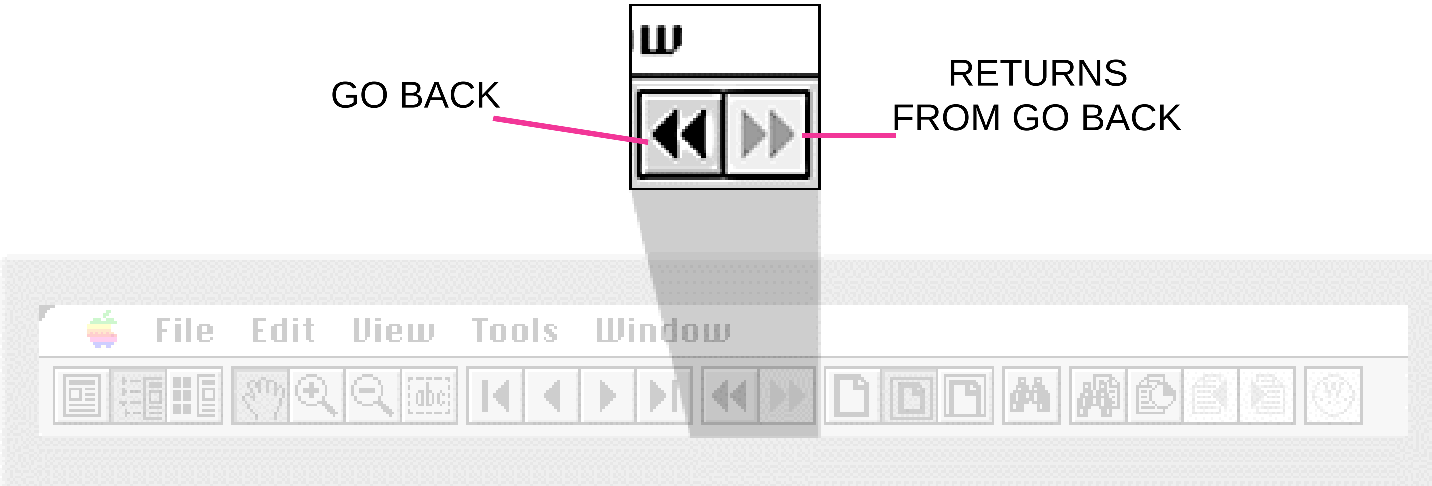
Help Page

Tool bar

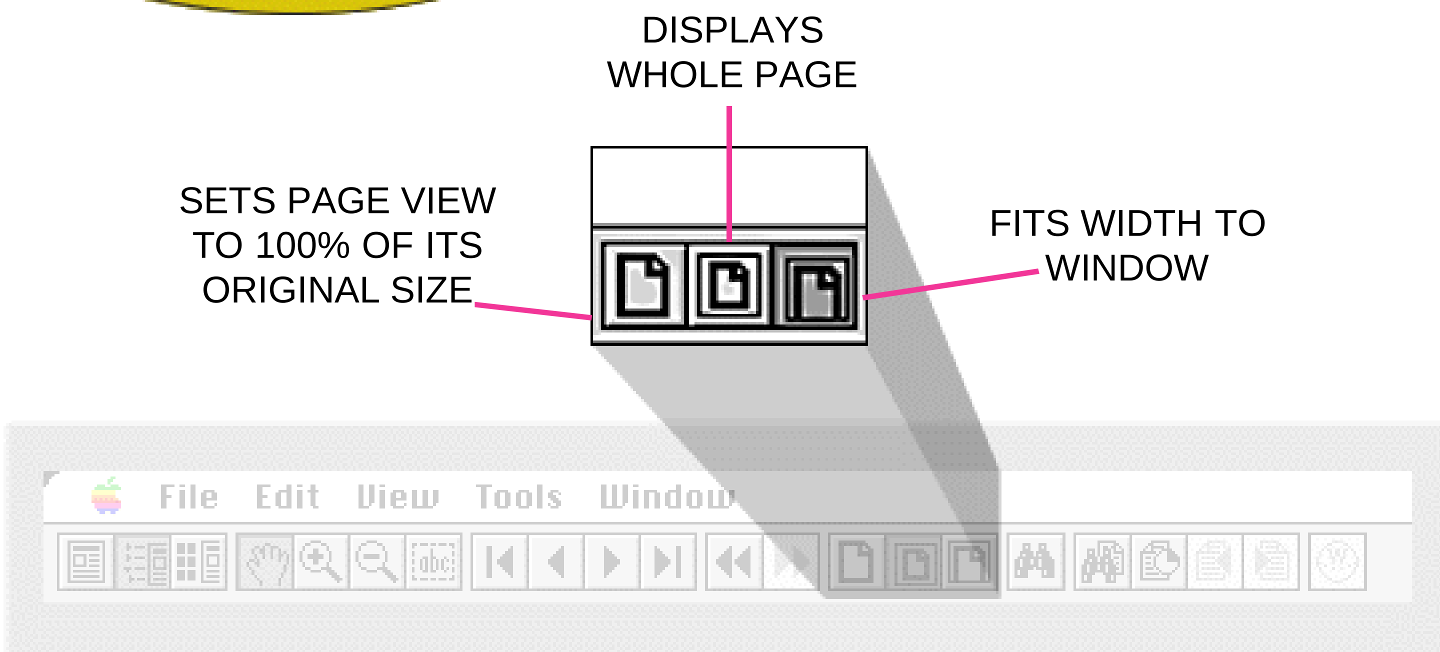


Help Page

Tool bar

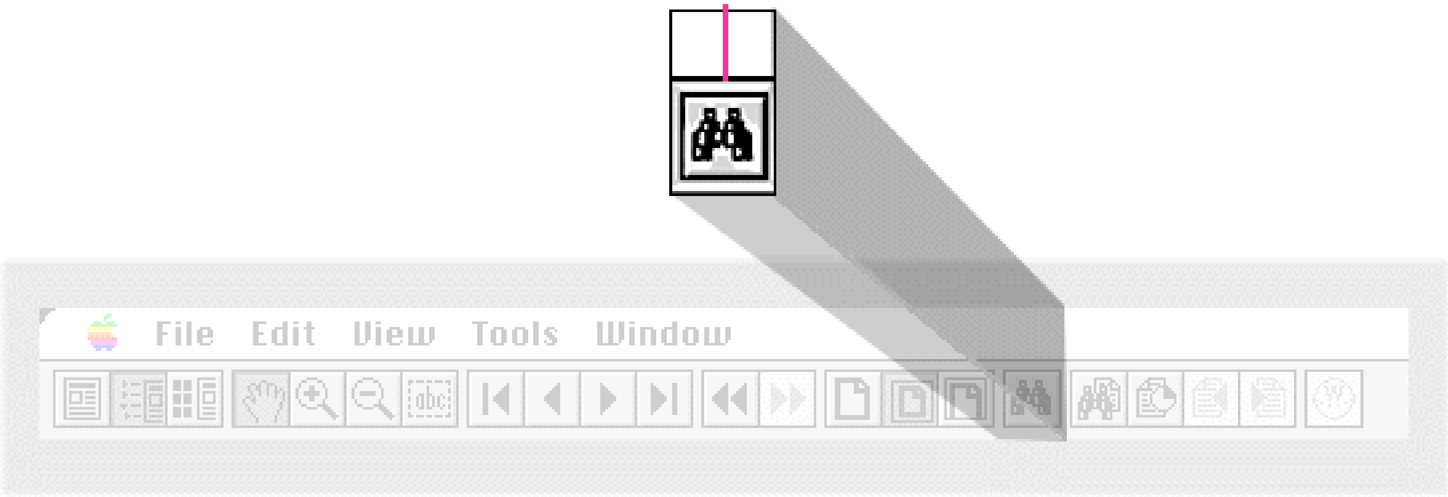


Tool bar


DISPLAYS
WHOLE PAGE
SETS PAGE VIEW
TO 100% OF ITS
ORIGINAL SIZE
FITS WIDTH TO
WINDOW
File
Edit
View
Tools
Window

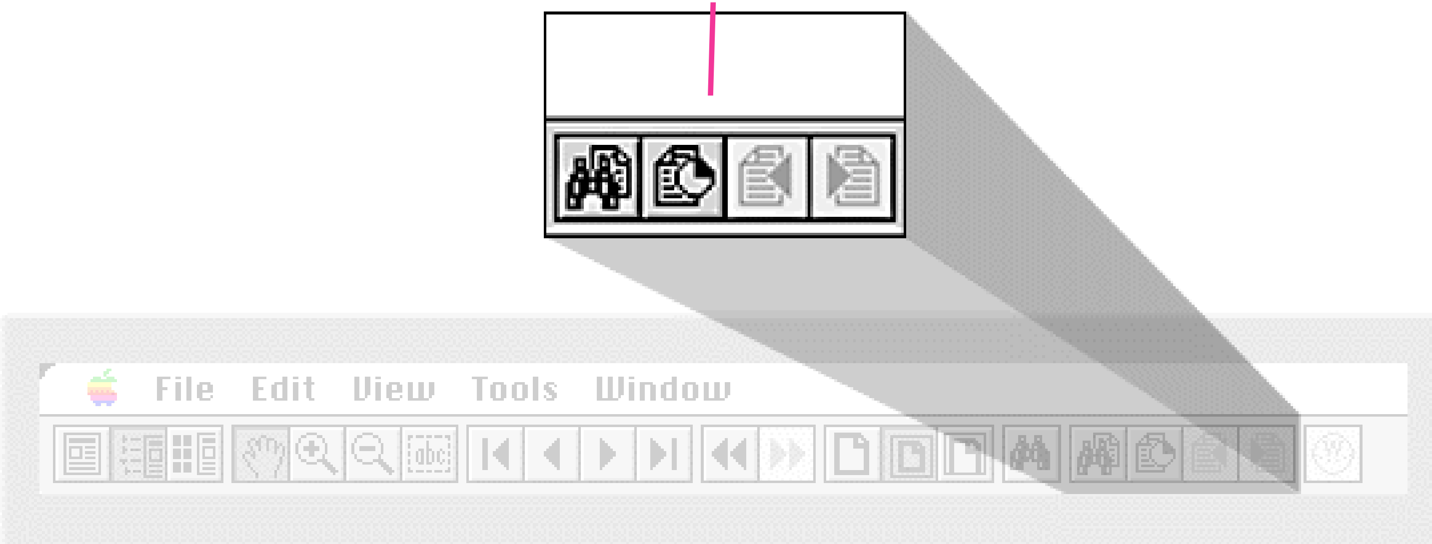
Tool bar

CLICK THE FIND BUTTON TO SEARCH FOR PART OF A WORD, A COMPLETE WORD, OR MULTIPLE WORDS IN A DOCUMENT.



Tool bar

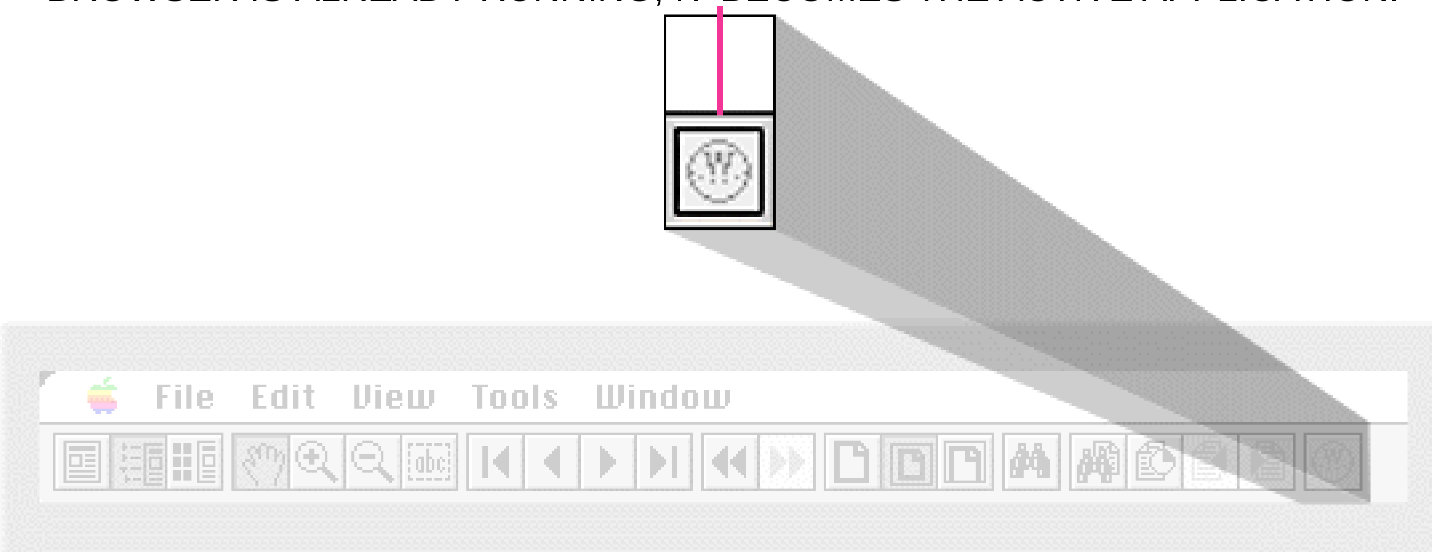
INDEX SEARCH, PREVIOUS INDEX, GO-BACK INDEX



Help Page

Tool bar

CLICK THE WEB BROWSER BUTTON TO START YOUR WEB BROWSER. IF YOUR WEB BROWSER IS ALREADY RUNNING, IT BECOMES THE ACTIVE APPLICATION.



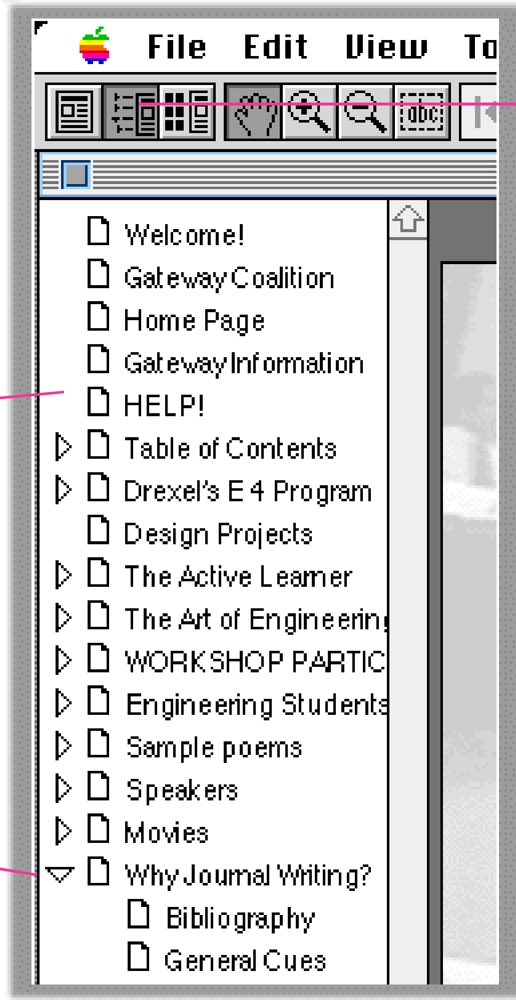
TOC

Help Page

The view to the left

OVERVIEW AREA SHOWING BOOKMARKS. BOOKMARKS ARE LINKED TO AREAS WITHIN THE DOCUMENT. PRESS ON ONE OF THE BOOKMARKS TO GO TO THAT AREA.

OVERVIEW AREA SHOWING BOOKMARKS. PLACE MOUSE OVER TRIANGLE AND CLICK MOUSE. TRIANGLES WILL POINT TO THE BOTTOM TO REVEAL SUB-HEADINGS.

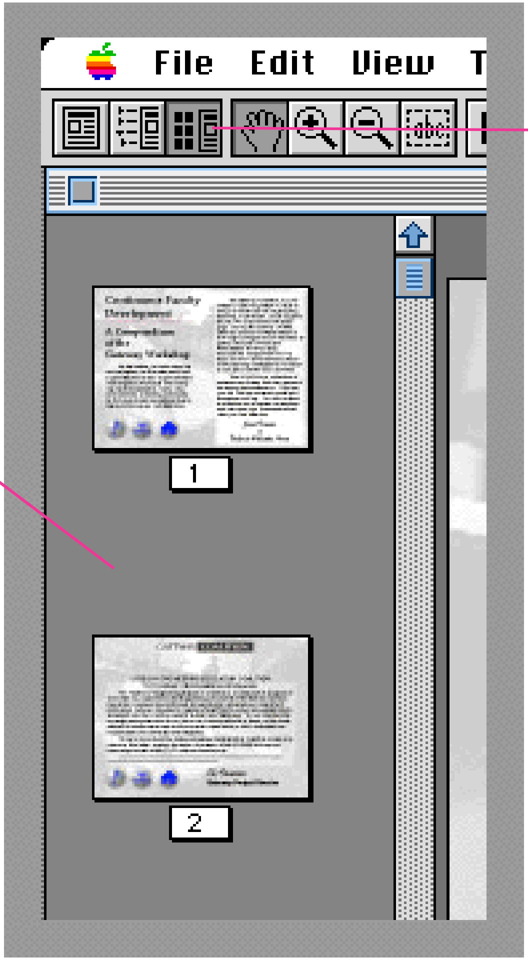


PRESS THIS BUTTON TO DISPLAY PAGE AND BOOKMARKS VIEW.

Help Page

The view to the left

OVERVIEW AREA SHOWING “THUMBNAIL” VERSIONS OF THE PAGES. THUMBNAILS ARE LINKED TO AREAS WITHIN THE DOCUMENT. PRESS ON ONE OF THE THUMBNAILS TO GO TO THAT AREA.

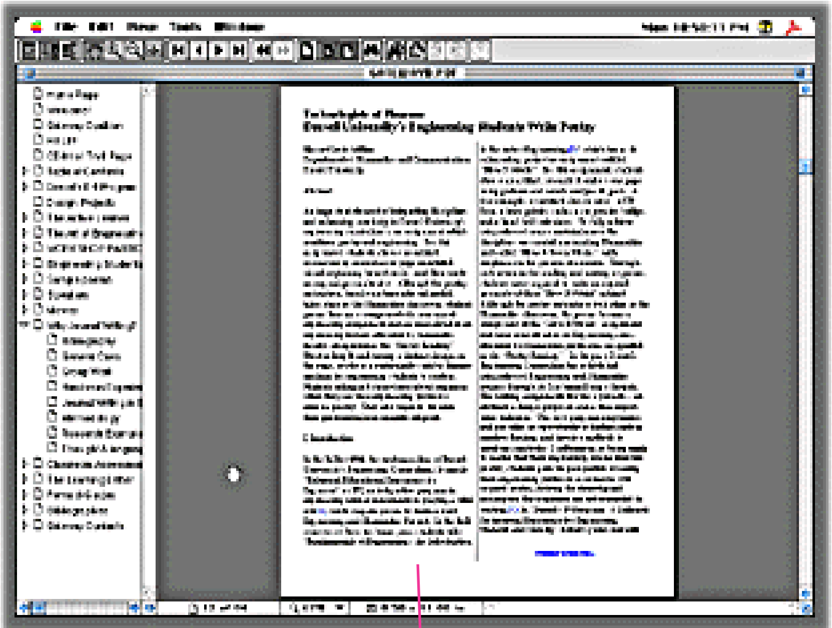


PRESS THIS BUTTON TO DISPLAY PAGE AND THUMBNAIL VIEW.

Help Page

Printing

TO PRINT THIS PAGE SELECT THE LAND-SCAPE MODE IN YOUR PRINTING SETTING.



PAGES ARE DISPLAYED AS 8.5 X 11 INCH (ON LEFT) OR 8.999 X 6.667 INCHES (ON RIGH)T. WHEN PRINTING THE LEFT PAGE, SELECT THE NORMAL 8.5 X 11 INCH DOCUMENT IN YOUR PRINTING SETTINGS.

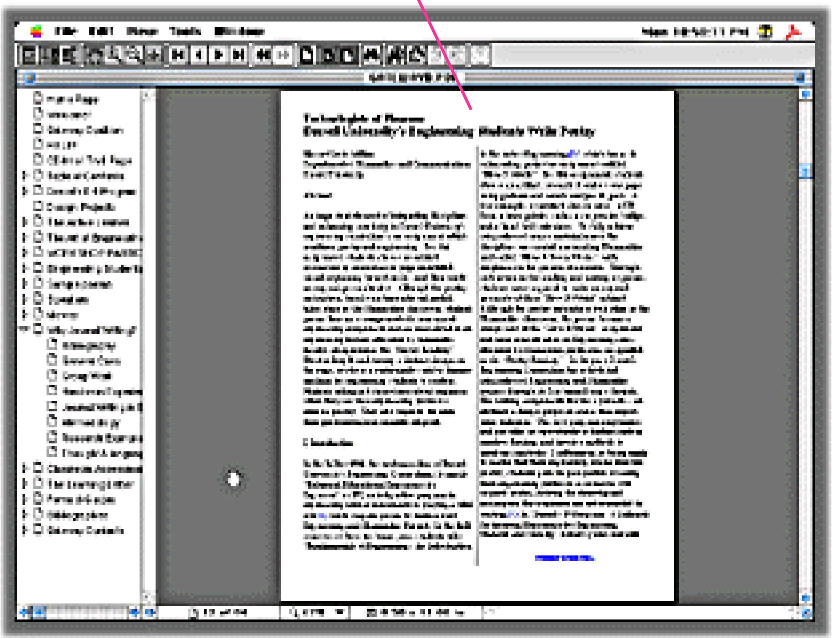
? TOC

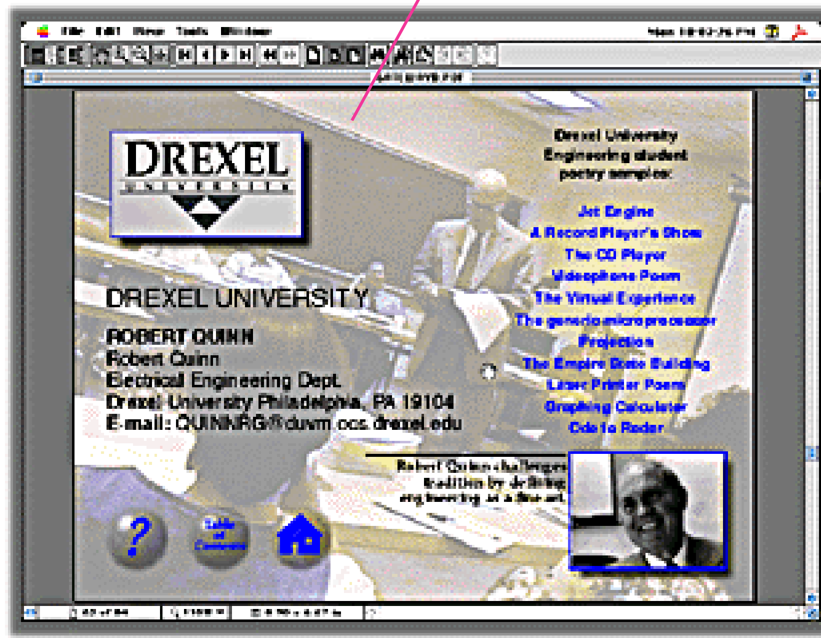
Help Page

Page display

THIS PAGE IS 8.5 X 11 INCHES.

THIS PAGE IS 8.889 X 6.667 INCHES.





THERE ARE TWO SIZES OF PAGES IN THIS DOCUMENT. MOST PAGES ARE 8.5 X 11 INCHES. AS SHOWN ON THE RIGHT, SOME PAGES ARE 8.999 X 6.667 INCHES. USE THE PAGE DISPLAY BUTTONS TO SHOW PART OR ALL OF THE PAGE.

? TOC

Credits

This CD-ROM was produced by

Elizabeth L. Haslam, Ph.D. & Associates

and

CreationZ Interactive Designs, Inc.